DRAFT FOR REVIEW

BIODIVERSITY ASSESSMENT

for the

AALWYNDAL PRECINCT PLAN, MOSSEL BAY

A synthesis of the specialist reports and findings
of the vegetation, ecology and freshwater reports on Aalwyndal.

PREPARED FOR:	Mr W Manuel Mossel Bay Municipality
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Document Author:	Debbie Bekker / Marita Burger
Document Reviewer:	John Sharples
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Document Owner Contact Details:	**Sharples Environmental Services cc.** Tel: 044 873 4923 Fax: 044 874 5953 Email: debbie@sescc.net Post: P.O. Box 9087, George, 6530 Physical Address: 102 Merriman Street, George, 6530

LIST OF ACRONYMS & ABBREVIATIONS	
CBA	Critical Biodiversity Area
DEA&DP	Department of Environmental Affairs & Development Planning
DWS	Department of Water & Sanitation
EA	Environmental Authorization
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
ESA	Ecological Support Area
GN	Government Notice
HGM	Hydrogeomorphic
MMP	Maintenance Management Plan
NEMA	National Environmental Management Act, Act 107 of 1998, as amended
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act, Act 25 of 1999
NWA	National Water Act, Act 36 of 1998
PES	Present Ecological State
SDF	Spatial Development Framework
WCBSP	Western Cape Biodiversity Spatial Plan 2017

Table of Contents

Table of Figures

List of Tables

List of Appendices

1 Introduction

The Mossel Bay Municipality (MBM) has to cater for the never ending demand for housing and development opportunities. The MBM plans to densify the urban areas and has included Aalwyndal as part of the new development pattern. The Mossel Bay Growth Options Study (MBGOS) conducted in 2015, found that increased density of urban development is significant in containing urban sprawl. Low density development of Mossel Bay will require an additional 2883 hectares of urban development by 2035. This scenario will have a huge impact on municipal infrastructure and finances since it will require connection of this extensive development with current infrastructure. Aalwyndal's location makes it the ideal area to densify as Mossel Bay expands in years to come. Keeping Aalwyndal in its current state will force development to areas further away from town centre. This will entail major costs for construction and maintenance of municipal infrastructure and delivery of services.

There are a few elements that shape how the precinct plan is developed. Firstly, the natural environment needs to be considered through protection of vegetation with a CBA classification. Furthermore, slopes of more than 1:4 will also restrict development and the existing boundaries and streets need to be considered as it is currently under private ownership. Lastly, a noise contour was identified within which no residential development should occur. In the Mossel Bay Municipality Spatial Development Framework of May 2018 a portion of Aalwyndal is identified for new development (Figure 1). This portion is located along Aalwyn Road. It stretches from the Num Num Cape Estate on the one side to one/two properties on the opposite side. The development of this north eastern section is preferred since linking it with current municipal services like electricity supply and a water network will be easier and cheaper than for properties further west and south.

Aalwyndal is currently zoned single residential. To some extent, to zone properties to single residential and then ask the question of what and how much can be conserved is to put the cart before the horse so to speak. However, the zoning was granted many years ago and the motivation for this study came from forward thinking officials at the Mossel Bay Municipality. This is a very important aspect of the study area as it is a right assigned to the properties and which has a major influence on the study area and this study. Willem de Kock, the town planner of WM de Kock associates Town Planners was appointed to develop a precinct plan. This precinct plan will take into account the needs for densification, containment of the development footprint, and linking Aalwyndal to the town of Mossel Bay, which is deemed to be one of the most sustainable and logical options for the MBM to address the need for housing.

Specialist biodiversity input is required to identify the environmental constraints and opportunities associated with the proposed precinct plan. These opportunities and constraints relate to how the development aims and objectives of the precinct plan can be achieved while not compromising on the minimum requirements needed to protect and avoid sensitive habitats and where possible restore areas and ecological processes. It was with this in mind that the assessment took place by the relevant specialists with a forward-thinking, realistic, and holistic approach.

Essentially the MBMs question was as follows; “given the fact that this area is zoned single residential and given the fact that the vegetation is sensitive, what areas of vegetation should be kept aside to not only ensure a sensible town planning precinct but also a sensible and viable ecological/open space system.” It is with this in mind that we have mapped the various vegetation types, what ecological functions they serve and how they fit together with the drainage lines and their functioning and other ecological constraints. It’s also important to understand that conserving isolated pockets of vegetation is of little use and will ultimately lead to the demise of that vegetation or river system if it is not conserved properly or as a unit. This is the reasoning and approach behind the study.

1.1 Location

Mossel Bay is one of the coastal towns of the Garden Route and is a very popular amongst tourists. Aalwyndal is situated north east of Mossel Bay (Figure 2). The N2 National Road passes south east of the study area and provids easy access to the site. To the east of Aalwyndal past the N2 lies the busy Louis Fourie Road and the Langeberg Mall in Voor Baai. The Mossel Bay Airport is situated southwest of the site, beyond the study area. The Mossdustria development is located further west, past the R327 Road.

Figure 1: Google Earth satellite image of Aalwyndal in relation to Mossel Bay and Voor Bay

1.2 Project Team

Sharples Environmental Services cc (SES) contracted a team of specialists to conduct studies on the biodiversity of Aalwyndal pertaining to their respective fields of expertise. Nick Helme is the Botanical Specialist with an Honours degree in Botany. He has been working as a specialist botanical consultant in the diverse flora of the south-western Cape, since 1997. Debbie Bekker holds a M.Sc. degree and is the freshwater ecologist for this project. She has over 8 years of experience in consulting and is well established in her specialist field. She is also responsible for the GIS management. Ken Coetzee and Bruce Taplin are the Ecological Specialists involved with this report. Ken holds a M.Sc degree and Bruce a B.Sc. Ken is the founding member of Conservation Management Services, his consulting business based on 45 years of active conservation management experience. Bruce has over ten years' experience in the formal biodiversity conservation sector. He earned most of this experience through being the Regional Manager for biodiversity programmes in National Parks in the Western and Eastern Cape. The information contained in the specialist reports has been synthesised into this report by SES. John is the Managing Director of SES and acts as the Project Manager and Environmental Assessment Practitioner for the Aalwyndal project. He has been running SES since 1998 and has 12 years working experience in environmental organizations prior to that. Marita recently joined the aquatic division of SES and assists Debbie with projects.

Table 1: Team of this project with their qualifications, role and professional details

	SES Project Team		
SPECIALIST	**QUALIFICATIONS**	**ROLE**	**DETAILS**
JOHN SHARPLES	M.Sc - Environmental Management	**EAP & PROJECT MANAGER**	John is an environmental assessment practitioner. He started SES in 1998 and has overseen the company's growth and development. SES is located in George, within the Eden District Municipality. He has consulted for 20 years running a team of highly trained and qualified consultants and prior to this gained 12 years of experience working for environmental organizations. John is registered with EAPASA as a certified Environmental Practitioner. SES has been actively engaged in the fields of environmental planning, assessment and management. John leads a team of highly skilled consultants.
DEBBIE BEKKER	M.Sc degree – Environmental Science (Rhodes University)	**FRESHWATER SPECIALIST & GIS MANAGEMENT**	Debbie is a qualified freshwater ecologist and holds a BA (Environmental Science and Geography), BA (Hons) and M.Sc in Environmental Science from Rhodes University. She was awarded her Master of Science degree, by thesis, in Wetland Science, entitled: The origin and evolution of the Tierkloof Wetland, a peatland

			dominated by *Prionium serratum* in the Western Cape. She has specialised in aquatic habitat assessment and has been consulting for more than 8 years producing numerous aquatic habitat impact assessment reports. She is well established in her specialist field and has worked in various provinces.
KEN COETZEE	M.Sc. degree Pri.Sci.Nat	**ECOLOGICAL SPECIALIST**	Ken is the founder member of Conservation Management Services. His consulting business is firmly based on forty five years of active conservation management experience, twenty five of which were with a formal conservation agency and 19 of which he has spent developing his private consultancy.
BRUCE TAPLIN	B. Sc. degree	**ECOLOGICAL SPECIALIST**	Bruce has over ten years of extensive experience in the formal biodiversity conservation sector, with the majority of this experience being earned as a Regional Manager for biodiversity programmes in National Parks in the Eastern and Western Cape.
NICK HELME	BSc (Honours) – Botany Pri.Sci.Nat	**BOTANICAL SPECIALIST**	Since 1997 Nick has been based in Cape Town, and working as a specialist botanical consultant, specialising in the diverse flora of the south-western Cape. Since the end of 2001 he has been the Sole Proprietor of Nick Helme Botanical Surveys. He has conducted over 1600 botanical and ecological assessments in the winter rainfall regions of South Africa (Western and Northern Cape). One of his core competencies is being able to rapidly assess the conservation value and ecological issues facing a diverse range of habitats, and reporting on this, accompanied by the drafting of accurate maps.
MARITA BURGER	BSc (Honours) – Environmental Science	**EAP**	Marita is an environmental assessment practitioner. She holds a BSc in Environmental and Biological Sciences and a BSc Hons in Environmental Science. Her key interests are water resource management and GIS mapping.

2 Scope of Report

(a) The objectives are to conduct a targeted ground-truthing of the area, based on desktop analysis, to assess the quality/functionality of the area's biological components. This would include biodiversity patterns, the ecological processes that support them, interactions, and connectivity (i.e. diversity, condition, landscape context/corridors) to determine the likelihood of long-term habitat persistence.

(b) Following this, we would identify representative biodiversity areas that are irreplaceable or ecologically important and produce composite maps using GIS software.

(c) The report will then discuss the biodiversity findings in relation to the Aalwyndal Precinct Plan; to achieve sustainable development in the context of spatial efficiency/optimal land use needs for urban expansion. This includes a discussion on the potential for the open space to be used as an offset area.

The report will not, however, be a full conservation or biodiversity offset plan. The phase, detailed above, will help determine if offsets are required at all. Due to the requirements needed for such a study, it would have to be undertaken at a later stage, after the findings of the initial assessment.

2.1 Vegetation Assessment

- ✓ Contextualization of the study area in terms of important biophysical characteristics and the latest available conservation planning information (including but not limited to vegetation, CBAs, Threatened ecosystems, Red List information, sensitive and protected areas).
- ✓ Undertake a site visit and ground-truth biodiversity information. Undertake baseline surveys and/or studies to supplement the information base and inform the assessment.
- ✓ Describe and map important biodiversity at the site and in the wider landscape, from both pattern and ecological process perspectives. Additionally, describe areas or features off site that could be indirectly impacted by the proposed land use.
- ✓ Note the condition of ecosystems and levels of degradation, including invasive species.
- ✓ Estimate the trajectory of change due to existing impacts and realistic future threats.
- ✓ Produce a sensitivity map of the vegetation of the site.
- ✓ Identification, prediction and description of potential impacts on habitat during the construction and operational phases of the project.
- ✓ Recommend actions that should be taken to avoid impacts on sensitive habitat, in alignment with the mitigation hierarchy, and any measures to restore areas/ ecological processes.

✓ Identify areas of high importance or sensitivity on which impacts should *preferably* be *avoided or prevented* or, should at least be *minimized* (e.g. through buffers or setbacks).

✓ Identify areas that are known to be important for biodiversity but are degraded or invaded by alien species and require rehabilitation or restoration, including areas that could improve connectivity and reduce fragmentation in the landscape.

✓ Identify areas that would be worthy of protection (i.e. through biodiversity stewardship).

✓ Evaluate whether or not the likely impacts would compromise the desired management objectives for specific biodiversity areas or features (CBA, ESA, FEPA, protected area, etc).

✓ An accurate description and map of the areas and features of importance to biodiversity and their sensitivity to the proposed development. Possibly recommend alternatives.

✓ Briefly discuss the potential for the area mapped as 'open space' in the Precinct Plan to be used as a biodiversity offset for the development.

✓ Reference all sources of information and/or data used.

✓ Indicate limitations and assumptions, particularly in relation to seasonality.

✓ Description of the methodology adopted in preparing the report

✓ Provide all necessary shapefiles (Google Earth kmz files) and a comprehensive report

✓ The specialist and the report must comply with the latest guidelines and legislation

2.2 Ecological Assessment

2.2.1 Provide a general overview of the affected area in terms of connectivity, corridors, and ecological viability of the affected area.

a) In terms of biodiversity pattern, identify or describe:

i) Community and ecosystem level.

ii) The habitat extent and interaction with neighbouring types, soils or topography

iii) Threatened or vulnerable ecosystems (cf. new SA vegetation map/National Spatial Assessment, conservation plans, WCBSP, CapeNature State of Biodiversity Report.

iv) The types of animal communities (fish, invertebrates, avian, mammals, reptiles etc).

b) Species level:

i) Red Data Book species (give location if possible using GPS).

ii) The viability and estimated population size of the RDB species that are present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70–100% confident; Medium 40–70% confident; Low 0–40% confident).

iii) The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (include degree of confidence).

c) Other pattern issues:

i) Any significant landscape features or rare or important vegetation/faunal associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.

ii) The condition of the site in terms of current or previous land uses.

d) In terms of biodiversity process, identify or describe:

i) The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire.

ii) Any spatial component of an ecological process that may occur at the site or in its vicinity (i.e. corridors such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and vegetation boundaries such as edaphic interfaces, upland-lowland interfaces or biome boundaries).

iii) Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.

iv) Would the conservation of the site lead to greater viability of the adjacent ecosystem by securing any of the functional factors listed in (1)?

v) Would the site or neighbouring properties potentially contribute to meeting regional conservation targets for both biodiversity patterns and ecological processes?

vi) What is the significance of the potential impact of the proposed project, alternatives and related activities –- with and without mitigation –- on biodiversity pattern and process (including spatial components of ecological processes) at the site, landscape and regional scales?

2.2.2 Indicate on a map:

a) The location of vegetation, habitat and spatial components of ecological processes that should not be developed or otherwise transformed.

b) Areas, including the site and surrounds that must remain intact as corridors or ecological “stepping stones”.

2.2.3 Recommend actions that should be taken to prevent or, if prevention is not feasible, to mitigate impacts and restore disturbed vegetation or ecological processes. Indicate how preventative and remedial actions will be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity. This must be discussed in the context of the proposed precinct plan, especially considering the potential for the open space to serve as an offset area.

2.2.4 Indicate limitations and assumptions, particularly in relation to seasonality. Description of the methodology adopted in preparing the report. Provide all necessary shapefiles and a

comprehensive report. The specialist and the report must comply with the latest guidelines and legislation.

2.3 Freshwater Assessment

The broad purpose of this freshwater habitat assessment project component is to conduct a ground-truthed delineation of aquatic ecosystems within the Aalwyndal area (in accordance with Precinct Plan study area) to ascertain, amongst other variables, the location, extent, functionality, importance and sensitivity of any wetland or riparian systems present. This also includes biotic and abiotic indicators that are crucial for functioning ecological processes. The attributes of the freshwater habitats and corridors associated with them, will then be assessed according to the proposed urban expansion and present any opportunities or constraints associated with the proposal. The basic scope involved:

- ✓ Contextualization of each study area in terms of important biophysical characteristics and the latest available freshwater conservation planning information.
- ✓ Desktop delineation and illustration of all watercourses within each study area utilising available site-specific data such as aerial photography, contour data and water resource data.
- ✓ Ground-truthing, infield identification, delineation and mapping of any affected freshwater ecosystems in terms of the Department of Water and Sanitation (DWAF 2008) *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas*.
- ✓ Classification of the identified freshwater ecosystems in accordance with the, '*National Wetland Classification System for Wetlands and other Freshwater Ecosystems in South Africa'* (Ollis *et al*. 2013) and *WET-Ecoservices* (Kotze *et al*. 2009).
- ✓ Description of the identified watercourses with photographic evidence
- ✓ Conduct a Present Ecological State (PES), functional importance assessment and Ecological Importance and Sensitivity (EIS) assessment of the delineated wetland habitats, utilising:
    - o Level 1 WET-Health tool (Macfarlane *et al*., 2009) – PES
    - o WET-Ecoservices (Kotze *et al*., 2009) - Functional assessment
- ✓ Conduct a Present Ecological State (PES) and present Ecological Importance and Sensitivity (EIS) assessment of the delineated river/riparian habitats, utilising:
    - o Qualitative Index of Habitat Integrity (IHI) tool adapted from (Kleynhans, 1996) – PES
    - o DWAF (DWS) River EIS tool (Kleynhans, 1999) - EIS
- ✓ Indicate the Recommended Ecological Category (REC) of the freshwater ecosystems.
- ✓ Identification, prediction and description of potential impacts on freshwater habitat during the construction and operational phases of the project.
- ✓ Identify direct, indirect, and cumulative impacts the proposal will have on freshwater habitats and the significance of these impacts.

- ✓ Recommend actions that should be taken to prevent impacts on freshwater habitat, in alignment with the mitigation hierarchy, and any measures necessary to restore ecological processes.
- ✓ The identification and assessment of opportunities and constraints of the proposed project.
- ✓ Determination and mapping of No Go and buffer zones utilising the *Buffer zone guidelines for rivers, wetlands and estuaries* (Macfarlane & Bredin, 2016).
- ✓ Identify legislation requirements that are relevant to the proposal from a freshwater perspective.
- ✓ Indicate limitations and assumptions.
- ✓ References for all sources of information and/or data used.
- ✓ Meetings with the relevant project personnel
- ✓ Present recommendations of the suitability of site based on sensitivity analysis.
- ✓ GIS mapping and shapefiles
- ✓ Preparation of a Freshwater Habitat Spatial Assessment Report

3 Assumptions and Limitations

Included within each specialist report is a description of the assumptions and limitations associated with that specific component of the study. Additional assumptions and limitations, identified for the project as a whole, are detailed below:

- The study was based on information and datasets provided by the client. It is assumed that this information is accurate. The proposal consists of a spatial concept plan, and therefore no detailed technical reports are available as yet, which increases the potential 'unknowns'. It is assumed that the required refinements based on revised plans will occur further in the process.
- It must be noted that during the fieldwork phase of this study, access to a few of the properties was restricted. However, the large majority were accessible, and it is unlikely that this problem has affected the findings.
- Due to the nature of GIS software and datasets there are variables that can affect the accuracy of spatial analysis.
- Although an objective of this study is to provide input regarding potential biodiversity offsets associated with the open space, it is not a full biodiversity offset report/plan and purely a discussion involving the concept of offsets to best guide the process going forward. This is highlighted in the botanical report: "In this plan it specifically states that the extent of the Open Space is conceptual and must be ground-truthed. Given the absence of development detail for most of the study area – notably in the Residential areas (which cover about 60% of the area), it is not possible to accurately describe the type or extent of likely development impacts. As the extent of the likely impact on the entire site is not known, any discussion of biodiversity offsets that may be needed for the greater site is purely theoretical, as the quantum of any offsets would be determined by the unknown residual botanical or ecological impacts after mitigation (DEA 2017). Until such time as there is a specific development proposal and layout for a precise area any assessment of impact or planning of biodiversity offsets that may be required would be very premature, and hence inadvisable".
- The study does not exempt any persons from compliance with applicable legislation.

4 Environmental & Planning Legislative Framework

A number of pieces of environmental legislation regulating the use and management of environmental resources have direct relevance if development is proposed on the sites. It is important to understand that while the area is zoned single residential it may not be considered an Urban Area by the Department of Environmental Affairs. This has certain implications in terms of listed activities in terms of NEMA.

National Environmental Management Act (NEMA)

The National Environmental Management Act (NEMA) (Act 107 of 1998 as amended) is the primary piece of environmental legislation in South Africa, establishes principles for decision-making on matters affecting the environment, and establishes a framework for integrating good environmental management into all development activities. The NEMA dictates that certain activities such as the clearance of vegetation of more than 5 hectares or the development of infrastructure within 32 meters of a water course or the development of roads wider than 8 meters will require the applicant to apply for an Authorisation in terms of NEMA. The Environmental Impact Assessment (EIA) Regulations, 2014 (GN No. R 324 - 327 of 7th April 2017), identify those activities ("Listed Activities") that require Environmental Authorization before such activities can be undertaken, and also describes the environmental impact assessment process that must be followed to apply for Environmental Authorization. The EIA Regulations make provision for two different EIA processes, namely (1) Basic Assessment and (2) Scoping & Environmental Impact Reporting (S&EIR) depending on which listed activities are triggered. The EIA Process could take between 6 months and 1 year (minimum time frame) depending on which EIA process in triggered.

In addition to this the NEMA also places a **duty of care** on all persons who have caused, or may cause significant pollution or environmental degradation, to take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or where such pollution or degradation cannot be avoided or stopped, to minimize and rectify the negative environmental impacts.

National Water Act

Section 21 of the National Water Act (NWA) (Act 36 of 1998) identifies 11 different types of "water-use" that require authorization from the Department of Water & Sanitation (DWS) unless such water-use is permissible in terms of Section 22 of the NWA.

It is important to note that a wetland is considered to be a watercourse in terms of the NWA. In addition, activities occurring within 500m of the boundary of a wetland may constitute a Section 21(i) water-use (DWAF 2007).

Water use authorization for certain water use activities may take the form of a Water Use License or a General Authorization, depending on the nature of the proposed water use.

National Environmental Management: Waste Act

The National Environmental Management: Waste Act (NEM:WA) (Act 59 of 2008) regulates waste management in South Africa in order to protect human health, and to prevent pollution and associated environmental degradation. Government Notice 921 of 29 November 2013, published under NEM:WA lists the waste management activities that have had or are likely to have a detrimental effect on the environment, and which require a Waste Management License from the relevant authority. Activities associated with recycling, recovery, treatment and disposal of waste have been listed and if the thresholds are met a waste license is required following an Environmental Impact Assessment Process.

Even if no waste license is required for developing on the sites, provisions relating to the reduction, re-use, recycling and recovery of waste (contained in Part 3 of NEM:WA) and the general duty in respect of waste management (Part 2 of NEM:WA) would need to be taken into consideration and adhered to if the sites were to be developed.

Spatial Planning and Land Use Management Act (SPLUMA)

Section 21(j) of the SPLUMA (Act 16 of 2013) stipulates, amongst others, that a municipal SDF must include a strategic assessment of the environmental pressures and opportunities within a municipal area, including the spatial location of environmental sensitivities and high potential agricultural land, where applicable.

Western Cape Land Use Planning Act (LUPA)

Municipal Spatial Development Plans must in terms of section 10 (2) (d) of LUPA, provide for specific spatial focus areas, including towns, other nodes, sensitive areas, or areas experiencing specific developmental pressures

5 Spatial Planning Context

The Mossel Bay Municipality wants to incorporate Aalwyndal into the new development pattern with the goal to densify it in years to come. The area is going to be developed and transformed into a residential suburb over the next 20 to 50 years and possibly even longer. The spatial plan involves densification, containment of the development footprint and linking Aalwyndal to Mossel Bay. The 2018 SDF indicates the need to limit lateral urban growth, mentioning Aalwyndal and the Hartenbos River corridor to Sonskynvallei as the only exceptions subject to further detailed environmental and precinct planning. Currently, Aalwyndal is believed to be the most sustainable options to provide for future expansion of the town making it a main priority in the SDF. It is proposed to develop the precinct as “a precedent setting, well connected mixed income, mixed use compact model urban village”.

The Mossel Bay Growth Options Study (MBGOS) conducted in 2015, found that increased density of urban development is significant in containing urban sprawl. Low density development of Mossel Bay will require an additional 2883 hectares of urban development by 2035. This scenario will have a huge impact on municipal infrastructure and finances since it will require connection of this extensive development with current infrastructure. Aalwyndal’s location makes it the ideal area to densify as Mossel Bay expands. Keeping Aalwyndal in its current state will force development to areas further away from town centre. This will entail major costs for construction and maintenance of municipal infrastructure and delivery of services.

Aalwyndal’s current status as smallholding area was established in the 1990’s through the subdivision of Brakkloof properties. The Department of Agriculture did not consider it to be strictly farming properties any more, resulting in it being rezoned from Agriculture to Single Residential. Portion 190 of Farm Brakkefontein 220 was subdivided in 2004 and later included in the urban edge. The remaining smallholding properties range in size from 2 to 18 hectares, with 75% being between 5 and 10 hectares. The Aalwyndal precinct in its entirety is included in the proposed urban edge of the Mossel Bay Municipality in 2016.

The Aalwyndal Precinct Plan’s vision includes incorporating the natural environment in the design of land parcels. In this case, it mainly refers to the incorporation of open space into urban development. Annexure A shows Open Space as proposed in the Precinct Plan. The extent is mainly limited to the steep slopes and drainage lines given the development constraints in these areas. The Precinct Plan proposes the integration of open spaces with the main road system. It also mentions the importance of linking open spaces to provide linear routes for recreational activities such as cycling and walking. In order to promote this, extra wide arterial roads are suggested which will provide space for 10 meter

corridors on each side of the road. These corridors are proposed to be landscaped with indigenous vegetation, pathways and recreation areas.

The broad spatial concept of the 2018 Mossel Bay Municipality SDF makes provision for the protection of river and wetland corridors. It states the importance of restricting urban development to 32 m from each bank or to a setback line as determined by a freshwater ecologist. Development bordering the river valleys should be single sided and facing the natural areas. A road or path should line the corridor, forming the boundary between the natural area and development. This approach ensures a continuous, safe and secure cycling, running and pedestrian recreational network. Proper cleansing management is important in these public areas.

In the Mossel Bay Municipality Spatial Development Framework of May 2018 a portion of Aalwyndal is identified for new development (Figure 1). This portion is located along Aalwyn Road. It stretches from the Num Num Cape Estate on the one side to one/two properties on the opposite side. It essentially covers the entire area below the escarpment and outside the 55 DBA noise contour for the proposed airport. The development of this north eastern section is preferred since linking it with current municipal services like electricity supply and a water network will be easier and cheaper than for properties further west and south.

Figure 2: Map in Mossel Bay Municipality SDF of 2018 showing in yellow where new development for urban expansion should take place. Areas marked IX, X and XI are selected for new development in Aalwyndal.

The spatial form of Aalwyndal is dictated by the components of the spatial pattern. The Precinct Plan proposes approximate sizes for each component. The residential area is the biggest component, followed by the commercial and mixed-use are which is delineated by the noise contour from the airport. The main road system and small business node at the main junction of the new road system, are 40 ha and 4 ha in size respectively. The proposed open space system, as determined by the natural features, was calculated by SES from the shapefiles provided as being 104 ha. The remaining area is located south of the airport and could be residential or airport related commercial area.

The Precinct Plan states that the open space system should be Open Space Zone I with Public Open Space as the Primary use. Consent use for this zone excludes tourism facilities as it is not desirable in this context. Other consent uses under Open Space Zone I such as urban agriculture, environmental facilities, informal trading and freestanding base telecommunication stations are included.

There are certain design guidelines that should be taken into account when preparing precinct plans. The SDF states that creating open space systems that integrate the elements of a settlement to contribute to a meaningful urban structure is an important urban design guideline. There are several aspects in an attempt to achieve this. Connectivity and appropriate linkages between open spaces are important. Providing walkways and pedestrian routes will ensure accessibility to these areas. Aligning the open space system with public buildings and ensuring improved quality of linkages through the continuation of special activities or functions along major routes should also be given consideration.

On properties where open space corridors are provided on land that could be developed, an option may be to use the conservation of these areas as an off-set against capital contributions. Additionally home owners who purchase homes from a developer may need to contribute a levy for the protection, management and conservation of these open space areas.

5.1 Western Cape Biodiversity Spatial Plan

The Western Cape Biodiversity Spatial Plan (WCBSP) identifies areas crucial for conserving a representative sample of biodiversity and maintaining ecosystem functioning. Critical Biodiversity Areas (CBAs) are required to meet biodiversity targets. These areas have high biodiversity and ecological value and therefore must be kept in a natural state without further loss of habitat or species. Low-impact, biodiversity sensitive land uses are the only land uses allowed in CBAs. Critically Endangered (CR) ecosystems, critical corridors for maintaining landscape connectivity and areas required to meet biodiversity pattern targets, are included in CBAs. The WCBSP made a distinction between areas likely to be in a natural condition (CBA1) and areas that could be degraded (CBA2).

Ecological Support Areas (ESAs) are not essential for meeting biodiversity targets but are important as they support the functioning of CBAs and Protected Areas (PAs). ESAs support landscape connectivity, surrounds ecological infrastructure that provide ecosystem services, and strengthen resilience to climate change. These areas include Endangered vegetation, water source and recharge areas and riparian habitat around rivers and wetlands. The WCBSP also made a distinction between ESAs in a functional condition (ESA1) and degraded areas in need of restoration (ESA2).

According to Helme (2019) the WCBSP map for Aalwyndal is very inaccurate as it is based on the SA Vegetation map which is inaccurate as discussed in 7.3. The North Langeberg Sandstone Fynbos vegetation type is not listed as a threatened vegetation type and therefore the south western area lacks CBAs. The CBA mapping further draws heavily on the theoretical distribution and habitat for the bontebok, a threatened vertebrate. The map does not draw on any threatened plant data, which up until now has been largely lacking for this area.

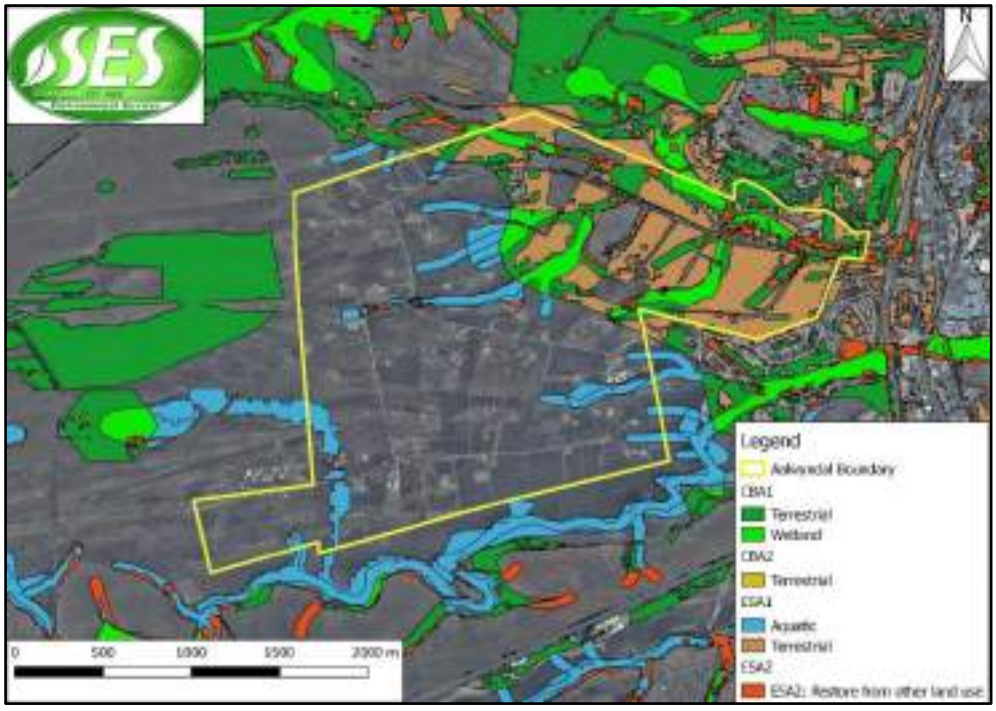

Figure 3: Map showing Aalwyndal in relation to the Western Cape Biodiversity Plan's CBA and ESA areas (Pence, 2017)

5.2 National Freshwater Ecosystem Priority Areas

Mapping the locality of aquatic habitat is essential for classification into the different wetland and river ecosystem types across the country, which in turn can be used with other data to identify aquatic systems of conservation significance. The National Freshwater Ecosystem Priority Area project (NFEPA) provides strategic spatial priority areas for conserving South Africa's aquatic ecosystems and supporting sustainable use of water resources. These priority areas are called Freshwater

Ecosystem Priority Areas (FEPAs) and the main output of the NFEPA project was the creation of FEPA maps. FEPAs were identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries (Driver *et al.* 2011). Various FEPA wetlands were identified by the NFEPA project throughout the study site as shown in Figure 10. No rivers are shown as present in the study area.

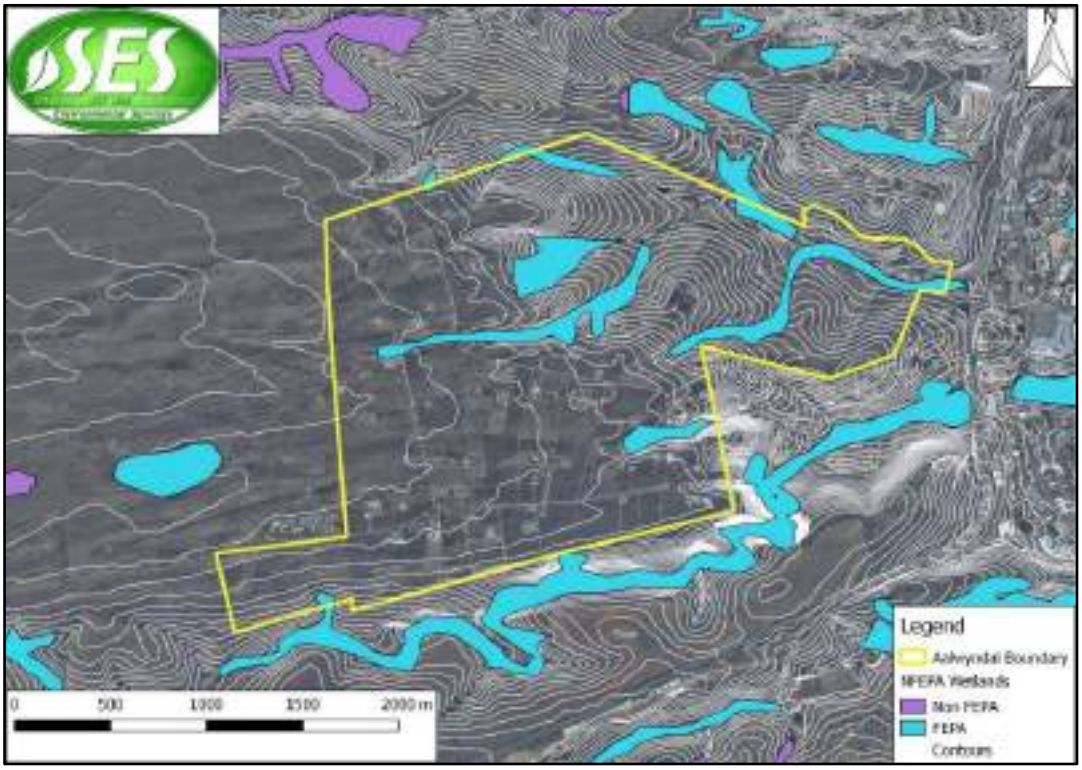

Figure 4: Map showing the NFEPA wetlands in and around Aalwyndal

The non-perennial streams within Aalwyndal are all contributing to flow into Mossel Bay's estuaries. Therefore, the impacts from any development on the tributaries will also influence the already heavily polluted estuaries. Estuaries form the boundary between freshwater and marine systems. They are of great ecological importance as they support biota and provide a range of services to the inhabitants of the region. Flow reduction, habitat modification and pollution are all threats to estuarine biodiversity (Pool-Stanvliet, 2017). The upstream changes in Aalwyndal should therefore be considered in terms of estuarine health as well. Currently, Aalwyndal's alien trees in the drainage areas alter the flow and increase the risk of erosion in tributaries. This leads to altered flow and sediment input into the estuaries. Development will change the surface runoff entering the tributaries which can cause flooding downstream if heavy rainfall occurs.

6 Historical development of Aalwyndal

Aalwyndal is currently comprised of small holdings (Figure 6). However, this has not always been the case. Figure 3 shows Aalwyndal in 1963. The coastal strip to the east is sparsely developed, leaving a big gap between Voorbaai and Hartenbos. Most of the area above the escarpment of Aalwyndal appears to be covered in natural vegetation, with the lower areas surrounding the northern drainage system developed as agricultural land. In 1974 the general vegetation cover (Figure 4) seems similar to 1963. One visible change is the National Road passing Aalwyndal to the south (Figure 4B). Figure 5 is a 1:50 000 scale aerial image taken in 1991. Subdivision of the area occurred in the 1990's, however no visible indication is evident yet in this image. Figure 6 shows the current state of Aalwyndal within which properties are easily distinguishable due to different land use and management in adjacent privately-owned properties.

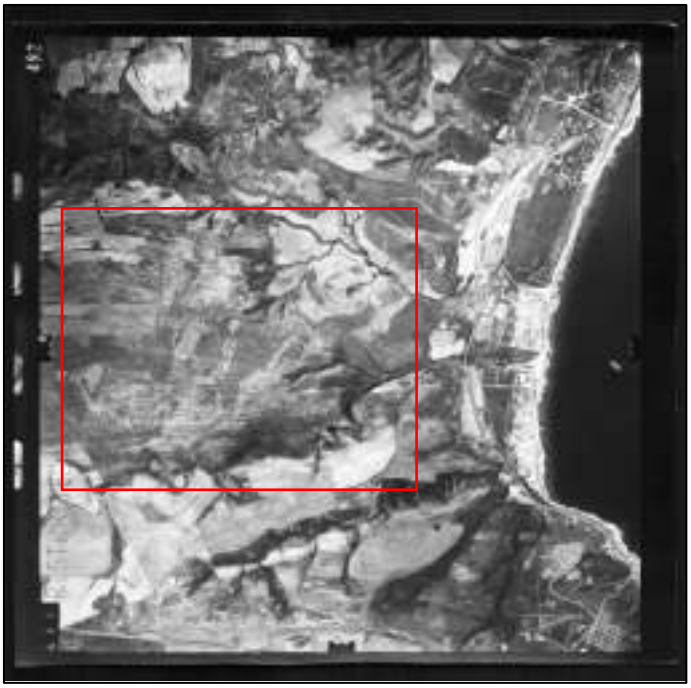

Figure 5: A 1:30 000 view of Aalwyndal in December 1963

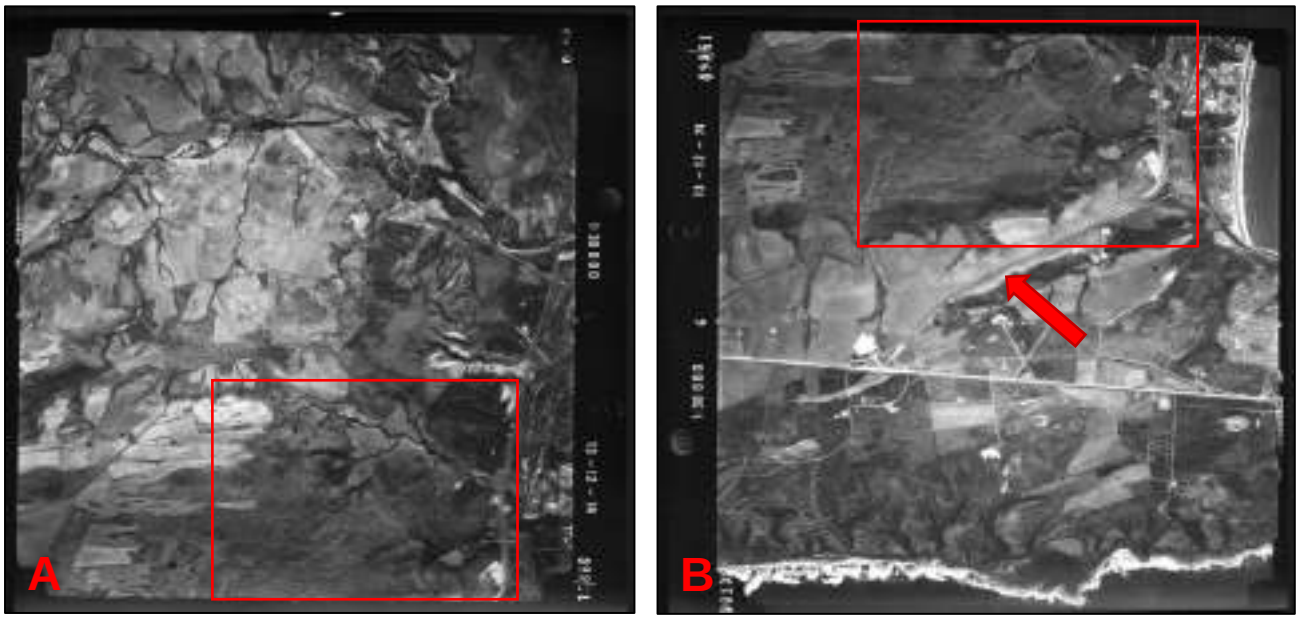

Figure 6: Northern (A) and Southern (B) Aalwyndal in 1974 at 1:30 000 scale. The arrow in 4B indicate the new National Road.

Figure 7: A 1: 50 000 view of Aalwyndal 1991

Figure 8: Aalwyndal, 2018

7 Results of Biodiversity Assessment

7.1 Botanical Specialist Findings

7.1.1 Habitat description

The vegetation in the study area is basically a mix of three different types that occur in a mosaic – Thicket, Renosterveld and Fynbos, with Renosterveld being the common factor. The vegetation in the undisturbed areas is species rich, with a diversity of life forms. Thicket occurs in some of the kloofs and on some of the warmer (north and northwest facing) slopes, often on stony, shale derived soils (Figure 11). The primary factor limiting the spread of the Thicket is probably fire, and in the long- term absence of fire the Thicket is likely to spread into the Fynbos and Renosterveld areas. As its name implies the unit is typically dense, and often spiny. Lichens are abundant in the Thicket, indicating significant long-term stability and coastal moisture. Renosterveld is the lowest growing vegetation type in the study area (Figure 12). Geophytes (bulbs) are a notable feature of this unit, and quite a number of succulents are present, such as *Ruschia tenella* and *Trichodiadema* spp. Fynbos typically occurs on the cooler, south and southeast facing slopes (Figure 13), or where there is a higher quartzite and manganese component to the soils (rather than clays).

Figure 9:View of dense, spiny Thicket on erf 175.

Figure 10: View of Renosterveld with scattered Thicket elements (plus a few invasive rooikrans), on erf 175, looking northeast.

Figure 11: View of Fynbos habitat on the upper, quartzite plateau (erf 184). The large shrub in the foreground is Protea lanceolata, in a matrix of Erica peltata.

The vegetation within the previously disturbed areas is characteristically different from that found in the undisturbed areas. Firstly, species diversity is significantly lower, being about 15-30% of that which one finds in the undisturbed areas. Secondly, the disturbed areas are heavily dominated by a few species, all of which are typical indicators of disturbance. Thirdly, plant community composition is very different, with very few succulents or bulbs in the disturbed areas (these are common in undisturbed areas), and an almost total absence of large woody shrubs. Some landowners have managed to eradicate almost all indigenous plants and these erven are dominated by cultivated

lawns, whilst others brushcut the vegetation to make it more suitable for grazing (Figure 14). No rare or threatened plant species were found in significant numbers within the disturbed areas.

Figure 12: Heavily brushcut natural vegetation (Fynbos Renosterveld), used for livestock grazing.

7.1.2 Alien species

Woody alien invasive vegetation is common on parts of the study area, notably in areas where previous soil disturbance has taken place, such as along roads and pipelines, where there was previous cultivation or ripping, and around reservoirs. The most common invasive in the study area is rooikrans (*Acacia cyclops),* which makes up 80% of the alien cover on site and covers an estimated 40ha in total. Rooikrans is present on almost every plot, with the possible exception of a few erven where no natural vegetation remains. Fortunately, both *Acacia saligna* and *Acacia cyclops* have been infected with biocontrol agents, and seedset has consequently been much reduced. In the case of the former, seedset is now virtually zero, and for the latter it is probably down to about 25-30% of what it would have been in the absence of biocontrol. It should however be noted that there is likely to be a very large and still viable soil stored seedbank for both these species, which will typically germinate after a fire.

7.1.3 Plant Species of Conservation Concern

Three rare and/or localised plant species (Species of Conservation Concern; SCC) were recorded within the study area during the survey.

The best quality patches of Thicket in the study area support significant numbers of white milkwood (*Sideroxylon inerme*). This tree is common and widespread along the south coast, but it is still listed as a Protected Species in terms of the Forest Act of 1998 (updated 2018) and permits are required for the removal or even the trimming of this species. *Ruschia leptocalyx* (Figure 15) is a rare succulent Red Listed as Endangered and was common only on erf 175. *Polygala pubiflora* is a small shrub Red Listed as Vulnerable and was recorded along the edges of thicket patches and amongst Fynbos, mainly on erf 184. *Ruellia pilosa* (Figure 16) is a regional endemic and is Red Listed as Vulnerable

and is common on erf 175 and on Ptn 6 of Farm 221. Mossel Bay Shale Renosterveld is known to support a number of rare and threatened *Haworthia* species and these small, highly cryptic succulent plants could well be present on some of the undisturbed parts of the site, although none were found.

Figure 13: Ruschia leptocalyx is a rare vygie only known from 5 localities in the southern Cape, and is Red Listed as Endangered, and was found to be common only on erf 175, along the eastern edge of the study area.

Figure 14: Ruellia pilosa is a regional endemic (Swellendam to Mossel Bay) and is Red Listed as Vulnerable. The species was found to be common in the Renosterveld parts of the site (notably on erf 175 and on Ptn 6 of Farm 221).

7.1.4 Botanical sensitivity

Figure 17 is a summary map of the botanical (and faunal, by extension) sensitivity of the study area, and it can be seen that about 25ha (4%) of the site has been mapped as being of Very High Sensitivity, and about 320ha (55%) has been mapped as High sensitivity. Thus a total of about 40% is of Low or Medium sensitivity. This corresponds to the most disturbed parts of the site, typically the area around the human habitations, as well as some large areas that have been planted with lawn, heavily brushcut or heavily trampled.

All the recorded plant Species of Conservation Concern were found within the High or Very High sensitivity areas and none are expected within the Low or Medium sensitivity areas in any significant numbers.

The Very High sensitivity area is distinct in that it supports 100% of the large site population of *Ruschia leptocalyx* (Endangered), 30% of the site population of *Polygala pubiflora* (Vulnerable) and 60% of the site population of *Ruellia pilosa* (Vulnerable), as well as being the only part of the site with extensive, undisturbed Thicket Renosterveld habitat. This area is considered **irreplaceable** in a regional and national context, and should thus clearly be formally conserved.

High sensitivity areas support largely intact natural habitat that has the potential to support at least one plant Species of Conservation Concern, and in most cases may support from one to two such species. Overall species diversity is high, with more than 75% of the potential complement of species present.

Medium sensitivity habitat has typically been partly disturbed (often heavily brushcut or grazed) but could still be rehabilitated to a fully functional degree, and generally supports about 20-50% of the original species diversity.

Low sensitivity habitat has usually been heavily disturbed (often by ripping or some form of cultivation or soil disturbance), is unlikely to support any plant Species of Conservation Concern and is not easily rehabilitible. Species diversity is usually less than 20% of what it would have been prior to disturbance.

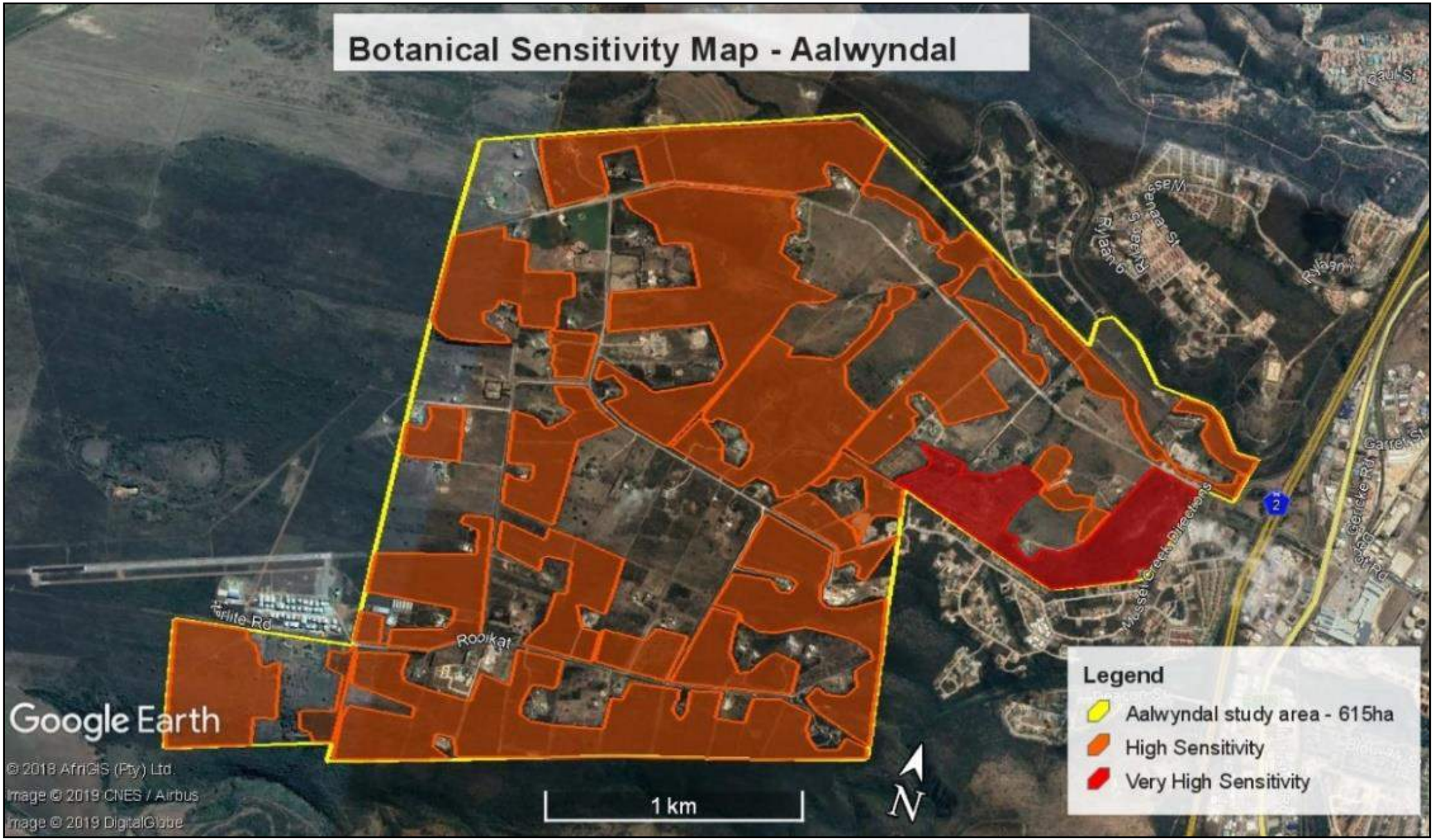

Figure 15: Botanical Sensitivity Map for the Aalwyndal study area. All unshaded areas within the study area are of Low or Medium botanical sensitivity.

7.2 Ecological Specialist Findings

7.2.1 Habitat description

The broad habitat units in terms of vertebrate fauna can be differentiated into a few areas. These habitats do not discriminate between alien and indigenous vegetation, but rather represent the structural and ecological attributes of the cover, as well as other habitat requirements, which are of importance to wildlife on the site.

The aquatic habitat is comprised of a number of earth dams and a network of drainage valleys. The dams are shallow with fluctuating water level and provide productive habitat for aquatic organisms as well as foraging and cover habitat for vertebrate fauna. The shores are grassy or red lined and cover alongside drainages are mostly dense thicket. The riverine areas have typical thicket drainage systems with seasonal water flowing over dense grass, reedbeds and other riverine aquatic vegetation. The banks of the stream are densely vegetated, but also infested with alien plants like black wattle.

The Fynbos and Renosterveld habitats are comprised of areas with intact and fairly dense (mature) Proteoid Fynbos. These habitats are present in fragments on the escarpment area and south-facing slopes and are sometimes grassy due to the disturbance of natural vegetation. Thicket habitat comprised of tree and shrub species occur along the drainage valleys.

Transformed pasture habitats make up the remainder of the area not covered by the above-mentioned habitats. These are all flat and gently sloping areas of former cultivation or land clearing, either for agricultural crops or the establishment of grazing pastures for cattle. Some of these pastures have not been actively tilled for some time and have consequently developed a tall and dense indigenous grass cover consisting mostly of *Eragrostis* sp. In some areas, due to the lack of grazing on these transformed areas, the Renosterveld and Fynbos appears to be staging a comeback as can be seen by a new dominance of renosterbos *(Elytropappus rhinocerotis)* and peperbos *(Oedera genistifolia)*.

Important features of these habitats are as follows:

a) The habitats vary greatly in complexity (density, cover type, structure, species, ground cover, substrate, slope), which results in a potential for high vertebrate faunal diversity.
b) All habitats have been modified or are in some way impacted by non-indigenous invasive trees, shrubs and grasses.
c) Transformed vegetation has resulted in different habitat conditions which favour a different fauna or larger populations of adaptable species (eg: rodents).
d) Plant and animal biodiversity will be lost if fires are withheld from Fynbos habitat and if alien plant infestations are not controlled.
e) Each habitat type must not be seen in isolation within the study area, but rather in terms of its importance in a landscape context - for example, connectivity with other areas of similar habitat on the study area and on adjacent land is important, as is the management and rehabilitation of these connected areas.

7.2.2 Habitat duplication on a landscape scale

The habitats identified on the study area extend well beyond the boundaries of the property. The Thicket, Fynbos and Renosterveld mosaic with disturbed areas of lands, pastures, residences and alien tree infestations, repeats itself continuously in the Mossel Bay, George, Knysna coastal area. The habitats of the study area are thus not unique, but they are under threat throughout the area. The threat of human residential expansion, commercial forestry and agriculture, coupled with invasion by aggressive alien trees elevates the value of each remaining patch of natural habitat, giving it threatened, conservation-worthy and high sensitivity to disturbance status. The thickets of the study area are thus not particularly unique, but they are under threat and dwindling. The transformed pasture areas represent sites of biodiversity loss and are rated to have a low priority in terms of wildlife and habitat conservation, but the rehabilitation of these areas back to a pioneer fynbos/renosterveld condition is possible and may help to re-establish certain faunal groups (particularly birds).

7.2.3 Habitat sensitivity

Following the evaluation of habitat sensitivity, it is clear that, in terms of the vertebrate fauna, only the transformed pasture areas are most suitable for development and that the other vegetation units should be rehabilitated and then managed as connected Fynbos, Renosterveld and Thicket conservation areas.

7.2.4 Vertebrate faunal occurrence

The fauna of the study area is typical of the Thicket, Renosterveld and Fynbos covered South Cape Coastal areas. It is relatively intact, except that many of the original larger mammal species were eradicated by the end of the nineteenth century. Smaller wildlife is, however, also under threat in the Southern Cape area as a result of habitat destruction; the effects of over-frequent fires fuelled by invasive alien plants and habitat fragmentation. The effects of domestic cat predation also have a significant effect on small indigenous wildlife, as predatory feral cats are widespread in the area. As no detailed checklists of fauna are available for the specific study area, fauna checklists for the general George coastal area were drawn up and included as appendices to the Ecological report.

7.2.5 Faunal sensitivity and red data species

Animals have been classified in terms of the ever-increasing threats of overexploitation, illegal trade or habitat transformation and habitat loss. They are rated in terms of their vulnerability to extinction in Red Data books, one for each animal group. See Appendix 5 of the Ecological Report for Red Data classifications (ie: degree of vulnerability).

Herpetofauna - None of the amphibian or reptile species predicted to occur in the study area are listed as Red Data species. However, the artificial and wetland habitats within the study area should not be impacted in the interest of herpetile persistence.

Mammals - There are a number of Red data Mammal species predicted to occur in Aalwyndal. The long-tailed forest shrew, least dwarf shrew, Fynbos golden mole and Cape golden mole are all likely to occur in the area. All of these species occur in Thicket habitat and therefore Thicket areas should be completely avoided and left unaffected by development. The golden moles will remain largely unaffected by the proposed development if it is completely restricted to the transformed pasture areas.

The white-tailed rat is considered to be endangered due to large-scale loss of habitat which includes fynbos, renosterveld and southern Savanna grassland. If this species does occur in the area, its continued existence can be ensured by conserving Fynbos and Renosterveld and re-establishing natural Renosterveld habitat on the transformed pasture areas (confidence level for prediction is medium, 40-70%).

A number of species will be unaffected or even positively impacted by development. Coetzee (2019) predicts that bats will be unaffected by development. They might even be positively impacted by residential structure providing additional feeding and roosting opportunities. The only threat to African wildcats will be genetic contamination with domestic cats which would have already occurred due to domestic cats being long established in the area. The smaller wildlife area will however greatly benefit

from the banning of domestic cats in the development. Honey badgers will not be significantly impacted due to lack of preferred habitat and the natural vegetation only representing a small portion of typical foraging for the badgers. The striped weasel will have adequate habitat in the unaffected riverine and thicket areas (confidence of prediction is high, 70-100%). Further habitat can also be provided in areas that can be rehabilitated. It will be benefited rather than disadvantaged by development, as the largely rodent prey of this small carnivore will be little affected and possibly enhanced through habitat transformation (unless it is outcompeted by large numbers of domestic cats). The blue duiker, which are considered to be vulnerable due to loss of habitat, are unlikely to occur in the area due to a lack of ideal habitat.

In addition to the Red Data species, the Cape clawless otter, caracal, porcupine, honey badger and common duiker have recently been listed as having protected species status in terms of Section 56(1) of the National Environmental Management: Biodiversity Act (Act 10 of 2004). These locally indigenous species may make use of the natural habitats of the study area and if they do occur, they will probably not be negatively impacted by sensitive development in the transformed habitats.

Birds - Two of the bird species that are predicted to occur in the general area are classed as Red Data species. They are the Stanley's bustard and the grass owl. Neither are provided with suitable habitat in the study area, but may occur occasionally or temporarily (low confidence of prediction, 0-40%). It is predicted that the common birds that occupy the transformed pastures will be able to persist in the ecotonal and impacted areas of the sensitive areas, should development occur in low sensitivity areas. Regardless, they are adaptable generalists that occupy areas disturbed by man.

7.2.6 Landscape Connectivity

Ecological corridors are connections in fragmented landscapes between separate areas of similar habitats. With suitable corridors, animals may travel between habitat "islands" and thereby maintain gene flow between the various segments of habitat or refugia. Corridors are thus a way in which the negative ecological effects of anthropogenic (man-induced) habitat fragmentation may be averted.

Habitat fragmentation, which can be brought about by forestry or agricultural modification (eg: extensive plantations, cultivated lands or pastures in a formerly Fynbos or forest habitat) can result in the disruption of the social organization of wildlife or even the genetic isolation and eventual extinction of divided populations. On Aalwyndal, almost half of the area has been completely transformed into an artificial agricultural pasture habitat. This also applies to the general area in which agriculture, urban spread and forestry activities have completely fragmented the remaining patches of natural habitat from each other.

Larger animals on the study area, like the bushbuck or bush pig, may use bigger corridors to move from one patch of natural habitat to another, while smaller animals like the vlei rat and the musk shrew may use the corridor as a part or all of their home range.

The principle of “as large as possible” should be applied to corridor design. Obviously, this has practical implications in terms of the size of the area, topographical layout, habitat types and proposed development design.

On Aalwyndal, the thicket lined drainages provide a practical option for true corridor development, providing a near-natural connection between the upper escarpment and the drainage to the estuary (Figure 18). By rehabilitating these riparian corridors, a valuable contribution will be made for the east/west movement of the small and larger wildlife of the area.

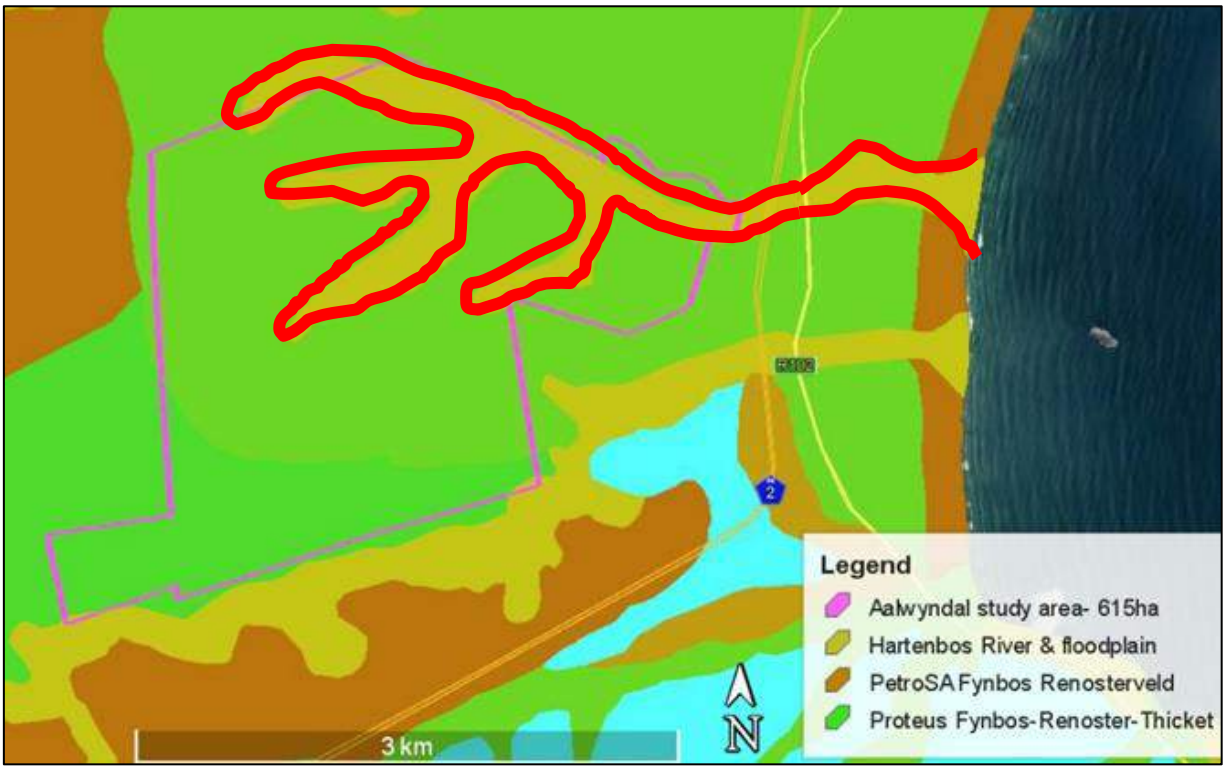

Figure 16: The drainage valleys in the north-eastern part of the study area provide a logical option for ensuring that connectivity is maintained in these wetland habitats and with the nearby estuary. Drainages in the south-eastern part of the study area can also be included in the drainage-based connectivity plan (Coetzee, 2019)

7.3 Overview of Aquatic Habitat

The broad purpose of this freshwater habitat assessment component was to conduct a ground-truthed delineation of aquatic ecosystems within the Aalwyndal area (in accordance with Precinct Plan study area) to ascertain, amongst other variables, the location, extent, functionality, importance and sensitivity of any wetland or riparian systems present. This also includes biotic and abiotic indicators that are crucial for functioning ecological processes. The attributes of the freshwater habitats and corridors associated with them, were assessed according to the proposed urban expansion and opportunities or constraints associated with the proposal were discussed.

The current spatial concept plan shows that the land surrounding the watercourses is mostly proposed for residential use. The development of the proposal will impact upon the vegetation, biota, flow regime, geomorphology, and water quality of the identified streams. Infrastructure and hardened surfaces will alter water retention and movement in the area, could decrease water quality through pollutants, and destroy or disturb habitat resulting in loss of biota in the systems.

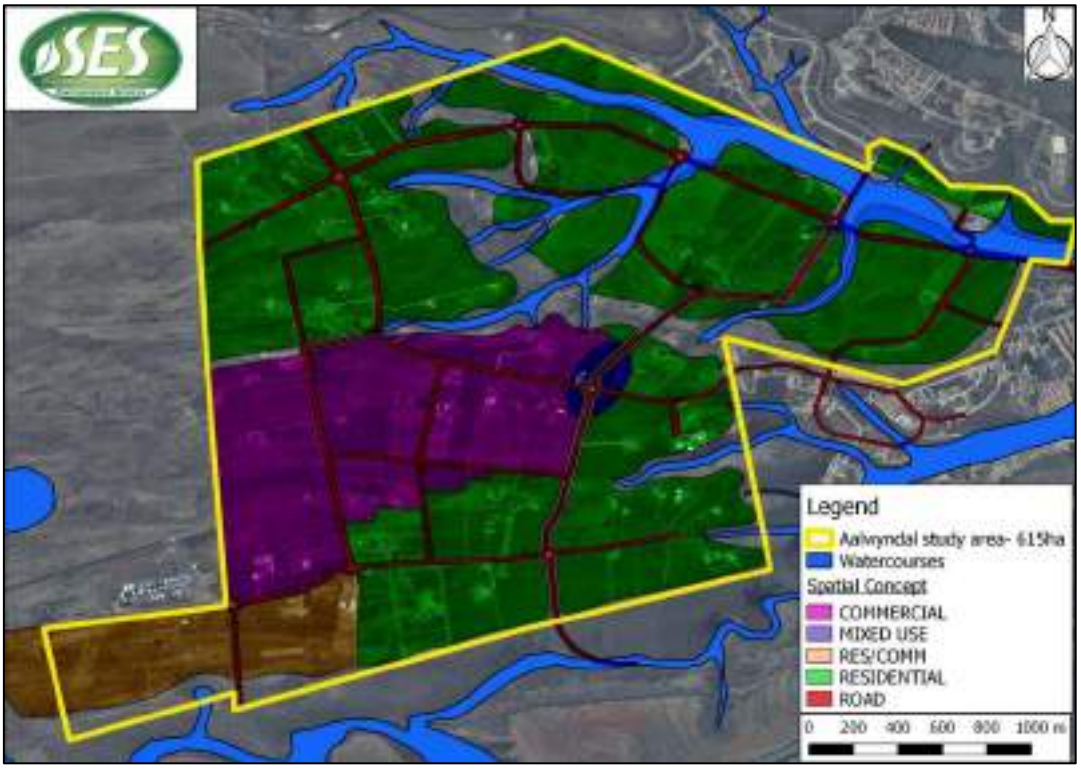

Figure 17: The watercourses in relation to the spatial concept plan of Aalwyndal

Aalwyndal falls within Quaternary catchment K10A and is situated within the Gouritz Cluster Biosphere. The study area is intersected by the drainage divide of two river basins; one in the north of the study area, and one to the south of the Aalwyndal area, each with a main stream. These two trunk streams have small, ephemeral tributaries that join them at various locations along their length.

Thirteen freshwater ecosystems were identified as likely to be impacted by the development Therefore, they were groundtruthed and assessed in detail.

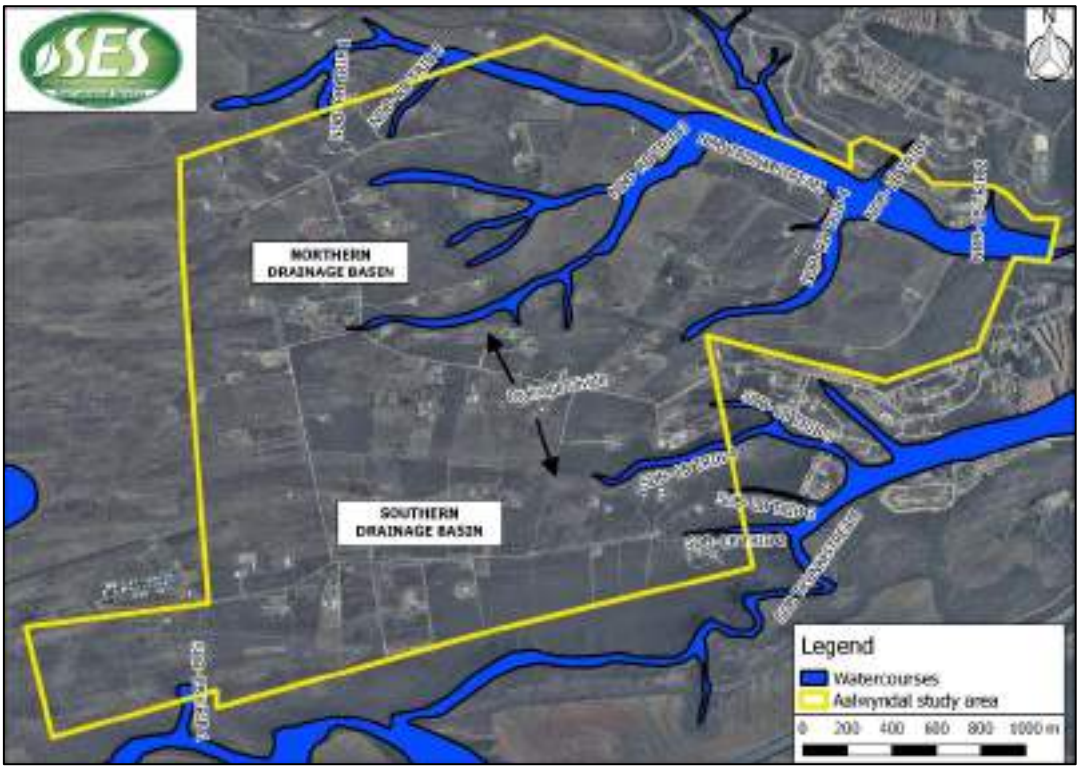

Figure 18: The delineated watercourses that will be impacted upon by the proposal

It was determined that the freshwater constraints associated with the proposal are simple. They are considered to be easily avoidable, or at least have high mitigation potential, if the specialist input is incorporated into the plan. The assessment of the watercourses determined that the management objective should be to maintain the systems in their present state. Therefore, the development of this area must not cause any degradation, or further degradation, of the watercourses.

It is recommended that development within any freshwater habitat (excluding the necessary roads) must be completely avoided. This also applies to any development within flood lines. The widest possible buffer area between development and the watercourses must be adopted. The proposal must apply the principles of SUDS (Sustainable Urban Drainage Systems). Maintenance of the riparian area must be implemented for it to remain effective. Apart from erosion control and alien invasive plant eradication, dumping and the encroachment of any further infrastructure or vehicles must be prevented.

There will potentially be legislated constraints to development associated with impacts upon water resources. It is likely that the activities associated with development will need authorisation for Section 21 (c) and (i) water uses under the National Water Act (1998). Additionally, activities under NEMA legislation (2014, as amended) associated with development within a watercourse, or 32 m of a

watercourse, may require authorisation depending on the finer details. Further specialist freshwater input will be required to confirm these findings within the environmental authorisation application processes.

8 Opportunities and Constraints

8.1 Botanical

Landowners generally assume they have the right to develop the areas as they wish, and NEMA, NEMBA, the NWA and other applicable environmental legislation that is designed to avoid, minimise and mitigate environmental impacts is seldom applied or enforced.

The primary concerns in the area, from an ecological perspective, are:

9.1.1 Direct habitat loss, and associated habitat fragmentation

9.1.2 Lack of invasive alien plant management

9.1.3 Lack of appropriate fire regimes for the vegetation

8.1.1 Habitat Loss and Fragmentation

Further loss of natural vegetation remnants will compromise the ecological connectivity of the area even more, and may, depending on location, mean the loss of mapped Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) or Other Natural Areas (ONAs).

In the case of the proposed commercial and industrial development east of the airfield this would obviously cause significant loss of north – south ecological connectivity in this area, as the proposed development is likely to be much less ecologically permeable than the current smallholdings.

The study area is surrounded by intact and sensitive natural vegetation along about 75% of its boundary, and hence further habitat loss on site would have a negative knock on ecological impact in these adjacent areas as well. These would be indirect impacts, in terms of disruption of natural fire regimes, displacement of fauna, possible impacts on soil moisture and drainage, loss of ecological connectivity and habitat fragmentation – which can both have long term negative impacts on things like pollination success and seed set, thus directly impacting on reproductive fitness and long term survival.

Current ecological connectivity within the study area is still adequate due mainly to the relatively small extent of hard development, and most of the fauna present can be expected to be able to work around this, but there is an important constraint on the ground that cannot be seen in the maps, and that relates to fencing.

Most of the developed properties are fenced, probably mainly for security reasons, and in some cases because they keep livestock. Fencing ranges from simple 4 or 5 strand fencing, to Bonox fencing to chicken wire, to electric fencing, to palisade fencing. The various types of fencing have different levels of permeability for different animals, although virtually all of them (except 4 or 5 strand fences) are probably impermeable to duiker and grysbok. Some of them, such as chicken wire, are impermeable to all but the smallest animals, and those with electric strands close to ground level will probably kill tortoises and any animals that try to burrow under them. It can thus be seen that navigating the apparent open space linkages across the study area is likely to prove very difficult or even impossible for certain animals.

8.1.2 Alien Invasive Plant Management

Woody alien invasive vegetation is an important threat to the remaining natural vegetation in the study area, but rate of spread now seems slow, and is slowing, thanks mainly to biocontrol impacts on the seedset of the primary invasive species - rooikrans (*Acacia cyclops*). Woody alien invasive vegetation increases the fuel load, and can burn substantially hotter than indigenous vegetation, leading to biodiversity loss, soil damage and resultant erosion, and potentially uncontrollable veld fires that threaten private property.

8.1.3 Fire Management

As noted, all the vegetation units (Fynbos & Renosterveld) on site, other than the Thicket, are fire driven systems, meaning that they are adapted to regular fire, and require regular fire for optimal ecological functioning. Optimal fire frequency in these sorts of Fynbos and Renosterveld systems is anywhere from once every 10 years to once every 15 years and the last fairly major fire in the study area was about ten years ago, so those areas do not need to burn again until after 2020, but that fire is estimated to have covered only about 20% of the study area, in the far western parts.

8.2 Ecological

In terms of the Fynbos and Renosterveld, there are a number of options that could be used for connectivity development and to combat fragmentation. Connectivity to the west of the study area is not considered to be critical, or even practical, as these neighbouring areas are used for grazing and are partially transformed for agriculture for a great distance west-ward. Connectivity to the east is only sensible in terms of the riverine corridor to the estuary, otherwise the coastal area consists of high-density development. Connectivity southwards leads to the high density settlement of Kwanonqaba and the N2 highway. There are thus few opportunities for landscape scale connectivity, other than the

riverine corridor, but improved connectivity between the Fynbos and Renosterveld habitats on the study area will certainly help to reduce the impacts of local fragmentation.

Figure 19: The potential for connectivity between fynbos and renosterveld patches is indicated by means of white bands on Helme's (2019) map of the sensitive and highly sensitive habitats. In some areas the connectivity will have to be restored but in many it already exists, it must be considered and managed at a landscape scale. (Coetzee, 2019)

At least half of the Aalwyndal area is of importance in terms of wildlife persistence and conservation. It contains fragmented patches of natural habitat, some of which can be linked to help combat the negative effects of habitat fragmentation. The establishment of effective habitat connectivity will be critical in order to conserve what is left of the vertebrate fauna. The impractical patches of sensitive Fynbos that are too small to conserve or to provide useful linkage can then be incorporated into the area potentially suitable for development.

Most of the area of conservation importance, and concern, lies within the remaining undisturbed Fynbos, Renosterveld and Thicket habitats but it is important to note that inviable (too small or too narrow) patches of sensitive habitat have no long-term ecological future and can thus be considered for development of some kind. Throughout the property, the drainage network, consisting of seasonal and perennial streams, wetlands and artificial impoundments, is of critical importance to wildlife and should not be impacted or modified in any way. The balance of the property is composed of transformed pasture areas, and some residential development, which represents areas of little importance to the vertebrate fauna and habitat and can thus be considered for development.

It is also important to note that the Red-listed (rare, threatened and endangered) species of vertebrate fauna that were predicted to occur on the site are mostly restricted to the natural (and relatively intact) thicket and Fynbos habitats. It is sensible to try and conserve these red data listed species by means of a linked network of only the largest patches of natural habitat, the smaller and narrow parts are of little use for these fauna due to “edge effect” which results in increased habitat impact and fragmentation.

It follows thus that any plan to develop the Aalwyndal area, should be restricted to the less sensitive transformed pasture areas, the unviable patches of the sensitive natural habitats and areas otherwise already developed, if the integrity of the sensitive vegetation and vertebrate fauna is to be ensured in the long term.

8.3 Freshwater habitat

The freshwater constraints associated with the proposal are simple. They are considered to be easily avoidable, or at least have high mitigation potential, if the specialist input is incorporated into the plan. The main areas of concern surrounding the proposal, from a freshwater perspective, are the:

- NDB – RB Trib 3 stream network (the entire system it is proposed to be surrounded by development);
- SDB – Trunk Stream (although more at risk from indirect impacts it is important);
- SDB – LB Trib 4

The other systems may be impacted to a lesser degree, have less ecological importance, or will be protected by other factors (such as the flood lines of the NDB Trunk Stream and steep slopes of tributaries). However, development within any freshwater habitat (excluding the necessary roads) must be completely avoided. This also applies to any development within flood lines (the regulated area) which significantly reduces the developable area between the Aalwyndal Road and the NDB Trunk Stream.

The assessment of the watercourses determined that the management objective should be to maintain the systems in their present state. Therefore, the development of this area must not cause any degradation, or further degradation, of the watercourses. The soils are highly erodible and stormwater management and largest possible buffer is essential. No unnecessary additional water must be allowed to flow into the systems as it must maintain the non perennial flow regime. No encroachment must be allowed into the riparian areas, as they are already narrow, and much of the riparian vegetation has been loss from past land clearance. It is recognised that roads and pipelines will be required for development, but the areas circled below must be approached cautiously and preferably aligned with already disturbed habitat (Figure 20).

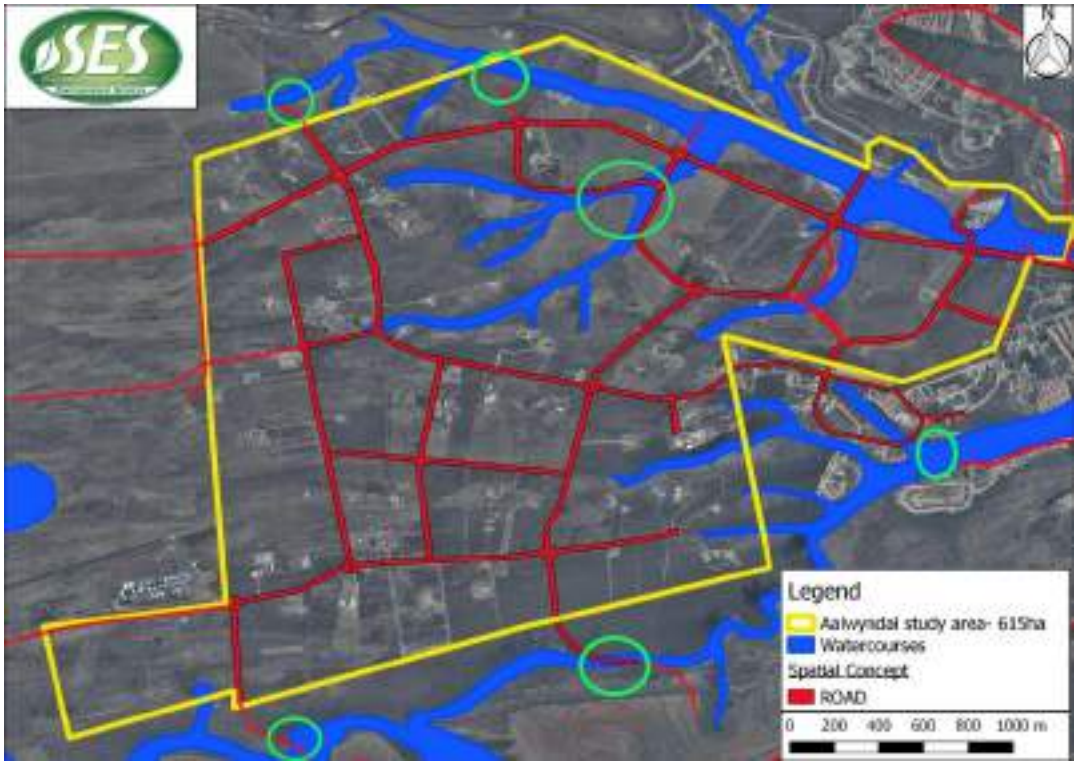

Figure 20: The proposed road network associated with the plan with green circles indicating road crossing locations that present a risk of degradation to freshwater habitat.

There will potentially be legislated constraints to development associated with impacts upon water resources. It is likely that the activities associated with development will need authorisation for Section 21 (c) and (i) water uses under the National Water Act (1998). Additionally, activities under NEMA legislation (2014, as amended) associated with development within a watercourse, or 32 m of a watercourse, may require authorisation depending on the finer details.

Regarding the opportunities associated with development of the area, from a freshwater perspective, the following ideas have potential:

- Integrating recreational activities with riparian networks and open spaces.
- Walks and benches within buffer zone with better management and active alien clearance.
- Increased longitudinal connectivity during low flows if dams on tributaries are removed and road crossings have appropriately designed culverts.
- There is currently limited surface roughness on the hillslopes due to overgrazing and vegetation clearance. If an appropriate buffer is allowed for, which is not grazed or cleared, the ground cover will increase, and the soils will allow for better infiltration.
- There is potential to slightly improve the watercourses, which are currently subjected to land use and cover changes, by concentrating on supporting the key ecological drivers with intensity.

9 Recommendations

This Biodiversity Assessment is a comprehensive study of the receiving ecological environment of Aalwyndal. It highlights the fact that this area is special in terms of unique vegetation. It also highlights the fact that this area is unique in terms of the topography, steep slopes, rivers, streams and drainage lines and that it should be protected. Certain areas have also been well looked after by the landowners of these individual properties. It is fair to say that it is a pity that this area was zoned residential before an assessment such as this was completed. However Kudos should go to the officials who realised that this study should in any event be completed to see how the development of such an area can coexist with the special biodiversity of this area.

From an ecological point of view, further loss of natural vegetation in the Aalwyndal area should be avoided as best possible. However, certain fragments of vegetation are not viable. Small fragments of sensitive habitat can be incorporated into development – if proper conservation of highly sensitive habitat is established. The widest possible buffer area between development and the watercourses must be adopted. The freshwater habitat must be considered as a No-Go area and avoided throughout development phases.

According to the botanist, the Open Space system as shown in the Precinct Plan of the SDP is inadequate in terms of habitat and species representivity, and if most of the natural habitat currently present on site was lost and only the designated green areas were left that would have a High negative botanical impact at a regional scale. It is deemed inadequate as only about 25-30% of each main habitat type is represented, and best available science suggests that 65-70% of any one habitat should be conserved if there is to be no major long term loss of both species viability and habitat functionality. At the very least it is recommended by the botanist that this Open Space system be expanded to incorporate most (at least 70%) of the High and all of the Very High sensitivity areas.

Loss of habitat in certain areas could be mitigated by formal conservation of an expanded Open Space system. However this is an impractical recommendation given the above and the pressures of the housing requirements. This may lead to or be a requirement that offsets are considered. The option of using Erf 175 as an offset could also be considered. Various methods of compensation / contributions will need to be investigated but this is something which will have to be discussed and decided on by the MBM and by those who have intimate knowledge of the Municipal finance systems and operations.

The Very High sensitivity area (as shown in Figure 17) is a major regional conservation priority and permanent conservation of this area should be secured and formalised as soon as possible, perhaps

via the Stewardship Program of CapeNature or some other action. Loss of this area to development would have a High negative botanical impact. Erf 175 is the main priority area for conservation, and because it is mostly Thicket and is relatively large (12ha) would probably be ecologically viable even if it could only be connected to the riverine area to the north, and ideally also to some green linkage to the west.

The development and loss of all conservation worthy habitat with the proposed commercial, mixed use, commercial and airport related commercial zones would amount to an estimated 80-100ha of High sensitivity habitat. The likely botanical impact of this loss would be Medium to High negative at a regional scale and could be mitigated to some degree by formal conservation of an expanded Open Space system such as the one shown in Figure 19, which covers 240 ha of High and Very High sensitivity habitat. If this could be achieved overall development impact could be reduced to an acceptable Medium negative.

Red-listed species of vertebrate fauna predicted to occur on the site are mostly restricted to the natural and relatively intact Thicket and Fynbos habitats. Therefore, it is sensible to try and conserve these species through a linked network of the larger patches of natural habitat. It will therefore be imperative that a Conservation Management Plan (CMP) for the study area be complete prior to transfer of new erven and this may need to be funded by contributions from developers. The implementation of a programme to control the spread of invasive alien trees as soon as possible with the concentration on invasions within riparian thicket vegetation. Fynbos and Renosterveld are fire driven systems, therefore an ecological fire management plan for the rejuvenation of these vegetation types should be implemented. Landowners and authorities should work together to manage fire. An ecological fire management plan for the rejuvenation of Fynbos and Renosterveld biodiversity will also be required.

A comprehensive ecological management plan should be drawn up for the natural habitats of the study area. It must address and provide practical guidelines for the following aspects of its management as a nature conservation area:

- Alien vegetation control.
- Fire management.
- Wildlife protection and management.
- Public access to natural areas.
- Monitoring programme (habitats).
- Water runoff and treatment.
- Rehabilitation and landscaping.
- Gardening guidelines.
- Control of domestic pets.

- Co-operative landscape management (corridor development).
- Annual audit.

Conservation management agreements with direct neighbours must be initiated to ensure efficient functioning of the proposed landscape connectivity plan (corridors) and to establish joint ventures in the control of alien plants and fire management.

a) It is important to maintain ecological connectivity within the site. The riverine corridor forms an important part of landscape scale connectivity and is of critical importance to wildlife. Therefore, it must not be impacted or modified in any way. This will be easy to comply with, since the drainage areas are steep and thus unsuitable for development. Improved connectivity between Fynbos and Renosterveld habitats will help reduce impacts of local fragmentation.
b) Figure 21 shows the proposed Open Space Network for Aalwyndal.

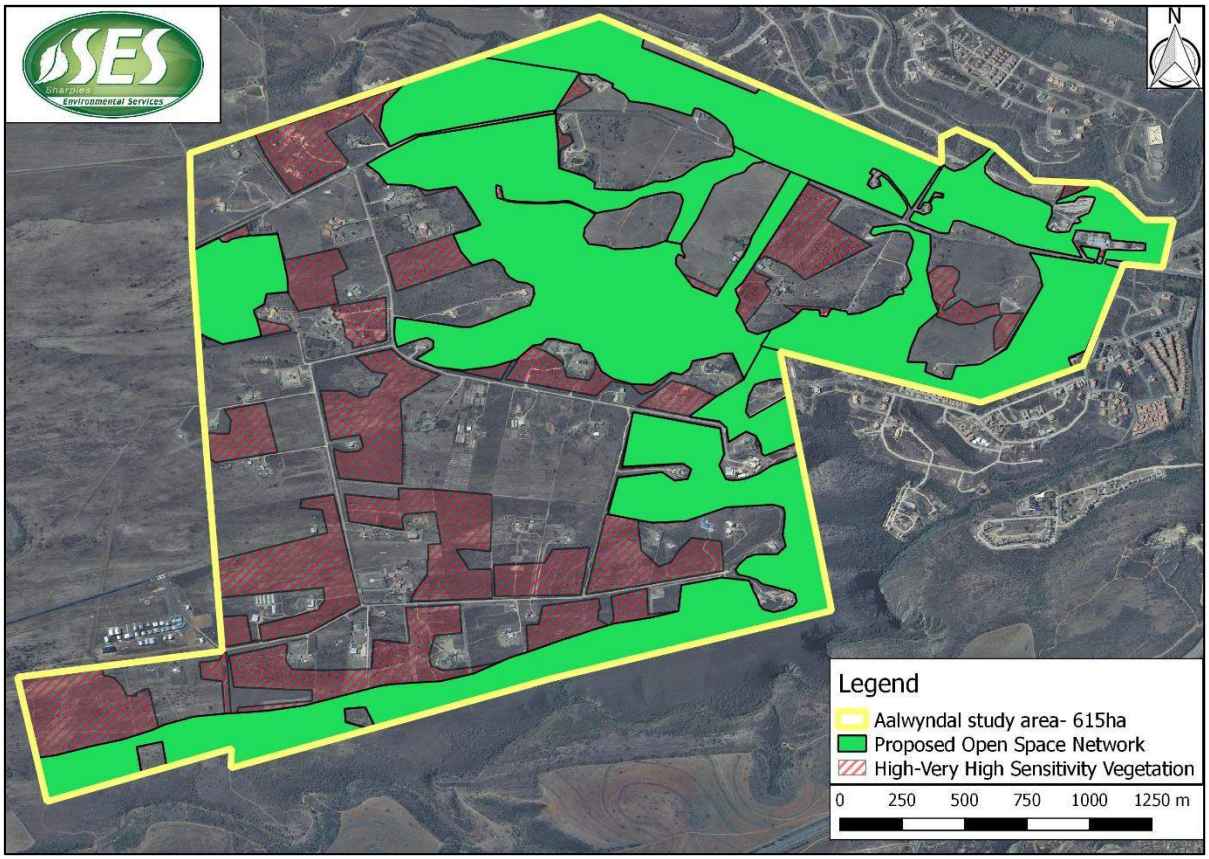

Figure 21: Proposed Open Space network for Aalwyndal

c) The transformed pasture areas and some residential development, which represents areas of little importance to the vertebrate fauna and habitat, can be considered for development.
d) A programme to control the spread of invasive alien trees should be implemented as soon as possible. Focus must be on the invasions within riparian thicket vegetation.

10 The potential of open space as 'offset area'

The Precinct Plan proposed 104 ha Open Space (Annexure A). This study has determined this area as insufficient to conserve enough of the special habitat and would result in High impacts if not expanded. It covers only 24% of the High Sensitivity Vegetation. The SES proposed Open Space as seen in Figure 21 covers 59% of the High Sensitivity Vegetation. See Table 5 for more details on size of Open Space (determined using GIS spatial analysis).

The botanical report requires at least 70% of the High Sensitivity Vegetation to be covered in order to compensate for the 30% loss of High Sensitivity Vegetation to development. It also states 65-70% conservation of a habitat will prevent long term loss of habitat viability and habitat functionality. To comply with the 65% threshold, a further 6% or 17 ha need to be included in the Open Space Network*.

To comply with the 70%, 30ha more Open Space is needed. However, to compensate for this loss it may be possible to incorporate biodiversity offset areas with the open space network or on nearby habitat that is suitable. This is seen as the last resort and should therefore be discussed with the relevant authorities after considering the results of this report in detail.

All the Very High Sensitivity Vegetation is covered in the SES proposed Open Space. This is in accordance with the botanist's recommendations and will ensure the conservation of Endangered plant species and habitat protection of fauna relying on this Thicket area. This area should be formally conserved. The SES proposed Open Space covers 94% of the watercourses within Aalwyndal. The remaining 6% is considered transformed area.

**The spatial analysis is subject to slight variability. This is due to the layout that still needs to be finalised. It is highly likely that the road network will alter the Open Space system in some way.*

Biodiversity Offsets

Biodiversity offsets generally target features or areas with similar biodiversity as that residually impacted by development but may target features or areas with biodiversity of higher conservation significance. The desired outcome of biodiversity offsets is to ensure that:

- The cumulative impact of development authorization and land use change does not:
  - result in the loss of CBA's or jeopardize the ability to meet South Africa's targets for biodiversity conservation;
  - lead to ecosystems becoming more threatened than 'Endangered'; and/or
  - cause a decline in the conservation status of species and the presence of 'special habitats'.
- Conservation efforts arising from the development application process and contributing to improved protection of South Africa's unique species and ecosystems in perpetuity, are focused in areas identified as priorities for biodiversity conservation. Particular emphasis is on consolidation of priority areas and securing effective ecological links between priority areas; and
- Ecosystem services provided by affected biodiversity and on which local or vulnerable human communities - or society as a whole - are dependent for livelihoods, health and/or safety, are at minimum safeguarded, and preferably improved.

Biodiversity offsets should always be the last option of mitigation. Measurements to avoid or prevent impacts on biodiversity should be the first option, followed by minimizing impacts. If neither is possible, restoration or repair of the areas harmed by impacts should be considered. If none of these options are possible, offsets can be looked at. If the need for offsets are confirmed, implementation of the biodiversity offset should preferably take place before the impacts of the activity occur.

Table 2: The size of sensitive vegetation, proposed open space and watercourses in Aalwyndal. The Open Space proposed by the Precinct Plan and Sharples Environmental Services cc (SES) are included and given in terms of the High Sensitivity Vegetation it covers.

Area		**Size in hectares**
Sensitive Vegetation	Very High Sensitivity	25
	High Sensitivity	288
	Total of Sensitive	314

SES Open Space	Proposed Open Space	239
	High Sensitivity Vegetation that will be Covered	170
	High Sensitivity Vegetation that will be Lost	118
Precinct Plan Open Space	Proposed Open Space	104
	High Sensitivity Vegetation that will be Covered	69
	High Sensitivity Vegetation that will be Lost	219
Watercourses	All Watercourses	49
	Watercourses Covered by Open Space	46

11 Summary of findings

According to the botanist, the Open Space system as shown in the Precinct Plan of the SDP is inadequate in terms of habitat and species representivity, and if most of the natural habitat currently present on site was lost and only the designated green areas were left that would have a High negative botanical impact at a regional scale. It is deemed inadequate as only about 25-30% of each main habitat type is represented, and best available science suggests that 65-70% of any one habitat should be conserved if there is to be no major long term loss of both species viability and habitat functionality. At the very least it is recommended by the botanist that this Open Space system be expanded to incorporate most (at least 70%) of the High and all of the Very High sensitivity areas.

Loss of habitat in certain areas could be mitigated by formal conservation of an expanded Open Space system. However this is an impractical recommendation given the above and the pressures of the housing requirements. This may lead to or be a requirement that offsets are considered. The option of using Erf 175 as an offset could also be considered. Various methods of compensation / contributions will need to be investigated but this is something which will have to be discussed and decided on by the MBM and by those who have intimate knowledge of the Municipal finance systems and operations.

The Very High sensitivity area is a major regional conservation priority and permanent conservation of this area should be secured and formalised as soon as possible, perhaps via the Stewardship Program of CapeNature or some other action. Very High sensitivity areas are not allowed to be offset unless under certain conditions. Loss of this area to development would have a High negative botanical impact. Erf 175 is the main priority area for conservation, and because it is mostly Thicket and is relatively large (12ha) would probably be ecologically viable even if it could only be connected to the riverine area to the north, and ideally also to some green linkage to the west.

The development and loss of all conservation worthy habitat with the proposed commercial, mixed use, commercial and airport related commercial zones would amount to an estimated 80-100ha of High sensitivity habitat. The likely botanical impact of this loss would be Medium to High negative at a regional scale and could be mitigated to some degree by formal conservation of an expanded Open Space system as developed by SES, which covers 240 ha of High and Very High sensitivity habitat. If this could be achieved overall development impact could be reduced to an acceptable Medium negative.

Red-listed species of vertebrate fauna predicted to occur on the site are mostly restricted to the natural and relatively intact Thicket and Fynbos habitats. Therefore, it is sensible to try and conserve these

species through a linked network of the larger patches of natural habitat. It will therefore be imperative that a Conservation Management Plan (CMP) for the study area be complete prior to transfer of new erven and this may need to be funded by contributions from developers. The implementation of a programme to control the spread of invasive alien trees as soon as possible with the concentration on invasions within riparian thicket vegetation. Fynbos and Renosterveld are fire driven systems, therefore an ecological fire management plan for the rejuvenation of these vegetation types should be implemented. Landowners and authorities should work together to manage fire. An ecological fire management plan for the rejuvenation of Fynbos and Renosterveld biodiversity will also be required.

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Conservation management agreements with direct neighbours must be initiated to ensure efficient functioning of the proposed landscape connectivity plan (corridors) and to establish joint ventures in the control of alien plants and fire management.

It is important to maintain ecological connectivity within the site. The riverine corridor forms an important part of landscape scale connectivity and is of critical importance to wildlife. Therefore, it must not be impacted or modified in any way. This will be easy to comply with, since the drainage areas are steep and thus unsuitable for development. Improved connectivity between Fynbos and Renosterveld habitats will help reduce impacts of local fragmentation. Figure 22 shows the expanded proposed Open Space Network for Aalwyndal.

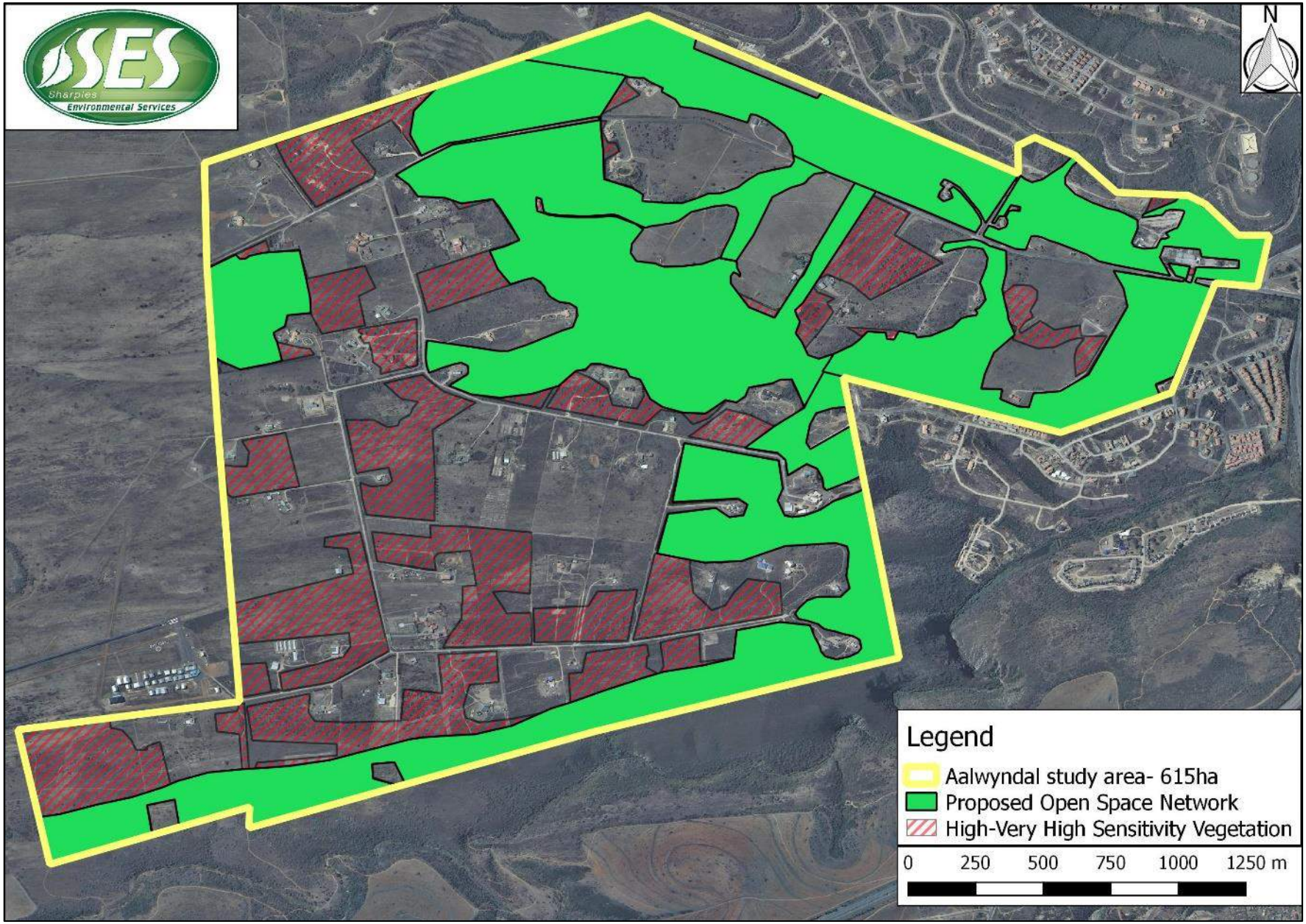

Figure 22: Proposed Open Space network for Aalwyndal

12 Conclusion

There is no doubt that Mossel Bay and Aalwyndal is a unique area and a unique situation. There are very few towns in South Africa and development areas which are surrounded by such sensitive and unique vegetation. This makes it particularly challenging for Municipal Planners to plan for future developments without impacting on sensitive vegetation and in the case of Mossel Bay and Aalwyndal it is basically an impossible task. However this study is a good start to moving towards a practical viable option. It will have to be a compromise both from an ecological and a development point of view. The mapping in this document has shown which areas are available for development and which areas should be protected. These areas have been mapped with 95% accuracy and its important that if an acceptable compromise is to be reached that these green open spaces and conservation areas are respected.

The development of this area cannot be 'business as usual' in terms of town planning if a meaningful attempt is going to be made to integrate development with conservation. It may be worth ensuring that urban designers are appointed to all town planning layouts to add value to development proposals. It's probably also fair to say that landowners who want to sell to developers and developers are going to see these findings as very restrictive on the properties they purchase and find the conditions onerous. However, if the ecology and the ecological functioning is destroyed it will be gone forever whereas due to the expanding population development land will always become more valuable. The implementation of these findings is going to essentially make the land more expensive to develop. Therefore, it stands to reason that the purchase price of the land by developers should reflect this expense. In other words the purchase price of the land may be lower per hectare than if the site could be used in its entirety. The flip side of this aspect is that there is little doubt that open spaces and green systems sell developments and are an asset to any development.

The management of these systems will add a cost to the development but the residents of these developments often welcome areas that can be used for recreation and relaxation and it will add value to such an area for the general population of Mossel Bay. This may also mean that it would make sense to densify development in the areas that are available for development to offset this extra cost. One should never underestimate the value the natural environment adds to the residents of such an area.

Coupled to this is the need for effective conservation of these areas. This will need to be completed in the form of a formal agreement with the areas zoned correctly and conserved in perpetuity. These areas will also need to be managed with the guidance of an Environmental Management Plan which

takes into account the ecological needs of the various areas including fire and hydrological regimes. If the above is achieved this area can not only become a model for how development of a unique area can be achieved while still conserving the environment which is the main factor attracting people to the Garden Route. This area will become an asset to the people who live in it as well as the people of Mossel Bay.

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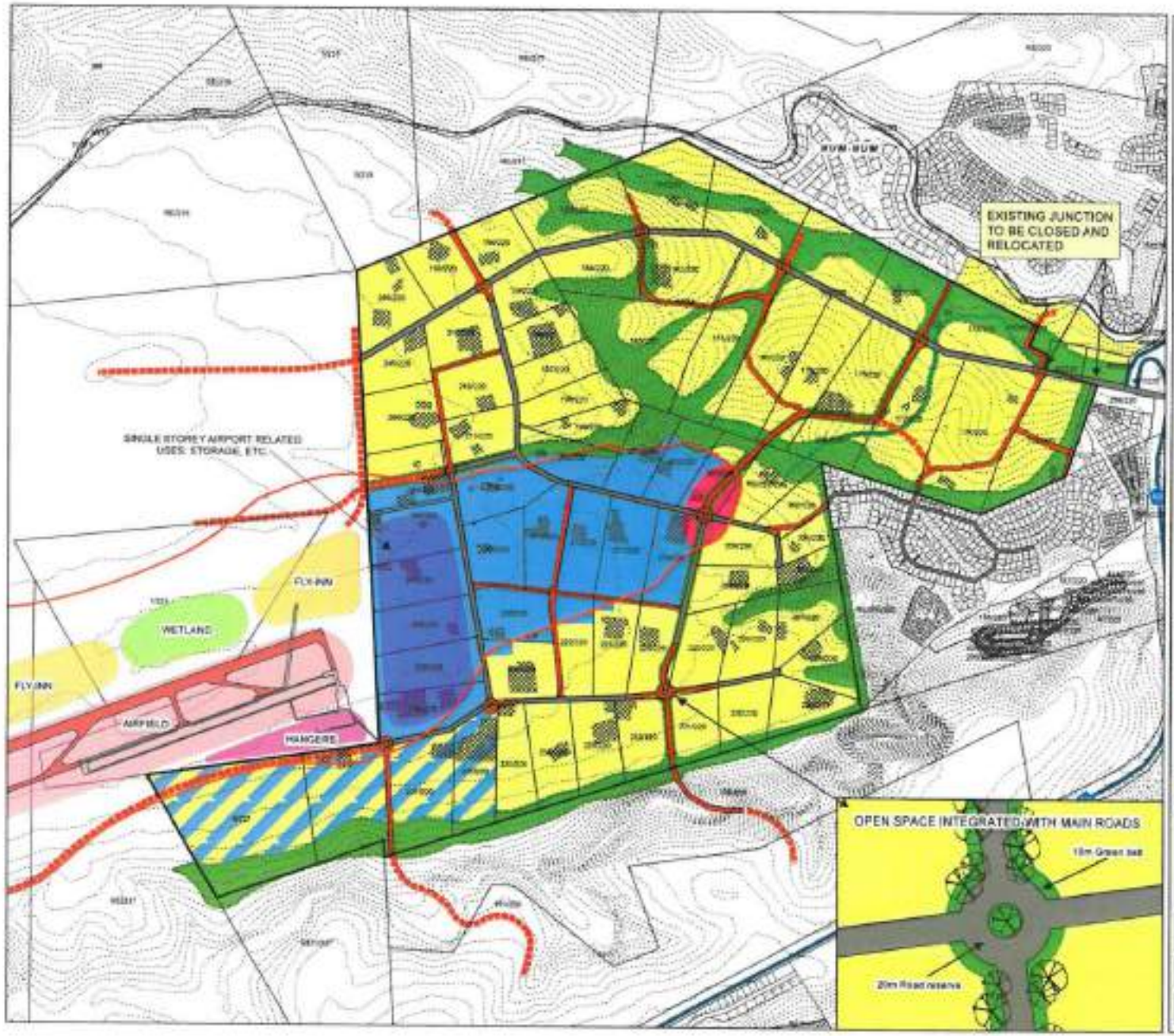
Annexure A



Explore Endless Horizons

AREA / TOWN

AALWYNDAL PRECINCT PLAN

TITLE

LOCAL SPATIAL DEVELOPMENT PLAN

ITO SECTION 5(1) OF THE MUNICIPAL BY-LAW ON LANDUSE PLANNING

LEGEND

- APP. 55 Lden NOISE CONTOUR
- EXISTING RESIDENTIAL COVERAGE
- RESIDENTIAL
- COMMERCIAL
- OPEN SPACE
- MIXED USE NODE
- RESIDENTIAL & AIRPORT RELATED COMMERCIAL USES
- MAIN DISTRIBUTOR ROADS
- NEW MAIN ROUTES (Alignment approximate)
- NEW MAIN ROUTES (Alignment to be further investigated during detail planning)

0 125 250 500 750 1 000 m

NOTES

EXTENT OF OPEN SPACE IS CONCEPTUAL AND MUST BE GROUND TRUTHED.

A3 SCALE 1:15 000

DATE: JAN 2018

PLAN NO: **MB/A/7.2**