FRESHWATER RESOURCE VERIFICATION AND RISK ASSESSMENT FOR THE PROPOSED DARLING COUNTRY ESTATE ON ERF 401 AND PORTIONS 8 & 9 OF FARM 577, DARLING, WESTERN CAPE

Prepared for

Darling Green Estate (Pty) Ltd

January 2019

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Report Reference: **SAS 219007**
Date: **January 2019**

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Watercourse:	In terms of the definition contained within the National Water Act, 1998 (Act 36 of 1998) a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes where relevant, its bed and banks.
Wetland:	"Land which 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 land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may, in turn, influence the ecological characteristics and functioning of wetlands.

1. INTRODUCTION

In January 2019 Scientific Aquatic Services (SAS) were requested to undertake a field verification of the watercourses identified within the specialist freshwater assessment conducted by Bluescience (2009), implement the DWS Risk Assessment Matrix (2016) and provide suitable mitigation measures for the proposed Darling Eco Estate, Darling, Western Cape Province. Additionally, CapeNature stipulated in December 2018 during the Environmental Authorisation process that an updated wetland study was required to inform any rehabilitation measures required and to provide more site specific mitigation measures.

The proposed Darling Green Estate is located on erf 401 and portions 8 and 9 of the Farm 577, in the town of Darling, Western Cape, hereafter referred to as the 'study area'. The study area is bordered by the R307 to the south west, the existing Golf Estate to the north and a railway line to the north east (Figure 1 and 2). The proposed estate will include (refer to Figure 3 for the proposed layout):

- The construction of 119 large residential erven (ranging between 1,211m^2 and 11,498m^2);
- 250 unit retirement village;
- 120 unit Village post;
- Large open space areas for recreational purposes; and
- Internal services including roads.

In order to identify all watercourses that may potentially be impacted by the proposed Darling Eco Estate, a 500m "zone of investigation" around the study area, in accordance with General Notice 509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e. the 500m zone of investigation around the study area – was assessed utilising desktop methods only and will henceforth be referred to as the "investigation area" (Figure 1 and Figure 2).

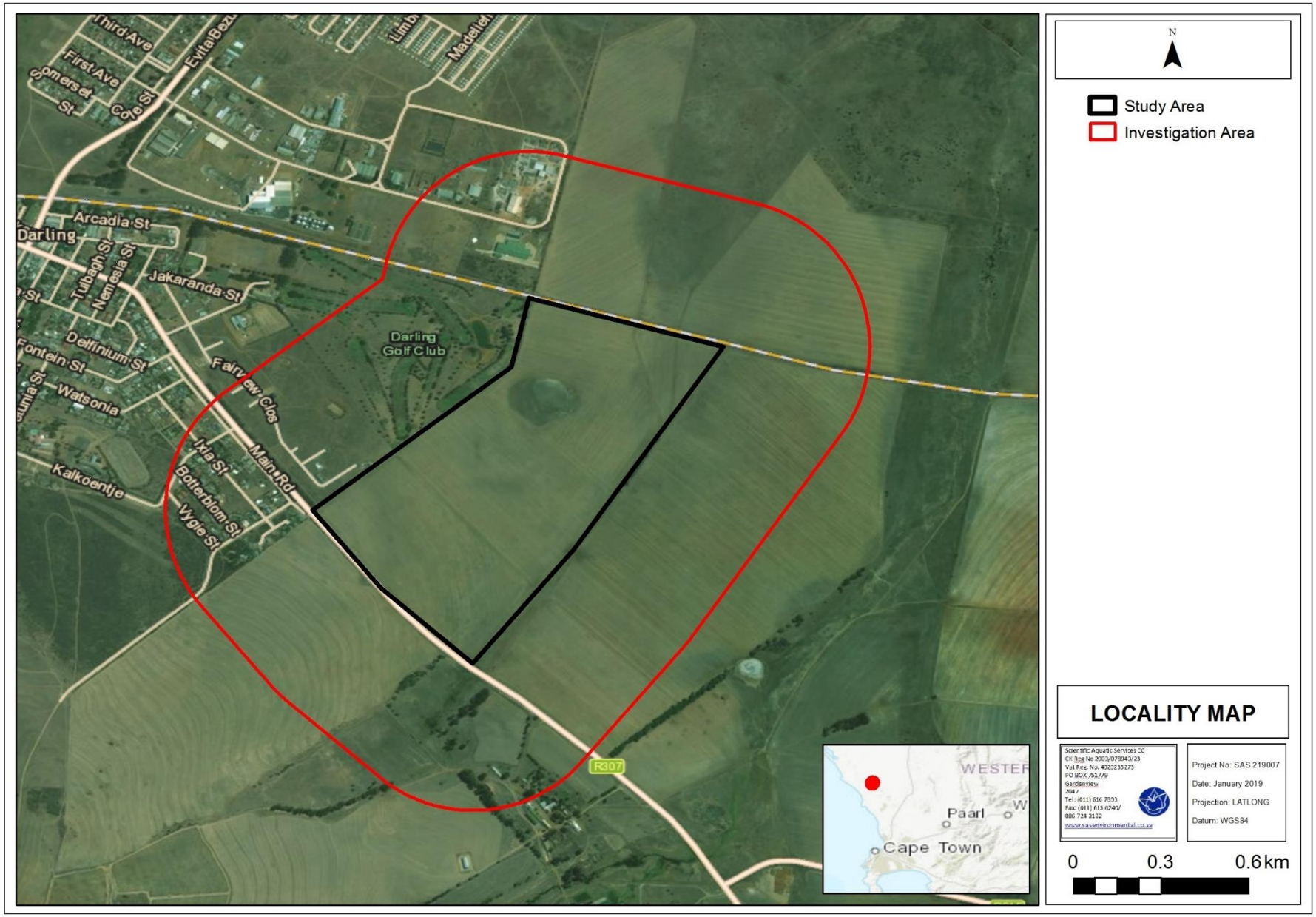

Figure 1: Digital satellite image depicting the study and investigation areas in relation to the surrounding areas.

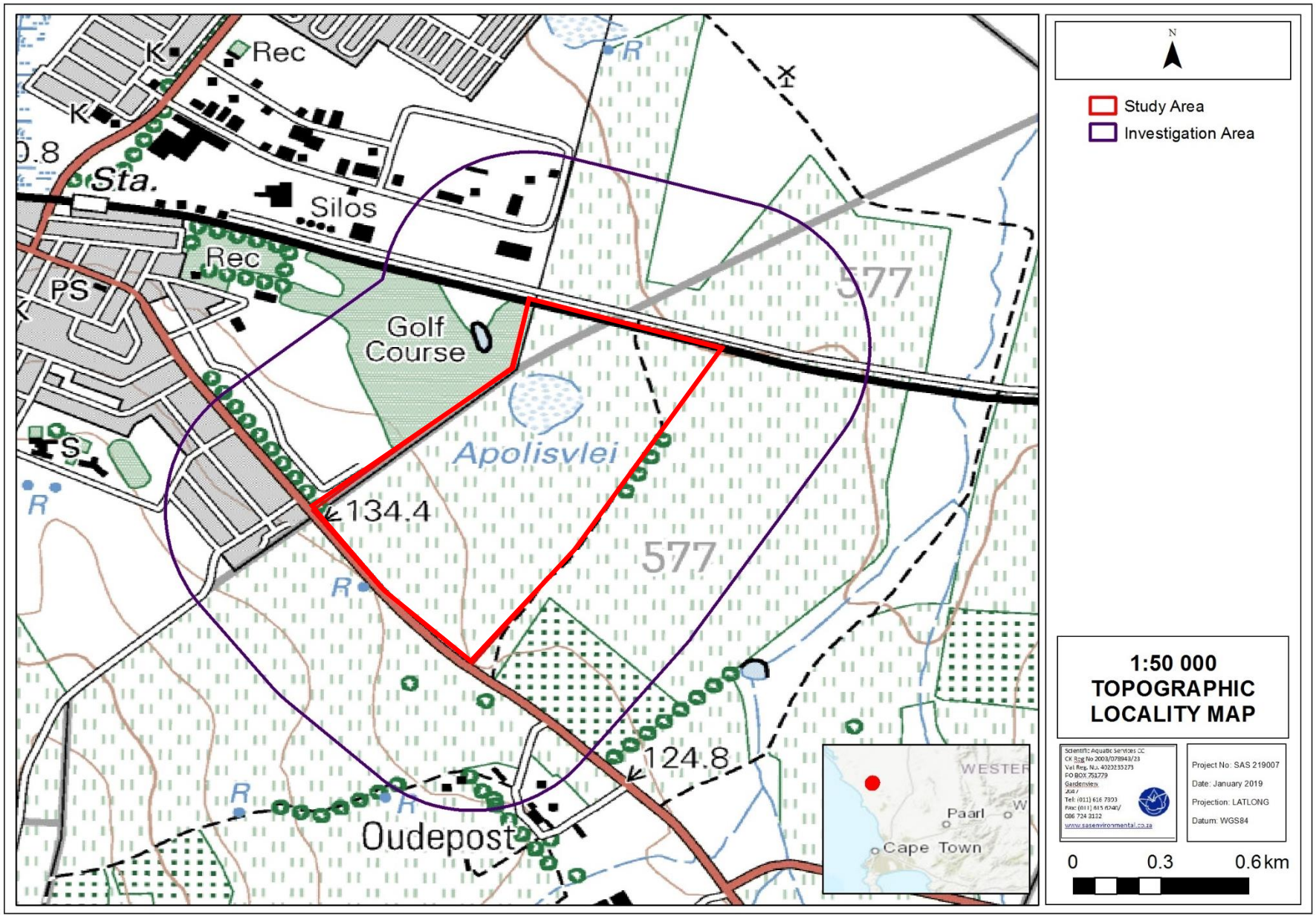

Figure 2: Location of the study and investigation areas depicted on a 1:50 000 topographical map, in relation to surrounding areas.

Figure 3: Proposed site layout plan for the Darling Green Estate.

1.1 Assumptions and Limitations

- The ground-truthing and delineation of the watercourse boundaries and the assessment thereof are confined to a single site visit undertaken on the 16th of January 2019 during the summer season, and is limited to the study area;
- All freshwater resources identified within the investigation area were delineated in fulfilment of Regulation GN509 of the National Water Act, 1998 (Act 36 of 1998) utilising various desktop methods including the use of topographic maps, historical and current digital satellite imagery and aerial photographs. These resources were not ground-truthed; however, the general surroundings were considered during the desktop assessment;
- The purpose of this verification was to confirm the delineations and classifications of the study undertaken by Bluescience (2009) and undertake the required Risk Assessment Matrix as promulgated in General Notice 509 of 2016. Therefore, this report does not include any additional calculations for the Present Ecological State (PES) or the Ecological Importance and Sensitivity (EIS) as this was undertaken by Bluescience (2009);
- Global Positioning System (GPS) technology is inherently somewhat inaccurate, and some inaccuracies due to the use of handheld GPS instrumentation may occur; however, the delineations as provided in this report are deemed appropriately accurate to fulfil the authorisation requirements;
- Watercourses and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the watercourse boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, the delineations as provided in this report are deemed appropriately accurate to guide any future development plans.

2. RESULTS

2.1. Desktop Assessment Findings

Use was made of aerial photography, digital satellite imagery, and available provincial and national wetland databases to identify points of interest prior to the field survey. Watercourses often display a diversity of digital signatures that can be used to assist the field verification.

Bluescience (2009) identified two freshwater resources within the study area, a pan, known as Apolisvlei (please refer to the topographical map – Figure 2) as well as a seepage zone. On review of historical aerial photographs dating back to 1938, the Apolisvlei wetland is clearly visible within the study area (Figure 4). When this historical imagery is compared to the most recent digital satellite imagery (circa 2018), it is clear that the study area has been significantly transformed by the current agricultural and livestock activities within the surrounding area (Figure 4) which has altered the pattern, flow and timing of water in the landscape within the study area and surroundings.

Figure 4: Historical imagery (top - circa 193 Flight plan 12638 of Job 120) indicates that the area surrounding the study area was predominantly agricultural, however, when compared to the most recent digital satellite imagery (bottom - circa 2018) increased urbanisation in the surrounding area is evident. The Apolisvlei remains clearly identifiable (indicated in blue) with limited change to the extent of the system.

2.2. Site Verification Results

A site visit was undertaken on the 16th of January 2019, during which the presence of any areas presenting with wetlands/riparian characteristics as defined by the Department of Water Affairs and Forestry (2008) or watercourses as defined by the National Water Act, 1998 (Act 36 of 1998) were identified. The following indicators assist in determining the presence of a watercourse within the study area:

- Terrain units are used to determine in which parts of the landscape a watercourse (including wetlands and rivers) was most likely to occur;
- Obligate and facultative freshwater species could be used in conjunction with terrain units as well as the point where a distinct change in the vegetation composition was observed to define the outer boundary of any watercourses. Obligate species are almost always found in a watercourse (>99% of occurrences) while facultative species are usually found in a watercourse (76%-99% of occurrences) but are also occasionally found in areas not associated with wetlands or rivers and often in areas of disturbance;
- Surface water and/or saturated soils can be used to determine if there is a permanent zone and to define the outer boundaries (temporary zone) of a watercourse; and
- Soil form indicators are used to determine the presence of soils that are associated with prolonged and frequent saturation and a fluctuating water table within 50 cm of the land surface.

It should be noted that for an area to be identified as a wetland, at least two (2) of the above indicators should be present (*Pers Comm Prof. F. Ellery*).

For the purposes of this investigation, the definitions of a watercourse and wetland habitat were taken as per that in the National Water Act, 1998 (Act 36 of 1998). The definitions are as follows:

A **watercourse** means:

(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the *Gazette,* declare to be a watercourse,
and a reference to a watercourse includes where relevant, its bed and banks.

Wetland habitat is “land which 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 land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

3. KEY OBSERVATIONS

1. As per the ecological study undertaken by Bluescience (2009), the Apolisvlei Wetland is located within the study area. At the time of the 2018 site verification (during the summer season) this wetland was completely dry (Figure 5). SAS agrees with the findings and delineations as provided by Bluescience (2009) for the Apolisvlei Wetland.

Figure 5: Apolisvlei Wetland located within the study area (indicated by the dashed line). No surface water was observed at the time of the field verification.

2. Bluescience (2009) also identified a seepage area with a defined channel in the north-eastern corner of the study area. On further investigation, SAS did not identify any obligate or facultative vegetation species, nor were any soil indicators (redoximorphic features such as mottling and gleying) present within the delineated seepage area (Figure 6). A distinct, uniform channel was, however, noted further east of the seepage zone noted by Bluescience (2009). SAS concurs with the statement made by Bluescience (2009) that this channel was likely man-made to drain the land during its use for cultivation.

Figure 6: (Left) uniform channel noted within the north-eastern portion of the study area (distinct channel indicated by the orange dashed line); (right) soil sample taken within the proposed seepage zone indicating dry soils with no redoximorphic features such as mottling and gleying present.

3. On further investigation of the seepage area identified by Bluescience (2009) pipe culverts were noted below the railway line to the north, associated with the excavated channel. These pipe culverts were noted to be heavily sedimented (Figure 7). Due to the limitations of this verification as a result of the field assessment being undertaken during the dry season, use was made of digital satellite imagery to identify if there were any digital signatures over the last 10 years (since the Bluescience assessment was undertaken in 2009) to determine if there is a seasonal wet response within the north eastern corner associated with the proposed seepage zone. Digital imagery was focused on the rainy season (i.e. only imagery within the months of June - September were considered).

Figure 7: Digital satellite Imagery taken during the wet season of the north eastern corner of the study area from various years. The orange line indicates the excavated channel and the blue dashed line indicates the proposed location of the seepage zone, as indicated by Bluescience (2009).

4. Based on the digital satellite imagery, greening can be identified within the man-made channel (as indicated by the orange line) but not within the area delineated as a seepage zone by Bluescience (2009) (indicated by the blue dashed area). Based only[1] on analysis of digital satellite imagery, it is likely that the hydropedological processes of the area have been irreversibly altered as a result of the extensive cultivation activities, and possibly the excavated channel identified within the study area and surroundings and therefore, over the last 10 years since the Bluescience investigation was undertaken there has been insufficient recharge of soils to elicit a wetland vegetation response.

5. Based on the above rationale, it is the opinion of SAS that the hydrological drivers of the seepage area have been permanently destroyed as there is no evidence that a wetland vegetation response has occurred over the last 10 years. The seepage area delineated by Bluescience (2009) therefore currently does not, and in future will not function as a wetland and therefore does not enjoy protection as a watercourse in terms of the National Water Act, 1998 (Act 36 of 1998). It is, however, recommended that this rationale be supported by a field verification during the wet season since the proposed development layout plan does not make provision to retain this feature.

[1] The seepage area has not been field verified during the wet season

4. LEGISLATIVE REQUIREMENTS AND CONSTRAINTS ANALYSIS

The following legislative requirements were considered during the assessment.

a) National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA);
b) National Water Act, 1998 (Act 36 of 1998) (NWA); and
c) General Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998).

It is important to note that in terms of the definition of a watercourse as per the National Water Act, 1998 (Act 36 of 1998), all of the natural watercourses within the study area will be regulated by Section 21(c) and (i) as well as the applicable zones of regulation. All of the watercourses that will persist under normal conditions will thus require further authorisation from the Department of Environmental Affairs and Development Planning (DEA&DP) and the Department of Water and Sanitation (DWS).

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however, it is considered to be "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered to be important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted, however, that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

Legislative requirements were taken into consideration when determining suitable zones of regulation for the Apolisvlei wetland. The definition and motivation for a regulated zone of activity as well as a buffer zone for the protection of the wetland can be summarised as follows:

- **Activity 12** of Listing Notice 1 (GN 327) of the NEMA EIA regulations, 2014 (as amended) states that:
  The development of:
  (xii) Infrastructure or structures with a physical footprint of 100 square meters or more;

  Where such development occurs—
  a) Within a watercourse;
  b) In front of a development setback; or
  c) If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse.

- **Activity 19** of Listing Notice 1 (GN 327) of the NEMA EIA regulations, 2014 (as amended) states that:
  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 more than 10 cubic metres from a watercourse.

- In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), a regulated area of a watercourse for section 21(c) and 21(i) is defined as:
  a) the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;

b) in the absence of a determined 1 in-100year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or

c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

A 500m zone of regulation (ZoR) was therefore implemented around the Apolisvlei Wetland (Figure 8). Consultation and authorisation from the Department of Water and Sanitation, the custodians of water resources in South Africa, will therefore be required for all activities associated with the development since the proposed development falls within the 500m ZoR. The DWS Risk Assessment Matrix was compiled (please refer to Section 5 below) to ascertain the proposed risk of the proposed Darling Eco Estate on the Apolisvlei wetland.

It should further be noted that activities within the 32m Zone of Regulation in accordance with the National Environmental Management Act, 1998 (Act 107 of 1998) will potentially be triggered should the recommendation that this be considered a buffer area not be implemented. It should be noted that it is the opinion of the freshwater specialist that this 32m Zone of Regulation should not be impeded upon and should be considered as a conservation buffer area for the protection of the Apolisvlei wetland.

Figure 8: Applicable Zones of Regulation in accordance with the NWA and the NEMA associated with the Apolisvlei identified within the study area.

5. RISK ASSESSMENT

Following the delineation and visual assessment of the Apolisvlei wetland, the Department of Water and Sanitation (DWS) specified Risk Assessment Matrix (as promulgated in GN509 of 2016) was applied to ascertain the significance of risk associated with the individual activities on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the Apolisvlei Wetland within the proposed development area. The points below summarise the considerations undertaken:

- The DWS risk assessment was applied assuming that all listed mitigation measures are implemented, thus the results of the DWS risk assessment provided in this report presents the perceived impact significance ***post-mitigation***;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et al*. (2013) would be followed, i.e. the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- The activities and the associated risks they pose are all highly site specific, not of a significant extent relative to the area of the wetland assessed, and therefore have a limited spatial extent (i.e. within the investigation zone). The exception is risks to water contamination, however, if the effluent control ponds are well managed, this risk is considered very low;
- While the operation of the proposed Darling Eco Estate will be a permanent activity, the construction thereof is envisioned to take no more than a year as a whole (depending on the phasing of the construction phase). However, the frequency of the construction impacts may be daily during this time; and
- Most impacts are considered to be easily detectable, with the exception of contamination of surface and groundwater which will require some effort.

5.1. Risk Assessment Outcome Discussion

The outcomes of the DWS Risk Assessment are provided in Table 1, at the end of this section. There are four key ecological risks on watercourses that were assessed, namely:

- Loss of watercourse habitat and ecological structure resulting in impacts to biota;
- Changes to the socio-cultural and service provision;
- Impacts on the hydrology and sediment balance of the watercourses; and
- Impacts on water quality.

Since the proposed development will be located outside of the wetland and a minimum 32m “buffer” area from its delineated boundary will be implemented (i.e. the 32m Zone of Regulation in accordance with the National Environmental Management Act, 1998 (Act 107 of 1998), hereafter referred to as the buffer area), the risk posed to the wetland feature as a result of construction related activities are likely to be reduced, however, the risk significance is still considered to be ‘Moderate’. This is mainly due to the largely Natural (Category B) ecological state[2] of the Apolisvlei wetland and the risks associated with vegetation clearing and changes to sediment and the hydrological regime of the surrounding area.

The terrestrial area surrounding the Apolisvlei wetland has already been degraded (through trampling, grazing and extensive cultivation activities) and due to the highly seasonal nature of the Apolisvlei wetland little to no obligate or facultative vegetation species were present. Due to the sensitive nature of depression wetlands, it is considered imperative that the wetland feature as well as the 32m buffer area be completely cordoned off as a no-go area and no construction equipment or personnel be allowed to enter. This 32m Zone of Regulation then serves a dual purpose of compliance with the

[2] As determined by Bluescience (2009). The Scope of Works as part of this verification did not include determination of the PES and EIS of any watercourses.

National Environmental Management Act, 1998 (Act 107 of 1998) as well as being retained as a conservation buffer.

Similarly, it is strongly advised that the 32m buffer zone be revegetated with fynbos species from the Swartland Granite Renosterveld vegetation type within which the study area is located. A suitably qualified botanist should be appointed to assist with this rehabilitation and reinstatement. In line with the development layout plan (Figure 3) pedestrian walkways can be constructed within the buffer area. It is advised that all walkways comprise of permeable surfaces, with raised wooden boardwalks with railing to ensure no disturbance to the reinstated habitat. The boardwalks should not be located closer than 5m from the edge of the delineated Apolisvlei wetland to reduce impacts to this wetland feature.

During the operational phase, it is considered likely that the surrounding landscaped areas will be irrigated. Care must be taken to not use fertilizers, herbicides or pesticides within the area surrounding the Apolisvlei wetland as this may have detrimental impacts on the water quality and flora and fauna within the buffer zone.

The results of the outcome of the DWS Risk Assessment Matrix (2016) are summarised in Table 1 below, including key mitigation measures for each activity that must be implemented to reduce the expected impacts. Although GN509 of 2016 makes allowance for activities with a low risk scoring to be generally authorised, most of the construction related activities were determined to pose a 'Moderate' risk significance to the wetland, and, due to the presence of sewer pipelines (forming part of the proposed development as a whole) within 500m of the wetland feature, a full Water Use Licence Application (WULA) from the Department of Water and Sanitation (DWS) will need to be obtained.

Table 1: A summary of the DWS Risk Assessment outcomes for the proposed development activities.

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
Construction Phase									
Site clearing prior to commencement of construction activities associated with the development within 500m of the Apolisvlei Wetland but outside the 32m buffer area.	*Exposure of soils, leading to increased runoff into the pan and erosion thereof, and thus increased sedimentation of the watercourse; *Increased dust resulting in smothering of biota and potentially altering the vegetation composition; and *Potential proliferation of alien and invasive species.	Loss of habitat and ecological structure resulting in impacts on vegetation and biota. Potential risks to water quality. Proliferation of alien and invasive spp. Changes to ecological and socio-cultural service provision. Changes to hydrological function and sediment balance.	2	6	9	**54**	**L**	**HIGH**	· A minimum 32m buffer area must be implemented around the Apolisvlei Wetland. This buffer area should be cordoned off for the entire construction period and all personnel be made aware that it is strictly a no-go area. No unauthorised personnel or construction equipment may enter into this area. · As far as feasibly possible, construction vehicles should utilise planned internal roads, especially for areas surrounding the Apolisvlei buffer area so as to limit vehicle movement in the surrounding area and dust generation. · Care must be taken to not alter the slope of the landscape surrounding the Apolisvlei wetland. · It is considered imperative that a suitably qualified Environmental Control Officer (ECO) be appointed to undertake regular audits to ensure the Apolisvlei wetland is not negatively impacted by the construction activities.
Construction activities associated with the housing development, within 500m of the Apolisvlei wetland but outside the 32m setback area.	*Disturbances of soils leading to increased alien vegetation proliferation, and in turn to further altered freshwater habitat; *Changes to surface water run-off surrounding the pan, reducing volume of	Impacts on the hydrology and sediment balance of the river Changes to ecological and socio-cultural service provision. Changes to hydrological function and sediment balance. Loss of habitat and ecological structure resulting in impacts on vegetation and biota. Potential risks to water quality.	2,5	6,5	13	**84,5**	**M**	**HIGH**	· All contractor laydown areas and stockpiles are to be established at as far as feasibly possible from the 32m setback area. · An Alien and Invasive Control Plan must be implemented for the construction and operational phases of the development to prevent proliferation of Alien and Invasive Plants (AIPs) and to manage potential garden ornamental plant species from escaping into the Apolisvlei and associated buffer area. · Dust suppression should be prioritised for areas upwind of the Apolisvlei to prevent excess sediment build up within the pan.

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
Construction activities associated with sewer and water pipelines within 500m of the Apolisvlei Wetland	water entering the watercourse seasonally.		2,5	5,5	11	**60,5**	**M**		· During the wet season, basic *in situ* water quality sampling should be undertaken on a monthly basis to ensure that no contamination of water is occurring as a result from the surrounding construction activities. <u>Concrete mixing on site (Sewer pipeline to be concrete encased for the length of the delineated watercourses)</u>: · No mixed concrete may be deposited outside of the designated construction footprint. · A batter board mixing trays and impermeable sumps should be provided, onto which any mixed concrete can be deposited whilst it awaits placing. · All wet concrete areas must be contained so as to prevent any contaminated runoff into the Apolisvlei and its associated buffer zone. At no point may dirty water be directed or pumped into the wetland from the construction area. · Concrete spilled outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site. <u>Rehabilitation of the Apolisvlei and associated buffer area</u> · A suitably qualified botanist should be appointed to assist with the restoration of fynbos species within the 32m buffer area and reinstatement of wetland vegetation species within the Apolisvlei. The buffer area will create a transitional zone between the aquatic and terrestrial environments and provide habitat for various faunal and avifaunal species. Furthermore, this setback area further create a buffer between the residential development and assist in polishing stormwater run-off from hardened surfaces.

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
Stormwater Management for the proposed housing development: Potential impacts to the Apolisvlei wetland	*Increased hardened surfaces and diversion of stormwater away from the Apolisvlei, resulting in reduced water volumes entering the pan seasonally.	*Proliferation of alien and invasive spp. *Changes to hydrological function and sediment balance.	1,75	4,75	12	57	M	HIGH	· A Stormwater Management Plan must be developed and a suitably qualified freshwater specialist should provide input in order to ensure that the hydrological drivers of the Apolisvlei wetland are retained. · Sustainable Urban Drainage systems (SUDs) should be implemented for the estate by means of earth swales. All swales should be sloped to no greater than a 1:3 ratio and a degree of sinuosity should be re-established. The swales should be lined with rock and/or cobbles to create additional ecological habitat.  **Figure A: Example of an earth swale as part of a development.**
Potential spillage from construction equipment.	Spills / chemical leaks from construction vehicles.	*Possible contamination of freshwater soils and surface water, leading to reduced ability to support biodiversity	1,5	3,5	8	**28**	L	HIGH	· Should any leakages from construction vehicles or material containers occur, they should be cleaned up immediately. · Refuelling of vehicles should take place on a sealed surface to prevent ingress of hydrocarbons into the soil. · Construction vehicles should be restricted to designated roads only.*Suitable waste disposal facilities should be provided. · These facilities should regularly be emptied and taken to a registered waste disposal facility.

Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
									· If waste/spillage has entered the watercourse and caused a decrease in the water quality of the watercourse, these spills should immediately be cleared and the water within the watercourse treated as per the instruction of the ECO.
Operational Phase									
Operation and maintenance of the Darling Eco Estate, including irrigation of open space areas within 500m of the Apolisvlei Wetland but outside the 32m setback area.	*Irrigation of open space areas resulting in changes to the hydrological regime and seasonality of the Apolisvlei Wetland. *Increased nutrients entering the Apolisvlei wetland through stormwater runoff from surrounding fertilized areas (gardens/parks).	*Potential eutrophication of water within the Apolisvlei wetland (during the wet season) resulting in unpleasant odour and proliferation of algae species. *Litter entering into the Apolisvlei wetland posing risks to resident faunal species that utilise the pan.	1,75	3,75	12	**45**	**L**	**HIGH**	· As much indigenous terrestrial vegetation should be included into the landscape plan for the open space areas. Indigenous vegetation will reduce the irrigation requirements as well as requirement for fertilizers. · Care must be taken when using herbicides and pesticides in gardens and open space areas, especially during the rainy season when stormwater runoff is high. These chemicals must be used in accordance with the prescribed quantities to prevent contamination of surface water in the nearby watercourse, especially since stormwater is released therein. · All walkways/boardwalks should be inspected quarterly to ensure integrity is maintained.
Operation and maintenance of sewer and bulk water pipelines within the Darling Eco Estate, within 500m of the Apolisvlei wetland.	*Potential leaking or blocked infrastructure resulting in contaminants entering the Apolisvlei wetland.	*Contamination of the watercourse with sewage effluent resulting in: - Increased concentration of salts, nitrate and toxic ammonia concentrations, as well as counts of *Escheria coli*; and - Potential eutrophication of the system, including anoxic conditions, leading to biodiversity simplification and the excess production of hydrogen sulphide gas as well as increased alien and invasive species encroachment. - Potential health risk to surrounding residents.	2,5	4,5	11	**49,5**	**L**		· All water and sewer pipelines and all manholes must be pressure tested for integrity upon the completion of construction; · It is recommended that the managing authority test the integrity of the pipelines at least once every five years or more often should there be any sign or reports of a leak; · Should a blockage occur all possible steps are to be taken to prevent the pollution (specific to the sewer pipeline) from entering the Apolisvlei wetland during repair, including the placement of sheeting around the manhole used for access as well as containment barrels for any effluent withdrawn. · No vehicles are permitted to drive through the delineated wetland or its associated 32m buffer area. Any maintenance works must be undertaken by foot or the relevant authorisations obtained beforehand. · On repair of any leaks, all excavated areas must be backfilled and alien vegetation proliferation must be monitored until basal cover has been established.

6. CONCLUSION

Based on the findings of the study, the following is recommended:

1. This verification concurs with the findings of the report compiled by Bluescience (2009), however, the seepage area as delineated therein was not identified. Although a wet season verification was not undertaken, it is opinion of SAS that the hydrological drivers of the seepage area have been permanently destroyed as there is no evidence that a wetland vegetation response has occurred over the last 10 years.

2. It is, however, recommended that this seepage area be field verified during the wet season since the proposed development layout plan does not make provision to retain this feature.

3. A 500m Zone of Regulation in accordance with General Notice 509 of 2016, as it relates to the National Water Act, 1998 (Act 36 of 1998) and a 32m Zone of Regulation in compliance with NEMA (which will simultaneously serve as a conservation buffer, as well as a no-go area during construction)are associated with the Apolisvlei wetland. The buffer area must be reinstated with floral species representative of the Swartland Fynbos Renosterveld vegetation type.

4. Based on the outcome of the DWS Risk Assessment, the risk significance of the proposed development and associated activities on the Apolisvlei Wetland is considered to be a 'Low' and 'Moderate' risk, assuming that the mitigation measures as presented in Table 1 are implemented. It is recommended that the DWS be consulted and this report presented to them to ensure that they agree with the opinion presented herein, and to obtain guidance as to the requirements of a Water Use Licence Application.

7. REFERENCES

Department of Water Affairs and Forestry (DWAF). 2005. Final draft: A practical field procedure for identification and delineation of wetlands and Riparian areas.

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