SITUATION ASSESSMENT FOR THE ONRUS RIVER CATCHMENT, HERMANUS, WESTERN CAPE

2025

Anchor Environmental Consultants Report No. 2180/1

Cover photo: André de Villiers

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EXECUTIVE SUMMARY

The Onrus River is located in the Overstand Local Municipality in the Western Cape. The river arises in the Babylonstoren and Kleinrivier Mountains and flows in a south-westerly direction towards the town of Onrus, before flowing into the Indian Ocean. The river has a small catchment of around 55 km^2, with the main-stem river being approximately 16.5 km in length from source to mouth. In its upper reaches, the river supports extensive, ecologically important, wetlands, including peatlands. The river then flows as a single channel through cultivated lands for much of its middle reaches where the riparian zone is heavily invaded with alien woodland vegetation. The river is impounded in the lower-middle reaches by the De Bos Dam, which supplies water to the town of Hermanus, as well as various farms in the valley. Downstream of the dam, the river is joined by two of its major tributaries—an unnamed stream and the Antjies River. The Onrus River widens at the confluence of these three watercourses, to form a wetland of very high ecological importance and sensitivity. This wetland, termed the "Onrus Main Wetland" formed through the accumulation of palmiet *Prionium serratum* (and decaying palmiet plants), over the course of more than 10 000 years, and historically provided a suite of highly important ecosystem services . Downstream of the wetland, the river passes through a narrow kloof (ravine), and then meanders across the coastal plain (passing through the town of Onrus) before discharging into the Onrus Estuary which, in turn, discharges into the sea at Onrus Beach.

The Onrus River, catchment, estuary, and other associated aquatic habitats, have been heavily altered by human activity and are continuing to face serious anthropogenic pressures. The riparian habitat integrity of the lower Onrus River is considered to be seriously modified. This is primarily due to the invasion of the riparian zone by invasive alien plant species. The instream habitat is also considered to be largely modified, primarily due to alterations of the natural flow regime following the construction of the De Bos Dam upstream in 1976. Of greatest concern has been the continued degradation of the large Onrus Main Peat Wetland, located immediately downstream of the De Bos Dam. The Onrus peatland contains a peat layer of more than 7.25 m thick, dominated by a lower 4 m-thick sedge layer with a basal sand and not bedrock layer, which makes it unlike other palmiet systems elsewhere in South Africa. This system has been under continuous threat for the past 70 years—largely owing to the greatly reduced freshwater inflows due to the combination of the De Bos Dam, rampant water consumption by alien invasive plants (AIPs), and agricultural and domestic water consumption. Consequently, sediment losses and geomorphological changes to the river channel and wetland base have occurred, largely due to the progressive desiccation (drying out) of the wetland, which has exposed the wetland to accelerated erosive processes. Alien invasive plants (AIPs) have started to colonise the compromised wetland area.

A number of attempts have been made to rehabilitate the wetland over the years but for various reasons these have not proved successful, and, in September 2023, an intense "cut-off low" pressure system passed over the Onrus Catchment, with 141 mm of rainfall being recorded over a 24-hour period—equivalent to a 1:200 year flood event. The Onrus River came down in flood, and the wetland was almost completely destroyed. Unstable pockets of palmiet-covered peat could not withstand the force of the water, and large sections of peat broke away and were washed downstream, leaving an estimated 1/3 of the original wetland area intact. In addition, many roads and bridges were destroyed, along with a major sewerage reticulation pipeline, thus allowing untreated sewage to flow into the estuary and ocean. The rampant erosion from the flood, coupled with the incredible force of the floodwaters, resulted in enormous volumes of sediment and debris being carried downstream, much of which was deposited in the lower river, estuary, and beach. The Onrus estuary, already in a poor state of health has also been all but destroyed owing to the deposition of an enormous volume of sediment in the system which has essentially filled the estuarine basin with sand and mud.

In response to the flood damage, and the obvious need to conduct large scale rehabilitation works within the catchment, the Overstrand Local Municipality (OLM) approached numerous organisations to fund the required research and works required to initiate the ambitious rehabilitation/ restoration projects required in the Onrus Catchment.

Funding was primarily secured through the United Nations Environment Programme (UNEP), under the project title of "Generation Restoration: Catalysing a nature-based transformation in Finance, Jobs, and Cities" in Overstrand, South Africa", as well as from other public and private sources. The scope of works (SOWs) agreed upon between OLM and UNEP, included the preparation of a Situation Assessment Report (SAR) for the Onrus River Catchment, with required information being stipulated as follows:

- AIP infestation
- Land transformation
- Hydrology
- Geohydrology
- Wetland health and importance (including an updated quantification of Ecological Water Requirements (EWRs))
- Estuary health and importance (including an updated quantification of EWRs
- Ecosystem Services value within the catchment.

Anchor Environmental Consultants (Pty) Ltd. (Anchor) was approached by OLM to complete the SAR for the Onrus Catchment (this report), in addition to a number of other key related deliverables including the development of plans for rehabilitation of the main Onrus wetland and Onrus estuary, for removal of AIPs from the catchment, plans for securing authorisation of undertaking all of these activities, and a stakeholder engagement programme.

This report represents the first of the deliverables from this study and is a situation assessment that provides a high-level overview of the ecological and economic importance of the Onrus catchment, the major aquatic habitats in the catchment, and the legislative framework governing management of water, biodiversity and natural resources in this area.

This report should be read in conjunction with the other deliverables from this study including the Hydrological Assessment of the Onrus Catchment (Lorenz *et al*. 2024), Health Assessment of the Onrus Estuary (Clark *et al*. 2024), Onrus Estuary Maintenance Management Plan (Armitage *et al*. 2025), the Main Onrus Wetland Rehabilitation Plan (Day 2025), Design Report for Stabilisation of the Onrus Wetland (King 2025), Onrus Alien Invasive Species Monitoring Control and Eradication Plan (De Villiers *et al*. 2025), and the Onrus Restoration and Rehabilitation Programme Stakeholder Engagement Report (Swart *et al*. 2025).

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GLOSSARY

Word: definition

Abiotic: The non-living parts of an ecosystem that shapes its environment

Alien: An organism occurring outside its natural past or present range and dispersal potential including any parts of the organism that might survive and subsequently reproduce (organisms whose dispersal is caused by human action).

Aquifers: Underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand, or silt) from which groundwater can be extracted using a water well.

Aquitard: A saturated but poorly permeable geological material that does not yield water freely to a borehole or spring.

Baseline: Information gathered at the beginning of a study which describes the environment prior to development of a project, and against which predicted changes (impacts) are measured.

Catchment: The collection of rainfall over a natural drainage area.

Competent authority: Any person or organisation that has the legally delegated or invested authority, capacity, or power to perform a designated function.

Confluence: The junction of two rivers.

Cutoff lows: A cold-cored low-pressure system that has become detached from the main westerly winds of the jet stream.

Desiccation: The removal of moisture.

Dissolved oxygen: A measure of the amount of oxygen dissolved in the water; the amount of oxygen available to living aquatic organisms.

Endemism: The degree to which the plants and animals of a particular area are both native and restricted to it.

Environmental Impact Assessment: A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project.

Erosion: The action of surface processes (such as water flow or wind) that remove soil, rock, or dissolved material from one location on the Earth's crust, then transport it away to another location.

***Escherichia coli**:* Member of the group of faecal coliform bacteria. It is highly specific to the faeces of warm-blooded animals and cannot multiply in any natural water environment.

Estuary: An estuary is defined in terms of the National Environmental Management: Integrated Coastal Management Act (ICMA) and the NEMA 2014 EIA Regulations as "a body of surface water a) that is permanently or periodically open to the sea; b) in which a rise and fall of the water level as a result of the tides is measurable at spring tides when the body of surface water is open to the sea; or c) in respect of which the salinity is higher than fresh water as a result of the influence of the sea, and where there is a salinity gradient between the tidal reach and the mouth of the body of surface water.''

Fauna: General term for all of the animals found in a particular location.

Floodplain: An area of low-lying ground adjacent to a river, formed mainly of river sediments and subject to flooding.

Flora: General term for all of the plant life found in a particular location.

Impact: A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.

Invasive: Alien organisms that have naturalised in a anew area and expanding their range.

IUCN listed species: Species included and rated by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, a comprehensive inventory of the global conservation status of biological species. It uses a set of precise criteria to evaluate the extinction risk of thousands of species and subspecies.

Kloof: A steep-sided, wooded ravine or valley.

Mid-latitude cyclone: A large, low-pressure weather system that forms between 30° and 60° latitude, driven by the clash between cold, dry air and warm, moist air.

National Biodiversity Assessment (NBA): The threat status and sensitivity of different habitat types based on biodiversity (richness, uniqueness, spatial extent of the habitat type) and exposure levels to natural disturbance or environmental perturbations. Ecosystem types are categorised as "Critically Endangered", "Endangered", "Vulnerable", "Near Threatened" or "Least Concern", based on the proportion of the original extent of each ecosystem type that remains in good ecological condition relative to a series of biodiversity thresholds. See Ecosystem Threat Status.

Oligotrophic: A waterbody characterised by low accumulation of dissolved nutrients, supporting only a sparse growth of algae and other organisms, with a high oxygen content owing to the low organic content.

Orographic precipitation: Rain caused by moist air being forced to rise over a physical barrier like a mountain.

Peatland: A type of wetland whose soils consist of organic matter from decaying plants, forming layers of peat.

Porosity: The quality of having minute spaces or holes through which liquid or air may pass.

PSU: Salinity is generally defined as the salt concentration in sea water. It can be represented in PSU (Practical Salinity Unit), which is a unit based on the properties of sea water conductivity. It is equivalent to per thousand or (o/00) or to g/kg.

Quaternary catchment: A fourth order catchment in a hierarchal classification system in which a primary catchment is the major unit.

Riparian Zone: The region or interface between a river, stream or estuary and the adjacent land.

Sediment: Mud, sand, silt, clay, shell debris, and other particles that settle on the bottom of rivers, lakes, estuaries, and oceans.

Specialist study: A study into a particular aspect of the environment, undertaken by an expert in that discipline.

Tributary: A river or stream flowing into a larger river or lake.

Wetland: A transitional area between terrestrial and aquatic ecosystems where the water table is at or near the surface, or the land is periodically covered by shallow water.

Zooplankton: Plankton that is of animal origin.

ABBREVIATIONS AND ACRONYMS

AIPs	Alien invasive plants
CO2	Carbon dioxide
DWS	Department of Water and Sanitation
DAFF	Department of Agriculture, Forestry and Fisheries
WFW	Working for Wetlands
OLM	Overstrand Local Municipality
UNEP	United Nations Environment Programme
SOW	scope of works
SAR	Situation Assessment Report
EWR	Ecological Water Requirements
DFFE	Department of Forestry, Fisheries and the Environment
SAHRA	South African Heritage Resources Agency
NEMA	National Environmental Management Act
SEMA	Specific Environmental Management Acts
NEMPAA	NEM: Protected Areas Act
NEMBA	NEM: Biodiversity Act
NEMAQA	NEM: Air Quality Act
ICMA	Integrated Coastal Management Act
NEMWA	NEM: Waste Act
DEA&DP	Department of Environmental Affairs and Development Planning
NBA	National Biodiversity Assessment
IDP	Integrated Development Plan
SDF	Municipal Spatial Development Framework
EMF	Municipal Environmental Management Framework
CMAs	Costal Management Area
WMA	Water Management Area
UNESCO	United Nations Educational, Scientific and Cultural Organization
EIA	Environmental Impact Assessment
EMF	Estuarine Management Forum
SEA	Strategic Environmental Assessment
EMI	Environmental Management Instruments
CBD	Convention on Biological Diversity
SANBI	South African National Biodiversity Institute
NBF	National Biodiversity Framework
NAAQS	National Ambient Air Quality Standards
GDA	General Discharge Authorisations
CWDP	Coastal Waters Discharge Permits
WQG	Water Quality Guidelines
GN	Government Notice
GG	Government Gazette
CMP	National Coastal Management Programme
EMP	Estuary Management Plans

MLRA	Marine Living Resources Act
NWA	National Water Act
MPAs	Marine Protected Area
WUL	Water Use Licence
GA	General Authorisation
MSP	Marine Spatial Planning
SEZ	Special Economic Zones
SAHRA	South African Heritage Resources Agency
NHRA	National Heritage Resources Act
PAIA	Promotion of Access to Information Act
PAJA	Promotion of Administrative Justice Act
WCBA	Western Cape Biodiversity Act
BSP	Biodiversity Spatial Plan
CBA	Critical Biodiversity Areas
ESA	Ecological Support Areas
PA	Protected areas
ONA	Other natural areas
SDFs	Spatial Development Framework
SPLUMA	Spatial Planning and Land Use Management Act (Act 16 of 2013)
PSDF	The Western Cape Provincial
LUPA	Land Use Planning Act
IDP	Integrated Development Plan
SDG	Sustainable Development Goals
NDP	National Development Plan
MTDP	Medium-Term Development Plan
PSP	Provincial Strategic Plan
WCIF	Western Cape Infrastructure Framework
MSDF	Municipal Spatial Development Framework
SPLUMA	Spatial Planning and Land Use Management Act
GGWMA	Breede-Gouritz Water Management Area
BOCMA	Breede-Olifants Catchment Management Agency
BGCMA	Breede-Gouritz Catchment Management Agency
ODM	Overberg District Municipality
mASL	meters above sea level
TMG	Table Mountain Group
SWSA	Strategic Water Source Area
MAR	Mean Annual Runoff
ACRU	Agro Hydrological Model
DEM	Digital Elevation Model
MSL	mean seal level
PSU	Practical salinity units
EHI	Estuarine Health Index
E. coli	*Escherichia coli*
NT	Near Threatened
DD	Data deficient

LC	Least Concerned
IBA	Important Bird Area
CFR	Cape Floristic Region
PES	Present Ecological State
REC	Recommended Ecological Category
FEE	Foundation for Environmental Education
WWF	World Wildlife Fund

1 INTRODUCTION

1.1 Preamble

The Onrus River is located in the Overstand Local Municipality in the Western Cape. The river arises in the Babylonstoren and Kleinrivier Mountains and flows in a south-westerly direction towards the town of Onrus, before flowing into the Indian Ocean. The river has a small catchment of around 55 km^2, with the main-stem river being approximately 16.5 km in length from source to mouth (Heinecken & Damstra, 1983). In its upper reaches, the river supports extensive, ecologically important, wetlands, including peatlands. The river then flows as a single channel through cultivated lands for much of its middle reaches where its riparian zone is heavily invaded with alien woodland vegetation. The river is impounded in the lower-middle reaches by the De Bos Dam, which supplies water to the town of Hermanus, as well as various farms in the valley. Downstream of the dam, the river is joined by two of its major tributaries—an unnamed stream and the Antjies River (Belcher & Grobler, 2020). The Onrus River widens at the confluence of these three watercourses, to form a wetland of very high ecological importance and sensitivity (Figure 1-1). This wetland, termed the "Onrus Main Wetland" formed through the accumulation of palmiet *Prionium serratum* (and decaying palmiet plants), over the course of more than 10 000 years, and historically provides a suite of highly important ecosystem services (Tooth & McCarthy, 2007). Downstream of the wetland, the river passes through a narrow kloof (ravine), and then meanders across the coastal plain (passing through the town of Onrus) before discharging into the Onrus Estuary which, in turn, discharges into the sea at Onrus Beach (Figure 1-1).

Figure 1-1. The location of the Onrus River, Main Onrus Wetland, Onrus Estuary, and De Bos Dam, within the G40H Catchment.

1.2 Anthropogenic Pressures and the Recent Ecological "Disaster"

The Onrus River, catchment, estuary, and other associated aquatic habitats, have been heavily altered by human activity and are continuing to face serious anthropogenic pressures. The riparian habitat integrity of the lower Onrus River is considered to be seriously modified (Day 2025). This is primarily due to the invasion of the riparian zone by invasive alien plant species. The instream habitat is also considered to be largely modified, primarily due to alterations of the natural flow regime following the construction of the De Bos Dam upstream in 1976. Of greatest concern has been the continued degradation of the large Onrus Main Peat Wetland, located immediately downstream of the De Bos Dam. This wetland is classified as an "unchannelled valley-bottom wetland", with the vegetation cover comprising mostly endemic palmiet (*Prionium serratum*). Palmiet wetlands are endemic to the coastal provinces of South Africa; are estimated to comprise less than 10% of South Africa's wetlands; and are considered globally unique in their distribution (Grundling et al., 2019). Palmiet peatlands are generally associated with valleys with a broad U-shaped floor in the Cape Fold Mountains. Peat typically occurs in these rivers in layers, often separated by sand, and underlain by rocks.

The Onrus peatland contains a peat layer of more than 7.25 m thick, dominated by a lower 4 m-thick sedge layer with a basal sand and not bedrock layer, which makes it unlike other palmiet systems elsewhere in South Africa. This system has been under continuous threat for the past 70 years—largely owing to the greatly reduced freshwater inflows due to the combination of the De Bos Dam, rampant water consumption by alien invasive plants (AIPs), and agricultural and domestic water consumption. Consequently, sediment losses and geomorphological changes to the river channel and wetland base have occurred, largely due to the progressive desiccation (drying out) of the wetland, which has exposed the wetland to accelerated erosive processes. Alien invasive plants (AIPs) have also started to colonise the compromised wetland area.

The above situation was further exacerbated when the desiccated peatland areas caught fire on the 11th of January 2019 (Figure 1-2). This fire rapidly became uncontrollable and resulted in extensive burning of the dry peat material below ground. These sub-surface fires also periodically ignited surface vegetation, causing further damaged to this delicate ecosystem. Numerous attempts were made to extinguish the fires, but it ultimately took six months for the last fires to be extinguished. This prolonged burn resulted in catastrophic levels of damaged to the peatlands and led to the destruction of organic matter depositions that had accumulated over the course of millennia (and would likewise require a similar period of time to return to their prior state, if that's even possible under the system's altered state).

Beyond harming this sensitive ecosystem and releasing very large amounts of carbon dioxide (CO_2) gas into the atmosphere due the burning of this (previously sequestered) peat material, this burning also left the wetland at even further risk of uncontrollable soil/ sediment erosion. In healthy riverine/ wetland systems, the base and channel are maintained in a relatively stable state through the "anchoring" effect of plants and their roots. Dense wetland vegetation performs a very important function in slowing down river flows, hence enabling sedimentation to occur, and anchoring these accumulated sediments and preventing rapid erosion from occurring. The desiccation, and the subsequent fires, therefore left the peatlands extremely vulnerable to erosion from all manner of storms and other frontal systems (which it would've previously been able to endure without much erosion/ damage).

Figure 1-2. Top Left: Fire blazing in the Hemel En Aarde Valley. Top Right: The palmiet peat wetland smoking and burning underground. Bottom Left: Irrigation techniques utilised to extinguish subsurface fires within the peat. Bottom Right: Aerial view of the Main Onrus Wetland following the extinguishing of the fire, with the burn damage being clearly visible on the landscape. Images courtesy of Liezl de Villers.

In response to the above concerns, a comprehensive plan was developed to rehabilitate the wetland through the (then) Department of Water and Sanitation (DWS), and the (then) Department of Agriculture, Forestry and Fisheries (DAFF) Working for Wetlands (WFW) Programme (Working for Wetland Programme, 2020). The plan had the objectives of:

- Reducing erosion caused by AIP encroachment, wetland desiccation, and fire damage;
- Reducing incision (eroding of deep erosion gulleys) in the wetland;
- Controlling AIP invasions in the catchment, especially where encroachment extended into wetlands and watercourses.

The aim of this plan was, therefore, to increase plant diversity, reduce water loss, improve the stability of the wetland soils, and identify other interventions to mitigate the impairment of water quality in wetlands and watercourses in the Onrus Catchment.

However, for various reasons, this rehabilitation programme was never actually implemented and, in September 2023, an intense "cut-off low" pressure system passed over the Onrus Catchment, with 141 mm of rainfall being recorded over a 24-hour period—equivalent to a 1:200 year flood event. The Onrus River came down in flood, and the wetland was almost completely destroyed (Figure 1-3).

Figure 1-3. Images captured during June 2025, indicating the degree of erosion of the peat wetland. The burnt peat platform visible in the top two images represents the previous wetland bed level, prior to the extensive gulley erosion that has occurred.

Unstable pockets of palmiet-covered peat could not withstand the force of the water, and large sections of peat broke away and were washed downstream, leaving an estimated 1/3 of the original wetland area intact. In addition, many roads and bridges were destroyed, along with a major sewerage reticulation pipeline, thus allowing untreated sewage to flow into the estuary and ocean. The rampant erosion from the flood, coupled with the incredible force of the floodwaters, resulted in enormous volumes of sediment and debris being carried downstream, much of which was deposited in the lower river, estuary, and beach.

The estuary was in a poor state of health even prior to this flood event, due to anthropogenic pressures, including reduced freshwater inflows; increased sedimentation; extensive *Phragmites australis* reed encroachment (linked to increased sedimentation); growing intensity of coastal development and tourism; and deteriorating water quality linked with agricultural return flows and wastewater inputs (Western Cape Government, 2022).

Consequently, when the floodwaters reached the estuary, there was widespread damage to the existing riparian zone, and surrounding infrastructure. Furthermore, immense volumes of sediment rapidly fell out of suspension when they encountered the deep estuarine water body, with the entire estuarine and lower riverine area being covered in a thick layer of sediment. This sediment, which consists of a combination or mineralogic silt/ sand, the broken-up remnants of the upstream peatlands, trees and other plants, and assorted other debris, dramatically changed the estuarine form and function. The estuary almost-instantly changed from a useful recreational/ ecological environment, to essentially a continuous mudflat, with flows largely being conveyed through myriad rivulets, rather than a single channel.

Figure 1-4. Onrus Estuary before (top) and following (bottom) the flood in September 2023 (Onrus River Estuary Forum (OREF), n.d.).

This issue was further exacerbated in 2024, when much of the material that had previously settled upstream of the main estuarine body, was resuspended and completely silted up the remainder of the former estuarine basin (Figure 1-5). All remaining estuarine function was therefore essentially lost following this flood event.

Figure 1-5. Top and Middle: Aerial drone photography of the Onrus Estuary captured in July 2024 (King 2024). Bottom: Images captured during the October 2024 Ecological Health Survey showing the extensive sedimentation and absence of an estuarine water body.

1.3 THE CURRENT PROJECT IN CONTEXT

In response to the flood damage, and the obvious need to conduct large scale rehabilitation works within the catchment, the Overstrand Local Municipality (OLM) approached numerous organisations to fund the required research and works required to initiate the ambitious rehabilitation/ restoration projects required in the Onrus Catchment.

Funding was primarily secured through the United Nations Environment Programme (UNEP), under the project title of "Generation Restoration: Catalysing a nature-based transformation in Finance, Jobs, and Cities" in Overstrand, South Africa", as well as from other public and private sources. The scope of works (SOWs) agreed upon between OLM and UNEP, included the preparation of a Situation Assessment Report (SAR) for the Onrus River Catchment, with required information being stipulated as follows:

- AIP infestation
- Land transformation
- Hydrology
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- Wetland health and importance (including an updated quantification of Ecological Water Requirements (EWRs))
- Estuary health and importance (including an updated quantification of EWRs
- Ecosystem Services value within the catchment.

Anchor Environmental Consultants (Pty) Ltd. (Anchor) was therefore approached by OLM to complete the SAR for the Onrus Catchment (this report), in addition to a number of other key related deliverables including the development of plans for rehabilitation of the main Onrus wetland and Onrus estuary, for removal of AIPs from the catchment, and for securing authorisation of undertaking all of these activities.

2 LEGISLATIVE FRAMEWORK

South Africa's environmental protection is regulated at national, provincial, and local levels. The Constitution of the Republic of South Africa, 1996, is the supreme law and provides the fundamental legal basis for environmental management. It guarantees the right to an environment that is not harmful to health or well-being and requires its protection for present and future generations through appropriate legislative and other measures. National legislation includes primary laws (Acts), subordinate legislation (Proclamations, Regulations, Norms and Standards, and Lists of Activities), and Guidelines that support implementation. These are administered by departments such as the Department of Forestry, Fisheries and the Environment (DFFE), the Department of Water and Sanitation (DWS), or the South African Heritage Resources Agency (SAHRA), to name but a few. The National Environmental Management Act (NEMA; Act 107 of 1998) is the overarching framework for environmental protection and sustainable development. It is supported by Specific Environmental Management Acts (SEMAs), including the NEM: Protected Areas Act (NEMPAA; Act 57 of 2003), NEM: Biodiversity Act (NEMBA; Act 10 of 2004), NEM: Air Quality Act (NEMAQA; Act 39 of 2004), NEM: Integrated Coastal Management Act (ICMA; Act 24 of 2008), and NEM: Waste Act (NEMWA; Act 59 of 2008). These are further supported by various other key environmental laws. Provincial legislation supports national laws and addresses province-specific issues such as pollution control, conservation, and regional planning. In the Western Cape, the Department of Environmental Affairs and Development Planning (DEA&DP) is the lead authority.

At the local level, municipalities such as the Overstrand Local Municipality (OLM), develop their own policies and by-laws to regulate land use, zoning, environmental management, and infrastructure, which align with broader provincial and national objectives. They are required to prepare spatial plans and frameworks, guided by national and provincial legislation and informed by higher-level spatial and biodiversity data such as the Western Cape BSP and the 2018 National Biodiversity Assessment (NBA). Examples of key legislation and instruments prepared and applied by municipalities include:

- Zoning Scheme and Planning By-Laws: Regulates land use rights, zoning and consent use applications.
- By-Laws: Regulates management of stormwater, water use, air quality, and waste.
- Integrated Development Plan (IDP): A primary strategic plan which guides municipal development priorities, including budgeting, development, service delivery, safety, socio-economic growth, and environmental sustainability. Ensures alignment with national and provincial legislation and plans.
- Municipal Spatial Development Framework (SDF): Provides spatial direction for municipal growth and development while safeguarding sensitive environments.
- Municipal Environmental Management Framework (EMF): Identifies environmental sensitivities, defines compatible and incompatible activities, and provides guidance to prevent environmental degradation.

Table 2.1 summarizes the primary acts governing the management of the Onrus River catchment, drawing from national water and environmental laws. These apply broadly to South African catchments but are implemented locally through Costal Management Area (CMAs) and strategies specific to the Breede-Olifants WMA.

Table 2.1. Key National & Provincial Legislation, International agreements/ conventions and Local Plans, programmes and frameworks.

Legislation/ Plan/ Framework Name	Description
INTERNATIONAL AGREEMENTS AND OBLIGATIONS	
Conventions, programmes, summits and organisations	• World Heritage Convention, 1972: Convention Concerning the Protection of the World Cultural and Natural Heritage; • Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973 (CITES); • Bonn Convention, 1979: Convention of Migratory Species of Wild Animals (1979); • Abidjan Convention, 1981: The Convention for the Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region; • United Nations Convention on Biological Diversity, 1992; • United Nations Framework Convention on Climate Change, 1992; • Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, 1995; • Agenda 21, 1992—Confirmed at the United Nations World Summit on Sustainable Development, Johannesburg Summit, 2002; • The Sustainable Development Summit, 2015; • Ramsar Convention: Convention on Wetlands of International Importance,1971; and • UNESCO
RELEVANT NATIONAL LEGISLATION	
National Environmental Management Act (Act 107 of 1998)	NEMA provides for cooperative environmental governance by establishes principles for decision-making on matters affecting the environment. It requires identification, assessment, and authorisation of activities that may affect the environment, socio-economic conditions, or cultural heritage. Key provisions under NEMA include: • **Environmental Impact Assessment (EIA) Regulations and Specialist Study Protocols:** Assessing impacts of certain developments with listed activities and enabling stakeholder engagement. • **EMFs:** Spatial tools guiding sustainable development in sensitive areas (e.g. Saldanha Bay EMF). • **Norms and Standards:** Activity-specific requirements (e.g. waste storage, land remediation, biodiversity offsets). • **Appeals and Compliance:** Appeals, enforcement, and rectifying unlawful activities. • **Land Use Planning Guidance** • **Strategic Environmental Assessment (SEA) and Environmental Management Instruments (EMIs):** Tools for integrating environmental and sustainability considerations into policy and planning. **Biodiversity and Ecosystem Guidelines:** Promotes inclusion of ecosystem services and biodiversity priorities in planning and decision-making.
The National Environmental Management:	This Act governs biodiversity management and the protection of threatened species and ecosystems through regulations and permits. It gives effect to international agreements (e.g., the CBD, 1992), supports planning tools such

Biodiversity Act (Act 10 of 2004).	as bioregional and Biodiversity Management Plans, regulates alien and invasive species, and establishes the South African National Biodiversity Institute (SANBI) for research, monitoring, and reporting. The Act also mandates biodiversity assessments like the NBA, which informs conservation and planning. The latest NBA was completed in 2018, with the 2025 edition due in November 2025 (SANBI, 2024).
National Biodiversity Framework (NBF)	The NBF is a national-level strategic policy document mandated under Section 38 of the NEMBA. It provides a coordinated framework to guide the management, conservation, and sustainable use of South Africa's biodiversity, setting priorities, targets, and strategies across all sectors and spheres of government. The framework is reviewed and updated every five years
Animals Protection Act (Act 71 of 1962)	This Act consolidates and amends laws relating to the prevention of cruelty to animals.
National Veld and Forest Fire Act (Act No. 101 of 1998);	This Act governs the prevention and combating of veld, forest, and other fires, and provides for fire protection associations and fire management responsibilities in South Africa.
National Environmental Management: Air Quality Act (Act 39 of 2004)	This Act provides the framework for regulating air quality in South. It establishes Air Quality Management Plans, requires licences for listed activities that produce atmospheric emissions, sets National Ambient Air Quality Standards (NAAQS) for priority pollutants, and allows for the declaration of priority areas where air quality is degraded.
National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008)	This Act provides for integrated coastal and estuarine management in South Africa to promote conservation and ensure that coastal development is socially, economically, and ecologically sustainable. It defines rights and duties, regulates activities that may harm the coastal environment, and gives effect to international coastal obligations. It also guides the establishment of coastal management lines and development and implementation of management plans, programmes and protocols. It further regulates effluent discharges into the coastal environment through: • **General Discharge Authorisations (GDAs):** These apply to discharges with very low to insignificant impacts, provided that prescribed water quality and volume limits are met and is an alternative to a full CWDP. GDA regulations apply only to specific areas within certain Ports, which is also the case for the Port of Saldanha Bay. This was only recently (2022) published in terms of Section 69(2) of ICMA (Government Notice (GN) 2290 in Government Gazette (GG) 47019). • **Coastal Waters Discharge Permits (CWDPs):** Applies to significant discharges with potential environmental impact. Involves detailed assessment and permit conditions (refer to the CWDP, 2019). **Water Quality Guidelines (WQG) for Coastal Marine Waters:** Provides thresholds for water quality objectives and discharge limits. These guidelines apply to both GDAs and CWDPs and are used to assess compliance and potential impacts of discharges into the coastal environment (note that these guidelines have been updated.
National Coastal Management Programme (CMP)	Provides the framework for implementing integrated coastal management at national and provincial levels.
National Estuarine Management Protocol	Provides guidance for managing estuaries and developing Estuary Management Plans (EMPs), including integration into coastal and protected area management frameworks.
Marine Pollution Act (Prevention of Pollution from Ships; Act 2 of 1986)	Previously the "International Convention for the Prevention of Pollution from Ships Act, 1986". The aim of this act is to provide for the protection of the sea from pollution by oil and other harmful substances discharged from ships, and for that purpose to give effect to the International Convention for the Prevention of Pollution from Ships, 1973, as amended by the Protocol of 1978; and to provide for matters connected therewith.

The Marine Living Resources Act (MLRA; Act 18 of 1998)	This Act provides for the sustainable management of marine living resources and promotes the protection of entire ecosystems and marine biodiversity. It enables the declaration of MPAs where certain activities may be restricted to support conservation goals. It also regulates commercial, subsistence, and recreational fishing.
Sea Birds And Seals Protection Act (Act 46 of 1973)	This Act prohibits the harassment, disturbance, killing, or capture of seabirds and seals. It is supported by the South African Policy on the Management of Seals, Seabirds, and Shorebirds, 2007, aimed at reducing incidental mortality caused by fishing operations.
National Environmental Management: Waste Act (Act 59 of 2008)	This Act provides a framework for sustainable waste management to protect human health and the environment by reducing resource use and waste, promoting reuse and recycling, and ensuring safe disposal. It establishes a National Waste Management Strategy, sets norms and standards, requires licences for waste activities, regulates hazardous waste, mandates local waste planning and reporting, and covers contaminated land remediation.
Hazardous Substances Act (Act 15 of 1973)	Provides for the classification, control, and regulation of hazardous substances and certain electronic products that may pose risks to human health or safety, including restrictions on their import, manufacture, sale, use, and disposal.
The National Water Act (NWA; Act 36 of 1998)	Provides the framework for the protection, use, development, conservation, and management of water resources. One of the main provisions under this Act is the requirement to obtain permission for certain water uses through either a Water Use Licence (WUL) or, in certain cases, a General Authorisation (GA).
Water Services Act (Act 108 of 1997)	This Act regulates the provision of water services, including water supply and sanitation, and establishes the framework for the rights and duties of water services authorities and providers.
Marine Spatial Planning Act (Act 16 of 2018)	The Act establishes a national system for Marine Spatial Planning (MSP) to manage ocean use across sectors, promote sustainable development, conserve marine ecosystems, and resolve conflicts between competing uses. It is based on the 2017 National MSP Framework and guides the preparation of Marine Area Plans.
Spatial Planning and Land Use Management Act (SPLUMA; Act 16 of 2013)	Provides a national framework for spatial planning and land use decisions to ensure coordinated, sustainable, and equitable development. It guides zoning, aligns planning with other legislation, and empowers municipalities to prepare SDFs and land use systems that integrate environmental, social, and economic objectives.
Special Economic Zones Act (Act 16 of 2014)	This Act governs the establishment, development, and management of Special Economic Zones (SEZs).
National Heritage Resources Act (NHRA; Act 25 of 1999)	This Act sets out the framework for protecting and managing heritage resources, which includes cultural, archaeological (including shipwrecks), and palaeontological resources. It also establishes the South African Heritage Resources Agency (SAHRA) and provincial heritage authorities to provide oversight.
Promotion of Access to Information Act (PAIA; Act 2 of 2000)	Gives effect to the constitutional right of access to information held by the state or by another person when required to exercise or protect rights and assigns related powers and duties to the Information Regulator.
Promotion of Administrative Justice Act (PAJA; Act 3 of 2000)	Gives effect to the constitutional right to lawful, reasonable and procedurally fair administrative action, including the right to written reasons for such action.
Disaster Management Act (Act No. 57 of 2002)	Establishes a legal framework for disaster risk management, including the establishment of the National Disaster Management Centre and the development of disaster management frameworks at national, provincial, and local levels.

RELEVANT PROVINCIAL LEGISLATION	
Western Cape Biodiversity Act (WCBA; Act 6 of 2021)	This Act provides the provincial framework for conserving, protecting, and sustainably managing biodiversity and ecosystems. It recognises and mandates the use of the BSP as a key tool in planning and regulatory processes and integrates biodiversity considerations into land-use planning and decision-making. Some sections have been in effect since 15 November 2022, while others will be phased in through the development of Regulations. Once fully operational, the Act will repeal older legislation consolidating biodiversity management into a single statute.
Western Cape Provincial Biodiversity Spatial Plan (BSP)	The Western Cape BSP is a provincial biodiversity planning tool that identifies priority and sensitive areas, classifying them as Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Protected Areas (PAs), or Other Natural Areas (ONAs) based on ecosystems, species, and ecological processes. Data are presented in CBA Maps. It is used to integrate biodiversity into planning and decision-making, guiding conservation and sustainable development.
Nature and Environmental Conservation Ordinance (Ordinance 19 of 1974)	This Ordinance governs nature conservation in the Western Cape, including protection of wild flora and fauna. Once the WCBA is fully in effect, this Ordinance will be repealed. Until such time, relevant administrative and law enforcement provisions remain governed by the Ordinance.
Western Cape Biosphere Reserves Act (Act 6 of 2011)	This Act provides for the designation and management of biosphere reserves in the Western Cape. It regulates land use within these reserves through the preparation of framework plans and addresses related incidental matters.
Western Cape Land Use Planning Act (LUPA; Act 3 of 2014)	This Act governs spatial planning and land use management in the province. It guides the drafting of provincial and municipal SDFs and ensures that these align with national priorities and SPLUMA. It ensures that infrastructure, heritage, agriculture, tourism, ecologically important areas, biodiversity, soil conservation, pollution control, and climate change adaptation considerations are incorporated into planning. It also guides applications such as rezoning, subdivision, and consent use.
The Western Cape Provincial Spatial Development Framework	The Western Cape Provincial (PSDF) is the province's highest-level statutory spatial plan, prepared and adopted under the Western Cape LUPA. It sets the spatial vision and development principles for the province and ensures that all municipal SDFs align with provincial and national spatial and land-use priorities.
Western Cape Provincial Coastal Management Programme	The Western Cape Provincial CMP is a strategic framework guiding sustainable coastal management, conservation, and planning. It is mandated under ICMA, which requires provinces to implement coastal management programmes aligned with national policies.
RELEVANT MUNICIPAL LEGISLATION	
Water Supply & Sanitation Services By-Law 2022	Regulates the provision, use, and management of water supply and sanitation services, including prevention of pollution from sewage and wastewater, which is critical for reducing nutrient loads and spills into the Onrus River and estuary.
Waste Management By-Law 2021	Governs the collection, disposal, and recycling of waste to minimize environmental degradation, including controls on illegal dumping and hazardous waste that could contaminate the catchment's water resources.
By-Law Relating to Storm Water Management	Manages stormwater systems, drainage, and runoff to prevent erosion, flooding, and pollution transport into rivers like the Onrus, ensuring sustainable flow and water quality.
By-Law Relating to Trees	Controls the planting, maintenance, protection, and removal of trees, relevant for managing invasive alien vegetation and preserving riparian zones along the Onrus River to enhance ecological health.
By-Law on Municipal Land Use Planning (PG 7540, 4 December 2015)	Establishes rules for land development, zoning, and planning approvals to promote sustainable use and protect sensitive areas like river catchments from inappropriate urban or agricultural expansion.

Overstrand Municipal Integrated Development plan	The 2025/26 Integrated Development Plan (IDP) review is the third review of Overstrand Municipality's amended 5-year IDP (2022/2027), adopted on 31 May 2022. It responds to community and institutional needs, aligning with Sustainable Development Goals (SDGs), the National Development Plan (NDP), Medium-Term Development Plan (MTDP 2024-29), Provincial Strategic Plan (PSP 2025-2030), Western Cape Infrastructure Framework (WCIF 2025), and district plans. The review involved ward consultations (September–November 2024), public meetings (April 2025), and provincial assessment (May 2025)
Overstrand Environmental Management Framework	The Overstrand EMF serves as a strategic tool for sustainable development in the Overstrand Municipal Area (1,707 km^2 along the Western Cape's Overberg coastline, including towns like Hermanus and Gansbaai). It integrates biophysical, socio-cultural, and economic factors to guide land-use planning, biodiversity conservation, and climate resilience, aligning with frameworks like the National Environmental Management Act (NEMA, 1998) and the Provincial Spatial Development Framework (PSDF). The EMF informs decision-making for development applications, prevents natural resource degradation, and supports ecosystem services while addressing social needs such as housing and poverty alleviation.
Overstrand Municipal Spatial Development Framework	The Overstrand Municipal Spatial Development Framework (MSDF), adopted on 13 May 2020, is a strategic planning document that guides land use, development, and spatial growth in the Overstrand Municipality for the period up to 2040. It aligns with national legislation like the Spatial Planning and Land Use Management Act (SPLUMA, 2013), the NDP (2030), and provincial frameworks such as the Western Cape PSDF. The MSDF promotes sustainable, compact, and resilient urban form, addressing challenges like population growth (3.5% annual rate), climate change, biodiversity loss, and economic disparities. It integrates with the IDP and EMF, emphasizing ecosystem services, heritage protection, and equitable access to opportunities.

2.1 WESTERN CAPE BIODIVERSITY SPATIAL PLAN

The Western Cape Biodiversity Spatial Plan (BSP) identifies priority terrestrial areas essential for biodiversity conservation, encompassing diverse ecosystems, species, and ecological processes. It also includes aquatic features such as rivers. It classifies areas into several categories, including Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Protected Areas (PAs) and Other Natural Areas (ONAs). The definition of each of the categories within the Western Cape BSP (i.e. CBAs, ESAs, PAs and ONAs) are summarised in Table 2.2. These are all important for maintaining representative ecosystems, species persistence, ecological functioning, and landscape connectivity (Pool-Stanvliet et al., 2017). These classifications are spatially represented in CBA maps, which guide planning and decision-making to support sustainable development. While municipalities may adapt the naming conventions of these categories in local spatial plans, they must retain alignment with the BSPs underlying principles and national policy frameworks. Spatial data layers from the 2024 Western Cape Biodiversity Spatial Plan (CapeNature, 2024) were represented spatially in Figure 2-1 indicating the relation of the biodiversity priority areas with the Onrus River Catchment.

Table 2.2. Summary of the Western Cape Biodiversity Spatial Plan priority categories as listed in CapeNature, (2024)

Category	Definition
PAs	Areas that are legally protected and recognized under the National Environmental Management: Protected Areas Act (Act 57 of 2023), including formally gazetted Contract Nature Reserves and Protected Environments.
CBAs	CBAs are essential for conserving biodiversity, supporting ecosystem processes, and maintaining ecological infrastructure. They include areas needed to meet conservation targets, protect Critically Endangered ecosystems, and maintain landscape connectivity. CBAs must remain in a natural or near-natural state, with CBA 1 areas generally intact and CBA 2 areas potentially degraded or containing secondary vegetation.
ESAs	ESAs are not essential for achieving biodiversity targets but are crucial for supporting the ecological functioning of Protected Areas and Critical Biodiversity Areas, and for sustaining ecosystem services. They include key features such as climate adaptation corridors, water recharge zones, riparian habitats, and threatened vegetation types, and should be maintained in at least a functional condition. ESAs are classified as ESA 1 (functional areas in natural to moderately degraded condition) and ESA 2 (severely degraded areas requiring restoration), with land uses permitted only if they do not compromise ecological integrity or long-term biodiversity goals.
ONAs	ONAs are not designated as priorities in the current biodiversity spatial plan but still retain much of their natural character and contribute to biodiversity and ecological infrastructure. While they allow greater flexibility in management and land use, activities should aim to minimise habitat and species loss and maintain ecosystem functionality. High-impact land uses may be permitted but require appropriate environmental authorisation.

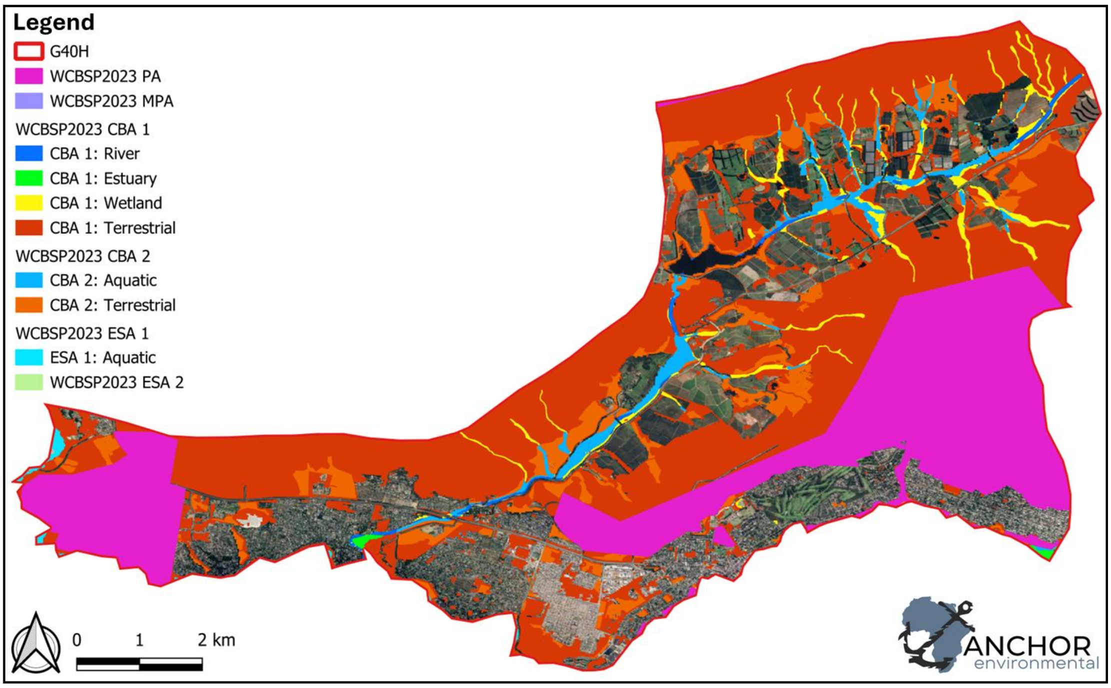

Figure 2-1. Spatial representation of designated biodiversity priority areas in relation to the Onrus River Catchment

3 BIOPHYSICAL CONTEXT

3.1 LOCATION AND EXTENT OF THE ONRUS RIVER CATCHMENT

The Onrus River catchment is situated within the temperate biogeographic region along the west coast of South Africa, approximately 7 km northwest of Hermanus (Harrison et al., 2000). It falls within quaternary catchment G40H and forms part of the Breede-Gouritz Water Management Area (GGWMA), which is managed by the Breede-Olifants Catchment Management Agency (BOCMA; formerly Breede-Gouritz Catchment Management Agency, BGCMA). Catchment G40H spans an area of approximately 59 km^2 and lies within the Overstrand Local Municipality (OLM), which is part of the Overberg District Municipality (ODM) in the Western Cape Province (Figure 1-1).

The Onrus River extends over a length of 16.8 km and flows through the Hemel en Aarde Valley, which is flanked by the Babilonstoringberge and Kleinrivierberge mountain ranges (Figure 3-1). The broader upper Hemel en Aarde Valley is situated at an elevation of 600–1000 m above sea level (mASL), while the narrower lower valley lies at an elevation of 200–400 mASL. These two sections are divided by the Attaquas Kloof ravine, at the head of which is the dam wall of the De Bos Dam (Figure 3-1). Several streams feed into the Onrus River, with the Antjies River being the primary tributary. These tributaries have their source on the steep slopes of the Onrus Mountains. Downstream of the De Bos Dam lies the Main Onrus Wetland, which is classified as an "unchannelled valley-bottom wetland", according to the national classification system for aquatic ecosystems (Ollis et al 2013).

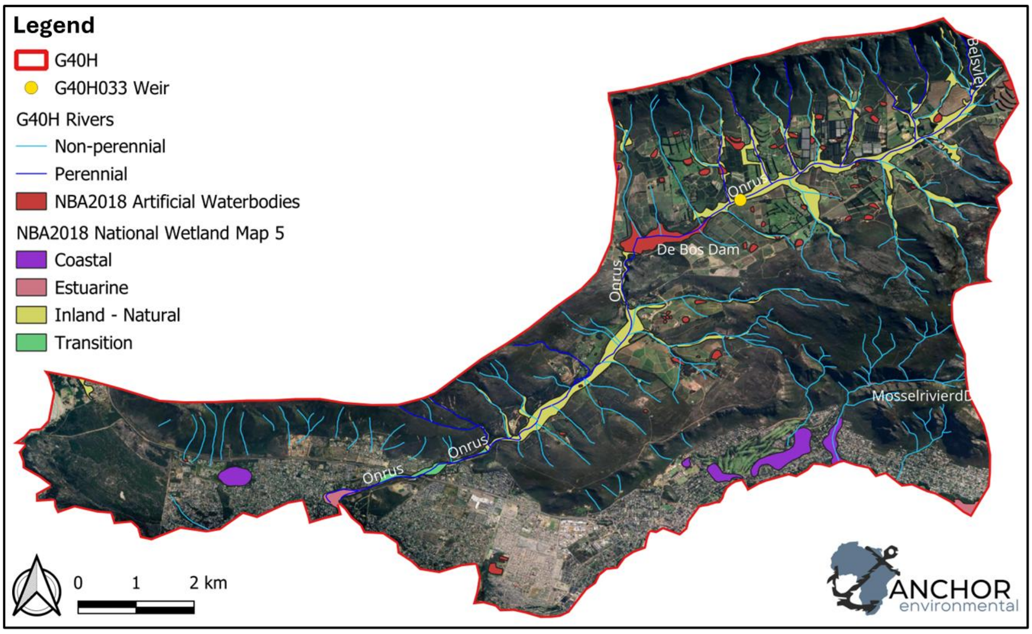

Figure 3-1. Waterbodies within the G40H quaternary catchment. Blue lines indicate perennial river channels; light blue line indicate non-perennial river channels; the yellow circle indicate the G40H033 weir; red polygons represent artificial waterbodies; purple polygons denote coastal wetlands; the pink polygon represents the estuarine functional zone; yellow polygons indicate natural inland wetlands; and green polygons represent transitional zones between the freshwater system and the estuary.

3.2 GEOLOGY

The primary stratigraphic units within the Onrus River Catchment include formations from the Malmesbury Group, Cape Granite Suite, Table Mountain Group (TMG), Bokkeveld Group, and Bredasdorp Group (Heineken and Damstra 1983). The Malmesbury Group, which represents the oldest lithological unit in the region, has been intruded by granitoids of the Cape Granite Suite and forms the basement complex upon which the thick sedimentary sequences of the Palaeozoic Table Mountain and Bokkeveld Groups were subsequently deposited. Granitic outcrops associated with the Cape Granite Suite are exposed in the Hemel-en-Aarde Valley, north of the De Bos Dam (Figure 3-2 and Figure 3-3).

The TMG is the predominant geological unit in the Hermanus region and comprises several formations, namely the Peninsula, Pakhuis, Cedarberg, Goudini, Skurweberg, and Rietvlei Formations (Heineken and Damstra 1983). The highly folded and mechanically resistant quartzites of the Peninsula and Skurweberg Formations give rise to prominent topographic features, forming steep, rocky ridges and mountain ranges (Figure 3-2 and Figure 3-3). These structures constitute the east–west trending topographic backbone of the Onrusberge, Babilonstoringberge, and Kleinrivierberge. In contrast, the Bokkeveld Group, composed primarily of more erodible shales and siltstones, underlies the northeast–southwest oriented Hemel-en-Aarde Valley and contributes to its subdued topography.

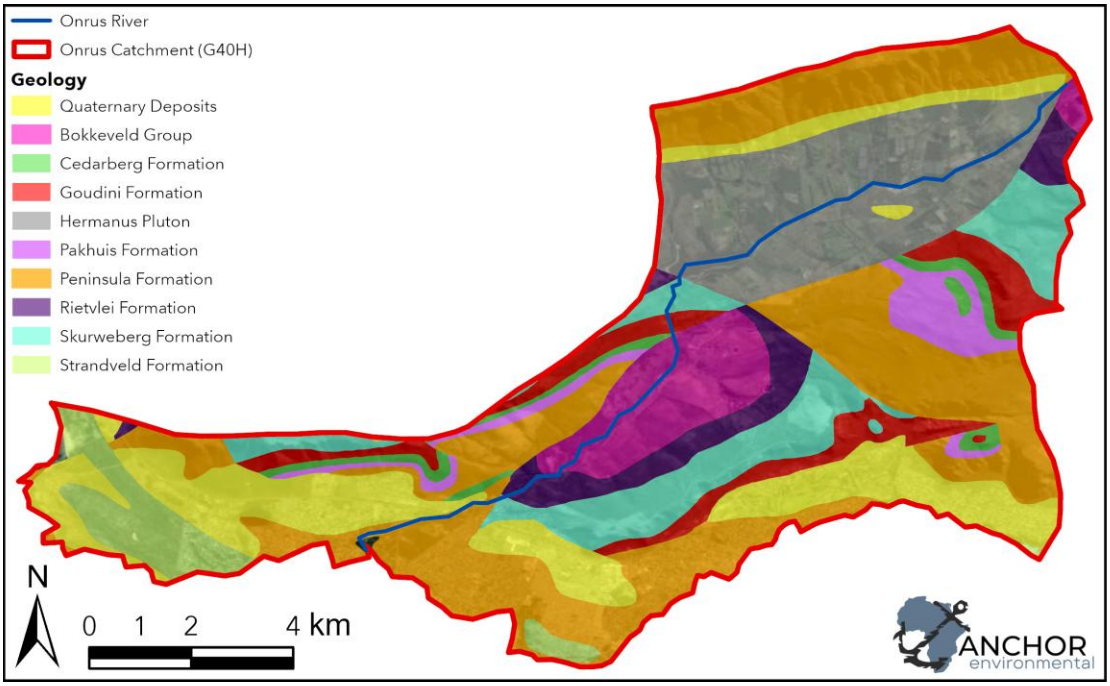

Figure 3-2. Geology of the Onrus Catchment.

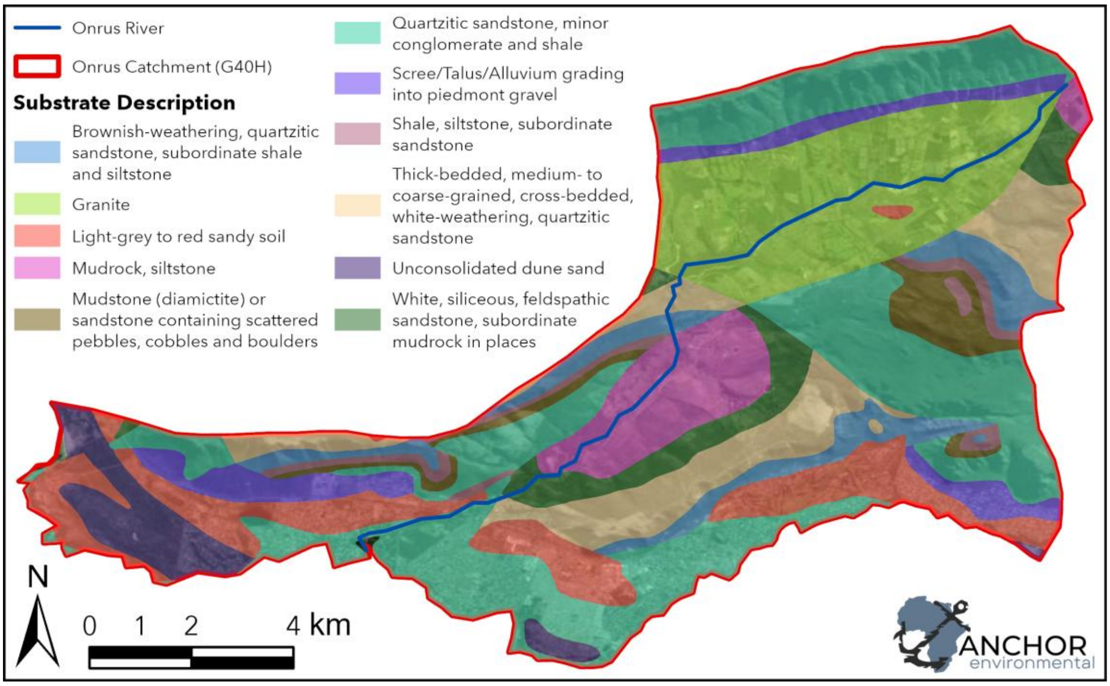

Figure 3-3. Descriptions of the various geological substrates present within the Onrus Catchment.

3.3 GEOHYDROLOGY

Geohydrology refers to the study of water falling beneath the Earth's surface (groundwater). The movement and accumulation of groundwater is dependent on factors such as soil structure, impermeable rock layers, porosity (the degree to which water can flow through tiny holes/ fissures in rock layers), etc. Groundwater typically accumulates in subsurface structures known as "aquifers", which can essentially function as groundwater reservoirs/ lakes, etc. These aquifers can be of critical importance for water security in some areas, as their abstraction through boreholes, wellfields, etc., can allow for access to freshwater volumes that would otherwise be impossible should only existing surface water resources be utilised.

Much of Catchment G40H falls within a Strategic Water Source Area (SWSA), which is classified as having importance for groundwater resources (Figure 3-4). The TMG sandstones and Bokkeveld Group in the area support a number of large underground aquifers suitable for groundwater abstraction. The groundwater depth within the catchment varies substantially (cite umvoto). This ranges from near-surface, to (~500–600 M) when aquifers are located deep underground (and under confining cap rock layers).

The suitable nature of the local aquifers for abstraction has resulted in the development of a number of wellfields in the area, which predominantly target the Peninsula Aquifer (which is located at a depth of between 50 and 300 m below the surface). The most notable of these abstractions occur at the Camphill and Volmoed wellfields, however, there are a number of other production (or monitoring) boreholes located within the catchment, which also utilise the Peninsula Aquifer.

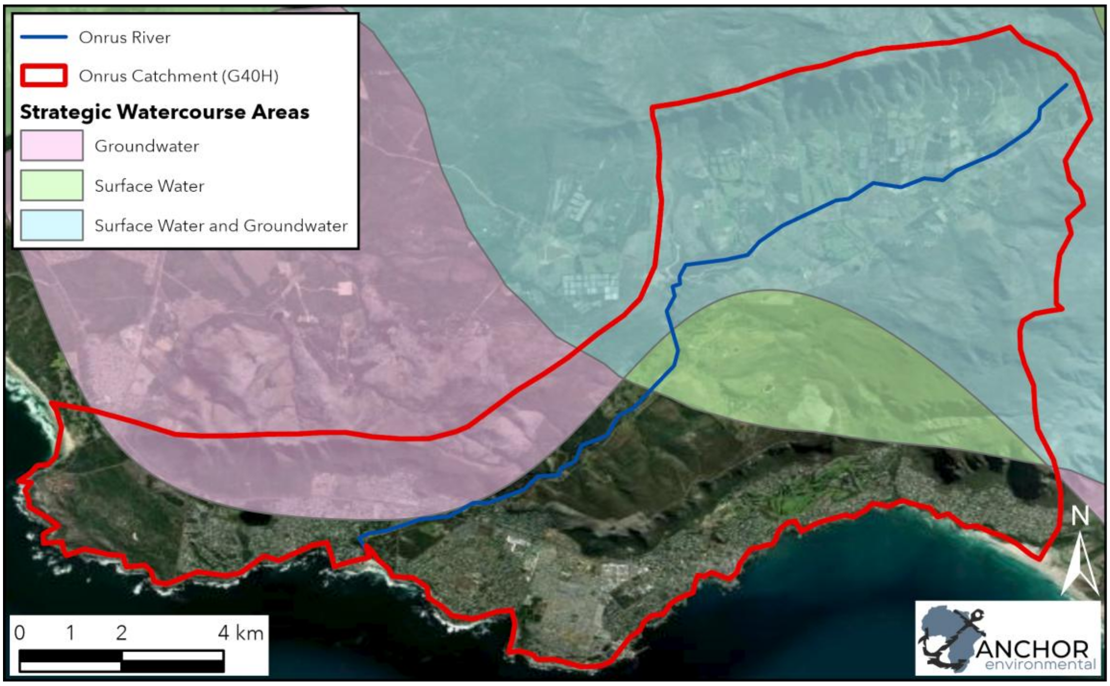

Figure 3-4. The Onrus Area in relation to delineated Strategic Water Source Areas.

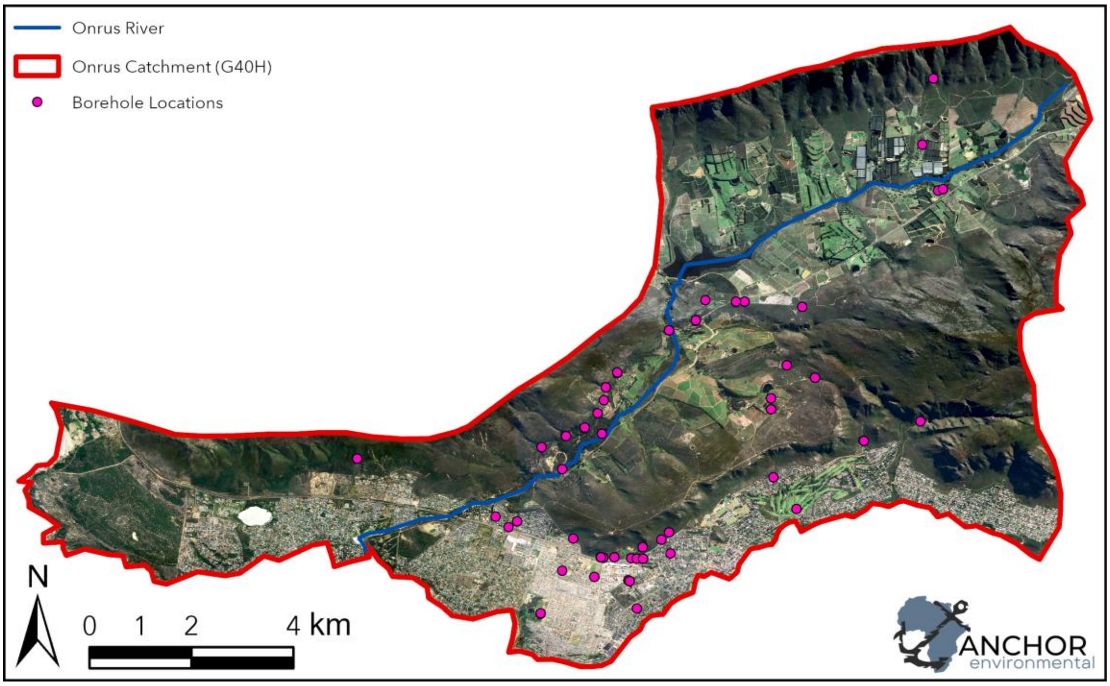

Figure 3-5. Monitoring boreholes in the Onrus catchment.

A number of famers abstract water from the Nardouw Aquifer, which overlies the Peninsula Aquifer, and is targeted in areas where the Peninsula Aquifer is located particularly deep underground (such as the area in the vicinity of the Southern Right Farm, Hamilton Russel Vinyards, and Ashbourne Farm, where it occurs at approximate depths of between 500–600 m below ground). In these areas, the Peninsula and Nardouw Aquifers are separated by the Winterhoek Mega-Aquitard (rock layer with very low permeability that allows only limited transfer between aquifers), which is between 250–300 m in this area, and has been confirmed through long-term (10–20 year) groundwater monitoring data for the Hemel en Aarde Valley (Umvoto 2020). Consequently, utilising the Peninsula Aquifer in these areas would present a substantial logistical and financial constraint, despite the Peninsula Aquifer being the highest-yielding aquifer in the area.

These boreholes are utilised by both the municipality and privately-owned farms for agricultural use (Umvoto 2020).

3.4 Climate

The Onrus River Catchment is subjected to a winter rainfall regime, which is typical of much of the Western Cape of South Africa. The majority of precipitation therefore occurs during the winter months, which is linked to the eastwards movement of low-pressure cells which form part of “mid-latitude cyclone” systems. These systems, which form within the Southern Ocean, pass just south of/ over the Western Cape during the winter, months, thus leading to precipitation, along with north-westerly winds. Conversely, the shifting of high-pressure cells in the region during the summer months results in these cyclones being pushed further south, with the result being that minimal rainfall occurs over the warm summer period, and a south-easterly wind prevails. This seasonality is visible in the precipitation charts for the closest continuously-recording weather station, “Caledon PP” (Figure 3-6, GIS Elsenburg, 2025).

However, in addition to winter rainfall, the Overberg Area is also vulnerable to phenomena known as “cutoff lows”, which refers to low pressure systems that form part of the easterly moving mid-latitude cyclone process (Heinecken & Damstra, 1983). These cutoff lows form when one of the low-pressure cells, forming part of a “family of fronts”, veers too far north, and is “cut off” from the rest of the broader system. These cells sometimes continue to travel further northwards and “sit” over the southern coast of South Africa, thus resulting in heavy rains and flooding conditions till the system dissipates. These systems are most prevalent (and concerning) in the Onrus Area during the spring-early summer period (September-to-November) and can result in the most intense conditions experienced within the region. It was an intense cutoff low system that, in September 2023, resulted in the estimated 1:200-year recurrence interval flood, that hit the Overstrand area, and caused the catastrophic damage to the Onrus River System, that is described within this report).

Orographic precipitation, induced by the nearby coastal mountain ranges, further contributes to localised rainfall intensification within the elevated areas of the catchment, when compared with the coastal plain, which typically experiences lower total precipitation (Heinecken & Damstra, 1983).

It is therefore evident that the system experiences substantial seasonal, interannual, and spatial variability with respect to climate/ rainfall, with extremes of both drought and flooding being experienced over the span of relatively few years.

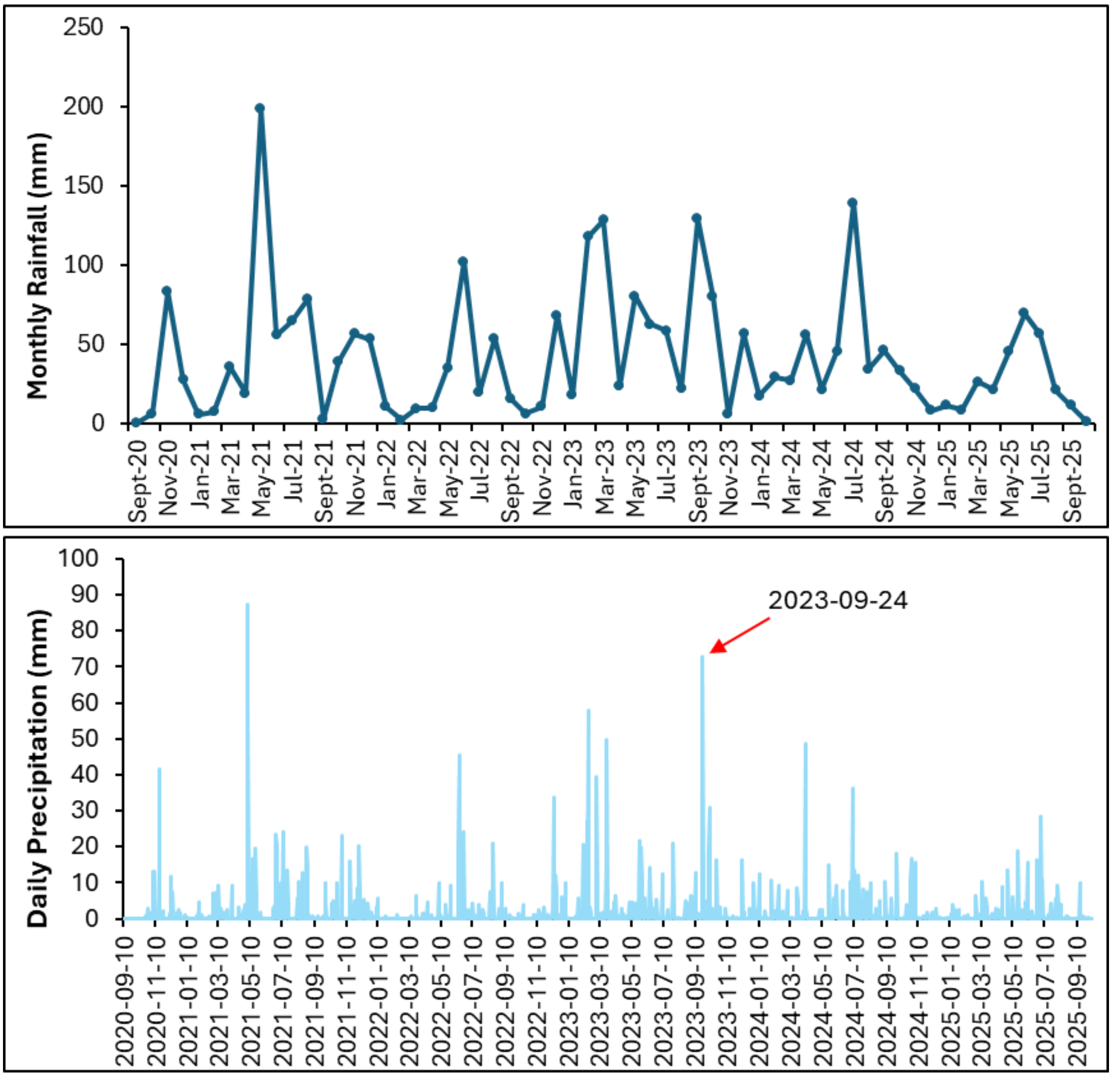

Figure 3-6. Top: Monthly rainfall data for the Caledon PP weather station. Bottom: Daily rainfall data for the Caledon PP weather station. Source: GIS Elsenburg (2025).

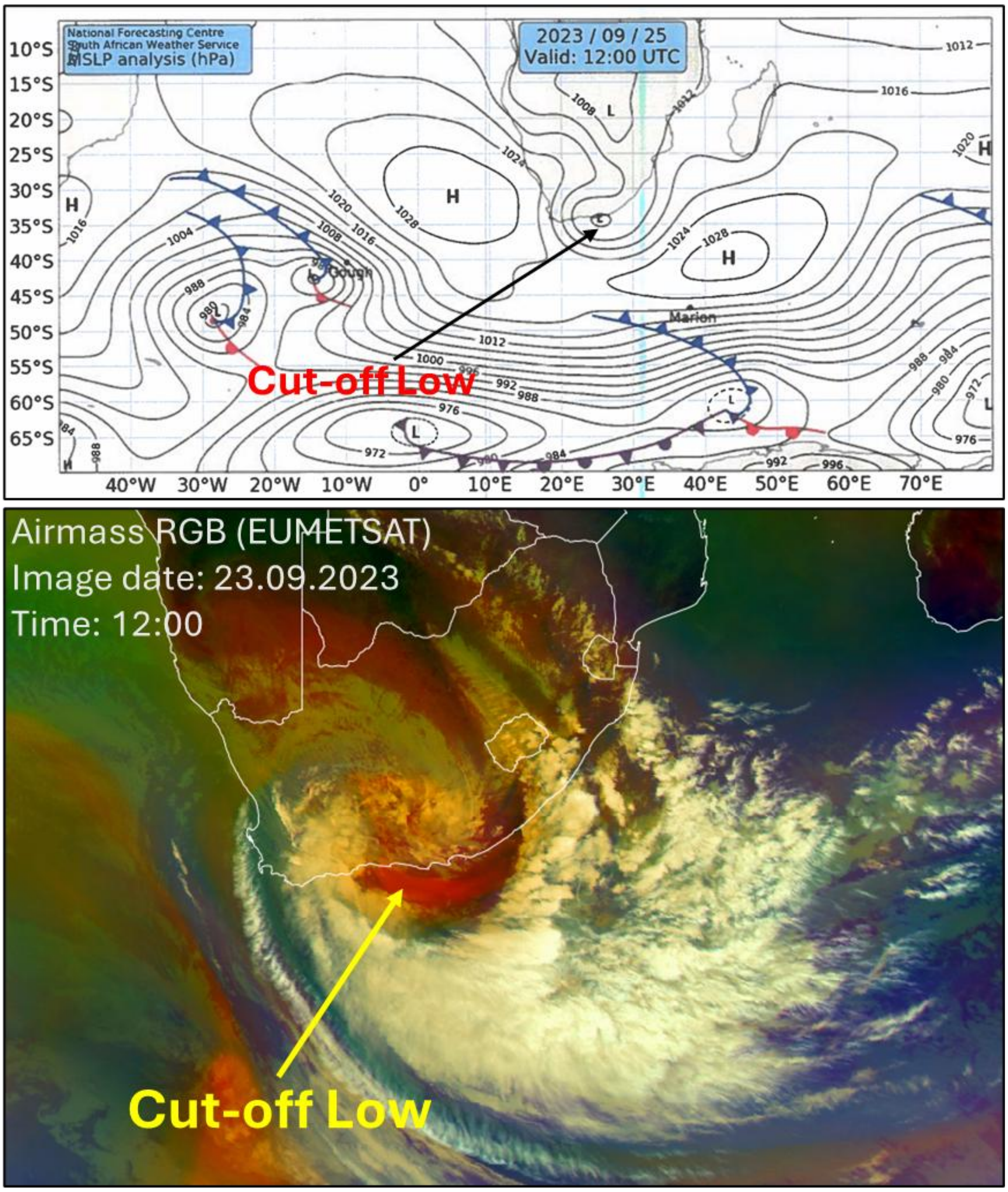

Figure 3-7. Synoptic weather chart of South Africa during the peak of the "Heritage Day" flood event, with the cut-off low being visible to the south of South Africa. Source: SAWS (2023). Satellite view of the airmass present over South Africa during the September 2023 "Heritage Day" flood. Visible is the cut-off low positioned over the southern coast of South Africa (indicated in red). Source: EUMETSAT (2023).

3.5 Hydrology

The following synthesis is based on the Onrus C2C Hydrology Report by Lorentz et al. (2024). A long-term hydrological dataset (1977–2023) of observed flows at the G40H033 weir, located upstream of the De Bos Dam (Figure 1-1), was analysed to identify trends and anomalies in streamflow. Prior to April 1993, the Mean Annual Runoff (MAR) at the weir was recorded at approximately 20 Mm^3/annum. However, a pronounced decline in flow was observed after April 1993, with the MAR decreasing to approximately 7 Mm^3/annum. Post-1993 annual flows ranged from a minimum of 2.7 Mm^3/annum to a maximum of 13.3 Mm^3/annum. The highest extreme event was recorded on 23 September 2023 with an estimated flow rate of $83m^3/s$. However, this value is considered unreliable, likely due to the weir being overtopped or operating beyond its measurement capacity during the event. Consequently, the actual peak discharge was probably higher than the reported value.

The cause of this abrupt reduction in flow evident in 1993 remains uncertain, though several hypotheses have been proposed. These include: significant changes in land use and/or water abstractions upstream of the weir; alterations to the rating curve applied before and after April 1993; and potential structural damage to the weir, which may have allowed low flows to bypass measurement due to insufficient ponding above the crest level.

To assess hydrological processes in the catchment and the impacts of land-use change, an ACRU agro-hydrological model was setup as part of the hydrology component of this project (Lorentz et al. 2024). The ACRU model was selected for its capacity to simulate daily flow dynamics and sensitivity to vegetation and land use. It maintains internal consistency across the climate–plant–soil continuum through integrated feedback mechanisms.

For spatial modelling purposes, the Onrus catchment was delineated into three major sub-catchments using a Digital Elevation Model (DEM):

- Sub-catchment 1: Includes inflow to and outflow from the De Bos Dam;
- Sub-catchment 2: Covers the river reach from the De Bos Dam outlet to the wetland outlet;
- Sub-catchment 3: Extends from the wetland outlet to the estuary discharge point.

A series of six land-use scenarios were developed to investigate the effects of vegetation change, invasive alien plant proliferation, and water abstraction:

- Scenario V1 (Natural Vegetation Baseline): Simulates pre-disturbance conditions using natural vegetation types defined by Acocks (1988).
- Scenario V2 (Current Land Use): Reflects present-day land cover based on the 2022 South African National Land Cover dataset, with combined farm dams and De Bos Dam operations included.
- Scenario V3 (Current Land Use + 50% Fynbos Alien Invasion): Assumes that 50% of existing fynbos areas are replaced by alien invasive vegetation. All other parameters remain consistent with Scenario V2.
- Scenario V4 (Current Land Use without Irrigation): Maintains current land use and alien vegetation distribution but excludes irrigation abstractions from the De Bos Dam.
- Scenario V5 (Current Land Use without Alien Vegetation): Assumes all alien vegetation has been removed and replaced with fynbos. Irrigation withdrawals remain.
- Scenario V6 (No Irrigation or Alien Vegetation): Represents a fully rehabilitated landscape with restored fynbos and no irrigation abstractions, but retaining current land-use boundaries.

The various scenarios (Scenario V2-V6) were compared to the baseline/ natural vegetation scenario (Scenario V1) (Table 3.1).

Table 3.1. Catchment-scale hydrological modelling outcomes.

Scenario	Description	Dam Inlet	Dam Outlet	Estuary	Change from Natural
		(Mm^3/a)	(Mm^3/a)	(Mm^3/a)	(%)
V1	Natural vegetation	9.4	9.4	13.9	0.0%
V2	Current Land Use	9.7	6.5	11.1	-20.2%
V3	Current Land Use, 50% of Fynbos = Alien	8.2	5.0	9.0	-35.3%
V4	Current Land Use without Irrigation	9.6	9.3	13.9	-0.2%
V5	Current Land Use without Aliens	9.7	6.6	11.1	-19.8%
V6	Current Land Use without Aliens or Irrigation	9.7	9.3	13.9	0.1%

Under current land use conditions (Scenario V2), simulated discharge at the weir exceeds that of the natural vegetation scenario, likely due to the increased extent of impervious surfaces. However, a notable decline in discharge is observed downstream at the dam outlet, likely reflecting storage and abstraction impacts. By the time flows reach the estuary, the MAR under current land use is estimated to be approximately 20% lower than under natural vegetation. Scenario V3, simulating 50% alien plant invasion into existing fynbos areas, results in an additional 15% reduction in MAR at the estuary compared to current land use. This suggests a significant reduction in runoff due to increased water use by invasive vegetation. In Scenario V4, where irrigation abstraction is removed but alien vegetation remains, MAR at the estuary approaches that of the natural vegetation scenario. This indicates that the water savings from eliminating irrigation nearly compensate for losses due to alien vegetation, with increased runoff from impervious areas further contributing. In Scenario V5, which assumes complete alien vegetation removal and restoration of fynbos, the model predicts a slight increase in runoff compared to current conditions. This may result from the replacement of alien species on steep slopes with grassland, which potentially has a higher runoff coefficient. However, the model may underestimate evapotranspiration from riparian alien vegetation, and improved calibration using field-based evapotranspiration data is recommended. Enhanced spatial mapping of alien species would also support more accurate runoff projections. Scenario V6, representing current land use with no irrigation abstractions and no alien vegetation, produces slightly higher runoff than the natural vegetation scenario, again attributable to increased surface runoff from impervious areas.

The projected climate change impacts for Quaternary Catchment G40H, which encompasses the Onrus River basin, indicate a decline in mean annual runoff due to decreased rainfall and increased evapotranspiration. Model simulations suggest a 10–20% reduction in runoff for the near-future period (2015–2044) and a 40–50% reduction in the distant-future period (2070–2099), as shown in Table 5-2. These projections are based on natural vegetation cover and do not incorporate potential future land use changes, the construction of impoundments, or increases in water abstraction.

These findings underscore the significant influence of land use, invasive species, and water abstraction practices on catchment hydrology. Improved field data on alien vegetation distribution and water use would enhance the robustness of model outputs and support more effective water resource management.

3.6 PHYSICAL CHARACTERISTICS AND DYNAMICS

3.6.1 ONRUS RIVER

The Onrus River arises on the Babilonstoring and Kleinrivier Mountains and flows in a south-westerly direction towards the town of Onrus where it flows into the ocean. In its upper reaches, the river contains significant wetlands associated with the watercourse channel. The river flows through cultivated lands for much of its middle reaches where the river consists of a single channel and the riparian zone is heavily invaded with alien woodland. It is in this reach that the river is dammed in the De Bos Dam which supplies water to the town of Hermanus and farms in the valley. Downstream of the dam the river is joined by two of its more significant tributaries; an unnamed stream and the Antjies River.

At the confluence of the three watercourses, the Onrus River forms a wide wetland (the main Onrus Wetland which is described in more detail below). Where the Onrus River leaves the Hemel en Aarde Valley and enters the coastal plain, it passes through a narrow kloof where the wetland habitat associated with the river largely disappears. Shortly fater this point the river discharges in to the Onrus estuary which is also described in more details below (Section 3.6.3).

3.6.2 ONRUS WETLAND

The Onrus Wetland comprises a large (± 37.5 ha) wetland on the main stem of the Onrus River, in the Hemel en Aarde Valley of quaternary catchment G40H. Using the national classification system for aquatic ecosystems of Ollis et al (2013), the wetland is classified as a naturally unchanneled valley bottom wetland and, prior to the impacts that have progressively ravaged it in recent decades, comprised a wide (approximately 220 m wide at its widest point), ± 2 km long wetland, with a downstream slope in the order of 1% on average (slopes estimated off 5 m contours) and dense wetland vegetation that provided a nearly 100% cover of the wetland, with occasional areas of channelled surface flow visible in early aerial imagery (e.g. 2004 Google Earth imagery). The lateral cross-sectional; slope within the wetland (i.e. from side to side) would be less than a 5m drop, as shown in aerial imagery in Cape Farm Mapper that indicate that the entire wetland pre-2023 floods lay within a 5 m vertical band (see Figure 3-8, Figure 3-8).

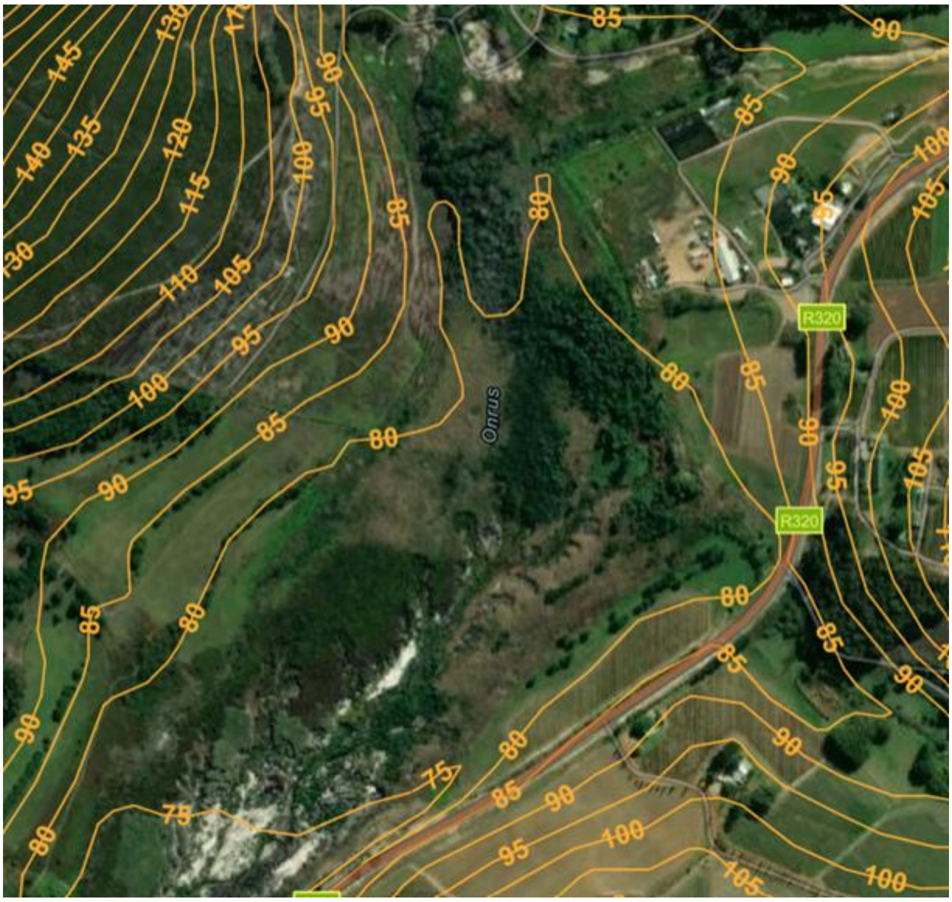

Figure 3-8 Upstream section of the Onrus wetland post 2023 floods (image 24/4/2025) but showing original (pre flood) contours. Map from Cape Farm Mapper (https://gis.elsenburg.com/apps/cfm/)

The Onrus Wetland itself is located in the wetland South West Fynbos Bioregion – a bioregion identified as Critically Endangered in van Deventer et al (2019) and lying, in the present case, within a terrestrial area mapped as naturally comprising (now Critically Endangered) Elim Ferricrete Fynbos. The Onrus Wetland is listed among South Africa's known peatlands in the current Global Peatland Map (https://maps.work/gpd/) and included in Grundling et al.'s (2021) listing of peatlands in the Cape Fold Mountains peat ecoregion that have been affected by fire.

Although considered in this section as a separate unit, it is important to note that the wetland, under natural conditions, would have formed a near-continuum of (mostly channelled) valley bottom wetlands along the river reaches upstream of the wetland. These wetlands are evidenced today in deeply incised, actively eroding channels, along the banks of which remnants of deep organic soils can still be seen.

3.6.3 Onrus Estuary

The Onrus Estuary is one of South Africa's 290 functional estuaries and is one of 21 estuaries within the warm temperate biogeographic region, classified as "temporarily open/closed" (Turpie et al., 2012; Van Niekerk & Turpie, 2012). It is a relatively small estuary, with a total floodplain area of approximately 15 ha. It was ranked 94th of all South African estuaries in terms of its overall conservation importance and, as such, is not considered to be particularly important for estuarine biodiversity at a national scale. Conversely, the estuary (and surrounding town) is an important recreational area and holiday destination, with the small residential population of Onrus being bolstered greatly during holiday periods, due to tourism—which also stimulates the local economy.

HYDRODYNAMICS

The Onrus Estuary is classified as a small temporarily closed system (Van Niekerk et al. 2019). In DWS (2017), it was reported that data from the DWS water level gauge (G4T011) and personal observations of the authors indicated that the mouth was closed at times with a large sandbar. CSIR (1991) estimated that the average crest height of the berm was estimated at +2.8 m mean seal level (MSL) and that due to its small size the estuary is most often in a semi-closed state as it can fill and overtop at relatively low inflow rates by means of a narrow channel that forms on the western edge of the sandbar. It was also noted in DWS (2017), that this narrow channel serves as an overflow, rather than a tidal inlet, and seawater only penetrates during high storm spring tides as evident from kelp in the lower reaches of the estuary. With the arrival of sufficiently large floods, however, the overflow channel scours deep enough to allow for a brief period of tidal fluctuations, i.e. Open State. The sandbar starts rebuilding on the seaward side as sand is deposited back on the beach by wave action and usually closes within ten days, reverting back to an overflow channel. The Onrus Estuary was therefore described in DWS (2017) as being in a “perched” semi-closed state for the majority of the time, with the estuary outlet higher than the tidal range. The main body of the estuary was at a level less than 1 m above MSL across much of its length and dropped down as low as 1.3 m below MSL in places.

A series of topographic surveys conducted between 1994 and 2024 indicated little change in the profile of the estuary up to 2022, and also suggest that the mouth region of the estuary has changed little since the 1990s, that the berm is still at around +2.8 m MSL and that there is still a narrow channel on the west side of the mouth that serves as an overflow for the estuary. The bed level in the main body of the estuary changed dramatically in 2023 following a major flood in September of that year when the Overstrand experienced 135 mm of rain in 48 hours. This flood resulted in an enormous quantity of sediment being deposited in the estuary which has fundamentally altered hydrodynamic and ecological functioning of the system. Much of the sediment that was deposited in the estuary originated from a major wetland system (the Onrus Wetland) some 4 km upstream of the estuary.

Deposition of sediment in the estuary caused the bed level to rise to between 0.5 m and 3.0 m above MSL across its entire length. The volume of sediment deposited in the estuary (based on the change in the bathymetry profiles between the 2021 and 2023 surveys) is estimated at around 180 000 m^3. Since the flood, there has been some redistribution of sediment in the estuary and bed levels are now

WATER QUALITY

There is limited historical data for water quality for the Onrus Estuary but it has always been identified as a freshwater-dominated system, where instantaneous salinity varied from around 0-4 PSU during the closed state to around 31.7 PSU when the estuary was open to the sea. DWS (2017) suggested that under the Reference condition, the open water areas of the estuary were mostly clear (suspended solids <5 mg/ℓ), well-oxygenated (dissolved oxygen ~8 mg/ℓ) and oligotrophic (dissolved inorganic nitrogen <50 mg/ℓ and dissolved inorganic phosphate < 10 mg/ℓ). DWS (2017) also provided some estimates of what they considered “characteristic” water quality conditions under each of the abiotic states (closed, semi-closed, open) for the Reference and for their Present Day (2017) condition. Based on these estimates, DWS (2017) rated water quality in the estuary as Moderately modified (D category) and allocated a score of 56% to water quality health.

A rapid ecological assessment was undertaken of the estuary by Clark et al. (2024), which included collection of data on water quality (temperature, salinity, dissolved oxygen, pH, Total Suspended Solids, ammonia, nitrate, nitrite and dissolved inorganic phosphorus). These data suggest that projections by DWS (2017) were largely correct but that conditions have deteriorated even further since this time as a result of the massive deposition of sediment in the estuary (salinity levels in the estuary are expected to be markedly lower now than in 2017, even under open mouth conditions, due to a much reduced tidal prism) along with further increases in nutrient levels and suspended sediment levels.

Water quality health scores for the Present Day (2024) were derived in a similar way to those for 2017 (DWS 2017), in accordance with methods set out in the EHI manual and were based on average water quality conditions under each abiotic state and the anticipated frequency of occurrence of the various states. Based on this, we estimate that the water quality health of the Onrus Estuary has declined from around 56% (D category) in 2017 to 36% (E category) in late 2024.

PHYSICAL HABITAT

In their assessment of the state of the Onrus Estuary Heinecken & Damstra (1983) concluded that it was likely that marine sediments (coarse sand) could enter the lower part of the estuary during extreme storm events but generally do not penetrate further than 100 m upstream of the estuary mouth. They found that beyond 100 m, marine sediment is replaced by finer, catchment-derived sediment with a higher percentage of organic mud. Average deposition of catchment-derived sediment for the period 1940 to 1990 was estimated at approximately 1 200 m^3 per year (CSIR, 1991). The De Bos Dam acts as a sediment trap and therefore most of the sediment deposits originate from the lower catchment below the dam. DWS (2017) surmised that over the subsequent two decades, agricultural development had remained relatively stable and sedimentation rates were not expected to have increased substantially over this period. This is borne out in the bathymetric surveys, which indicate little sediment build up in the estuary over this period. Based on this information and some limited observations of the habitats in the estuary, DWS (2017) surmised that supratidal and intertidal sediment structure were expected to be relatively similar to that under the Reference Condition, but there has been a significant increase in the organic sediment fraction in the subtidal areas of the estuary as a result of contamination by raw sewage.

The situation changed dramatically in 2023, following a major flood in September of that year when the Overstrand experienced 135 mm of rain in 48 hours. This flood resulted in an enormous quantity of sediment being deposited in the estuary which has fundamentally altered hydrodynamic and ecological functioning of the system as outlined above. Intertidal sand and mud flats that were present in the estuary are now entirely absent and are rapidly being invaded by *Phragmites australis* that was historically restricted to the shallow waters along the banks of the estuary. The characteristics of the sediment in the estuary also changed dramatically as a result of the flood, with the result that most of the estuary is now filled with coarse river sand with patches or even thick layers of peat scattered here and there. Muddy sediments that were present in the middle and upper reaches of the system in 2017 are now entirely gone.

Based on the forgoing, the physical habitat health of the Onrus Estuary was rated at a D category (50%) in 2017 but has now declined to an F category now (2024, 15%).

3.7 WATER QUALITY

Water quality monitoring in the Onrus River catchment focuses on faecal indicator bacteria, such as intestinal Enterococci and Escherichia coli (E. coli), which serve as proxies for pathogenic contamination from sources like sewage spills, agricultural runoff, and urban stormwater. Elevated levels of these indicators can pose health risks to humans engaging in full-contact recreation (e.g., swimming) and contribute to ecological degradation through eutrophication and habitat alteration. This chapter analyses a dataset spanning September 2015 to April 2025, comprising over 900 samples from seven primary sites along the river and estuary. The analysis evaluates spatial and temporal patterns in Enterococci and E. coli concentrations and compares them to national and local legislative limits under the NWA (Act 36 of 1998) and associated guidelines from the DWS. These limits are designed to protect human health and ecosystem integrity, with thresholds defined for recreational use categories (full-contact, intermediate-contact, and non-contact).

Sampling to test water quality was done in six locations (Figure 3-9). Samples were tested for intestinal Enterococci, E. coli and Coliforms. Intestinal Enterococci and *E. coli* were measured in Colony Forming Units per 100 milliliters (cfu/100ml).

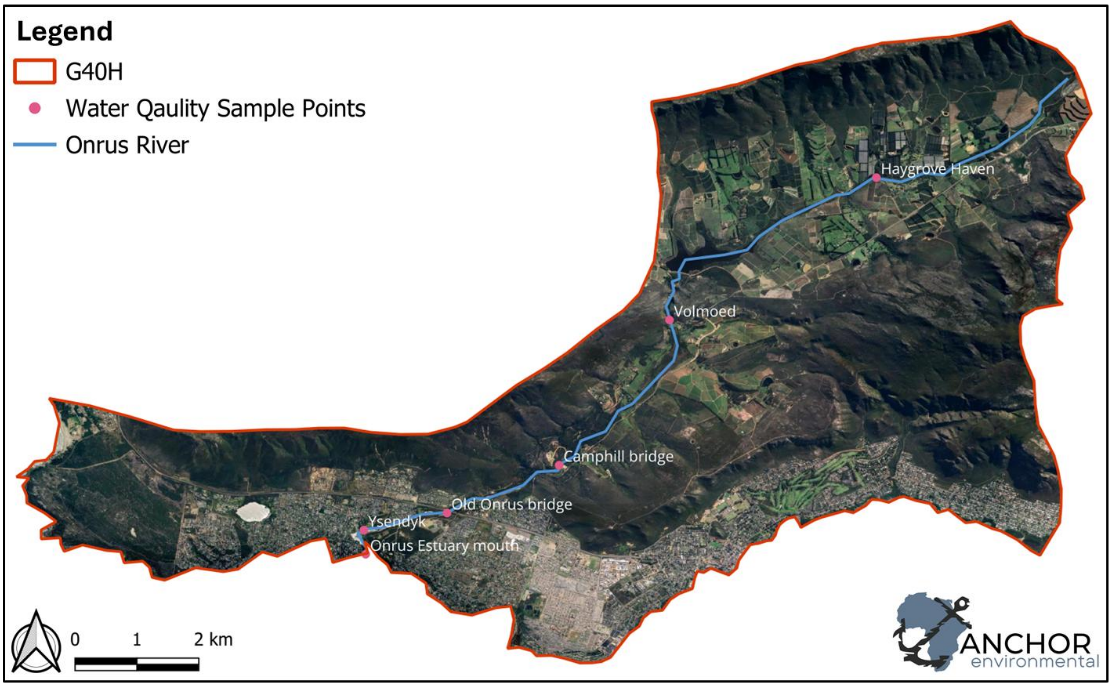

Figure 3-9. The water quality sampling points for the Onrus River Catchment

3.8 Flora

3.8.1 Terrestrial Vegetation

There are ten different terrestrial vegetation types present within the G40H quaternary basin; Agulhas Limestone Fynbos, Cape Seashore vegetation, Elim Ferricrete Fynbos, Hangklip Sand Fynbos, Kogelberg Sandstone Fynbos, Overberg Dune Strandveld, Overberg Sandstone Fynbos, Rûens Silcrete Renosterveld, Southern coastal Forest, Western Coastal Shale Band Vegetation (Figure 3-10) (Mucina & Rutherford, 2006; "South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm," 2019). The dominant vegetation types found within the G40H quaternary basin is Overberg Sandstone Fynbos, Elim Ferricrete Fynbos, Rûens Silcrete Renosterveld and Overberg Dune Strandveld (Mucina & Rutherford, 2006; "South African National Biodiversity Assessment 2018 Technical Report Volume 1: Terrestrial Realm," 2019). Overberg Sandstone Fynbos type is generally associated with Low mountains, undulating hills and moderately undulating plains which supports dense stands of restiod, ericoid-leaved and proteoid shrublands (Mucina & Rutherford, 2006). This vegetation type is dominated by proteiod and ericacous fynbos but can also have restiod fynbos occurring locally (Mucina & Rutherford, 2006). The Elim Ferricrete Fynbos vegetation type is associated with undulating hills and plains which is covered with open to closed dwarf shrubland with occasional scattered tall shrubs (Mucina & Rutherford, 2006). This vegetation type exhibits considerable ecological diversity, encompassing all structural variants of fynbos (Mucina & Rutherford, 2006). However, it is characterized predominantly by extensive areas of asteraceous fynbos, where low-growing proteoid species are dominant (Mucina & Rutherford, 2006). In degraded states, this vegetation type becomes increasingly dominated by *Elytropappus rhinocerotis* (Mucina & Rutherford, 2006). At ecotonal zones where soils transition to deeper sandy substrates, *Protea repens* may become the dominant species (Mucina & Rutherford, 2006). These transitional communities often exhibit higher species richness compared to the adjacent Overberg Sandstone Fynbos (Mucina & Rutherford, 2006). Rûens Silcrete Renosterveld occurs as highly fragmented patches on the summits and highlands of undulating hills and plains, with larger remnants frequently associated with drainage lines (Mucina & Rutherford, 2006). Unlike the rare and isolated occurrences of silcrete renosterveld along the West Coast, its presence on the South Coast represents a prominent landscape feature of the uplands, where it persists as part of a remnant African surface (Mucina & Rutherford, 2006). These isolated habitats support open, low-growing shrublands, typically comprising cupressoid and small-leaved species (Mucina & Rutherford, 2006). The vegetation structure ranges from low to moderately tall, is rich in succulents, and is usually dominated by *Elytropappus rhinocerotis* (renosterbos) (Mucina & Rutherford, 2006). Overberg Dune Strandveld is associated with flat to gently undulating dune fields, notably those of Die Plaat near Stanford and the De Hoop area. It supports closed-canopy, evergreen, sclerophyllous shrublands reaching heights of up to 4 meters in moist dune slacks and sheltered valleys protected from prevailing winds. In more exposed coastal areas, vegetation transitions to coastal thicket, typically wind-pruned and seldom exceeding 1 meter in height along the littoral zone.

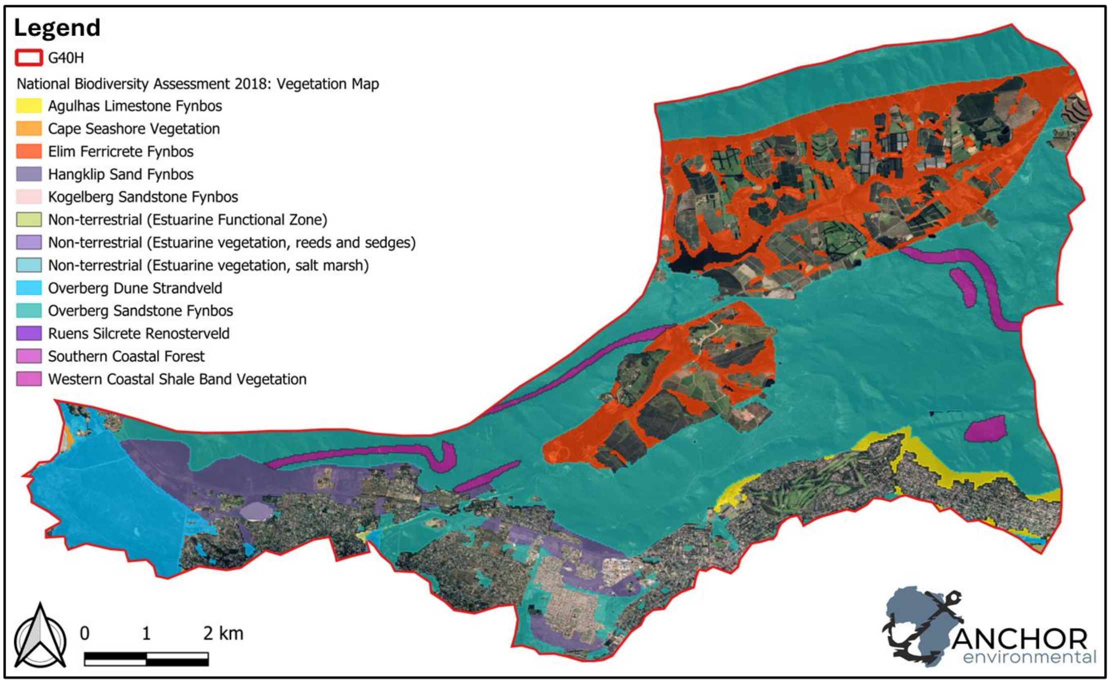

Figure 3-10. The vegetation types present within the G40H quaternary basin (SANBI 2019).

Of these 10 vegetation types three are critically endangered (Agulhas Limestone Fynbos, Hangklip Sand Fynbos and Kogelberg Sandstone Fynbos), three are endangered (Elim Ferricrete Fynbos, Overberg Dune Strandveld and Rûens Silcrete Renosterveld), while the remaining four vegetation types are listed as least concerned (Cape Seashore vegetation, Overberg Sandstone Fynbos, Southern coastal Forest and Western Coastal Shale Band Vegetation) (Figure 3-11) (SANBI 2019). Three of the four dominant vegetation types are classified as being endangered and have been significantly fragmented by anthropogenic activities (see Figure 3-10).

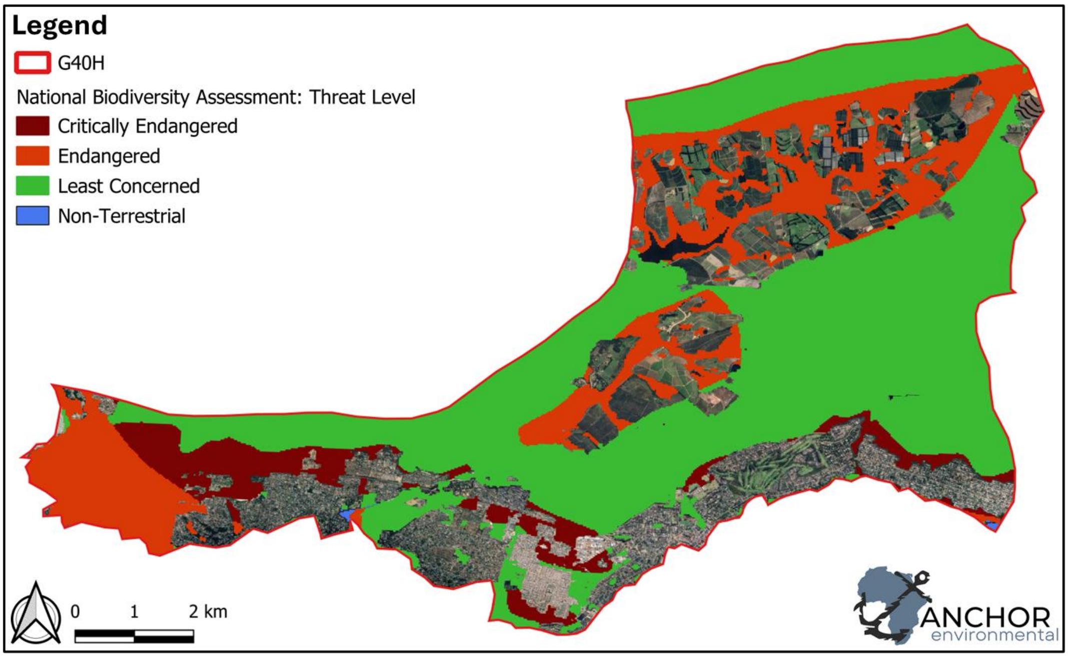

Figure 3-11. The threat status of the vegetation types within the G40H quaternary (SANBI 2019).

3.8.2 Perennial and Aquatic Vegetation

The natural (or reference) condition of the Onrus wetland is assumed to be a wetland dominated by *Prionium serratum* (palmiet) reedbeds. This species is a South African endemic, occurring naturally in (mainly coastal) wetlands in the Western and Eastern Cape Provinces and southern KwaZulu-Natal (Cook 2004). In the Onrus wetland, it occurs in conjunction with other indigenous wetland plants, including *Pteridium aquilinum* (bracken fern) (often forming dense bands in disturbed areas), as well as *Psoralea pinnata*, and *Cliffortia strobilifera*, in patches along the dense wetland margins and *Phragmites australis* (common reed), along drier wetland margins in places on the eastern sides of the wetland.

3.8.3 Alien invasive species

The G40H quaternary catchment has undergone extensive invasion by IAPs, posing a critical threat to the ecological integrity and hydrological functioning of its terrestrial, riparian, and wetland systems. IAPs have proliferated rapidly over recent years, with cover increasing more than tenfold — from 0.82 km^2 in 2018 to 8.6 km^2 in 2024 — now representing approximately 15.7% of the total basin area (Figure 3-12, Figure 3-13). The most heavily invaded zones occur along the middle and lower reaches of the Onrus River and within the degraded wetland upstream of the estuary.

The IAP community is dominated by five key woody genera, namely Gums (*Eucalyptus*), Wattles (*Acacia*), Pines (*Pinus*), Hakeas (*Hakea*), and Poplars (*Populus*), which collectively account for the vast majority of invasion. Spatial patterns reflect species-specific habitat preferences:

- Wattles and Gums are most abundant adjacent to watercourses, consistent with their high water-use efficiency and affinity for riparian corridors.
- Pines and Hakeas dominate mountain slopes and upland terrain, linked to historical forestry plantings and their ability to exploit nutrient-poor fynbos soils.
- Poplars are concentrated on agricultural properties, likely due to deliberate planting as windbreaks or shade trees.
- Coastal dune and sandy lowland areas exhibit elevated Wattle colonisation, demonstrating their adaptability to nutrient-poor coastal substrates.

Management units (MU), which are defined as spatially delineated areas within the broader management area that share similar environmental characteristics, invasion status, and management requirements, were delineated by cadastral boundaries (excluding residential erven) to/ with the purpose of structuring, prioritising, and implementing control operations in a systematic and cost-effective manner. Most units have received little to no IAP control and are dominated by mature, reproductive individuals. As such all MUs are considered to be in the initial clearing phase indicating that little to no clearing has been done. This study therefore focuses on adult plants (>1 m) and is specifically concerned with the completion of initial clearing operations rather than follow-up treatments.

The density of IAPs varies significantly across management units, with several units already exceeding 50–75% cover, particularly for Wattles, followed by Gums, Pines, Poplars, and Hakeas. This demonstrates advanced invasion pressure in key ecological and hydrological hotspots, underscoring the urgency for immediate, large-scale intervention before seedbank expansion and further hydrological degradation occur.

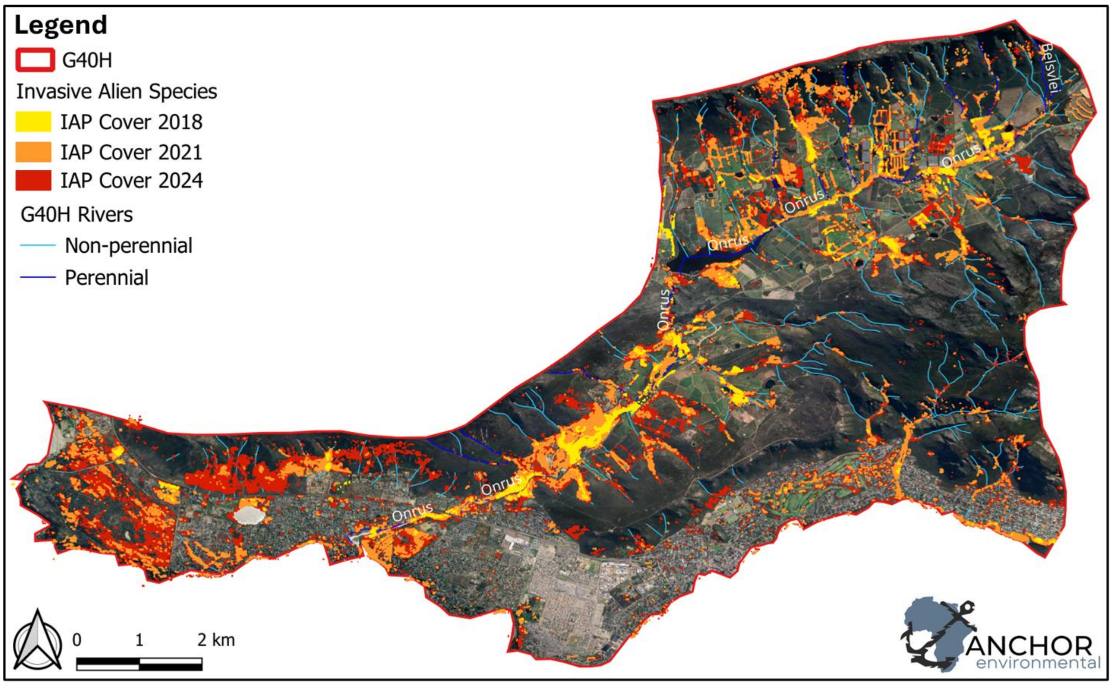

Figure 3-12. Invasive alien species cover over time in the G40H quaternary basin. Yellow indicates the IAP cover in 2018 (Lorentz et al., 2024), orange the IAP cover in 2021 (Lorentz et al., 2024) and red the IAP cover in 2024 (Lorentz et al., 2024).

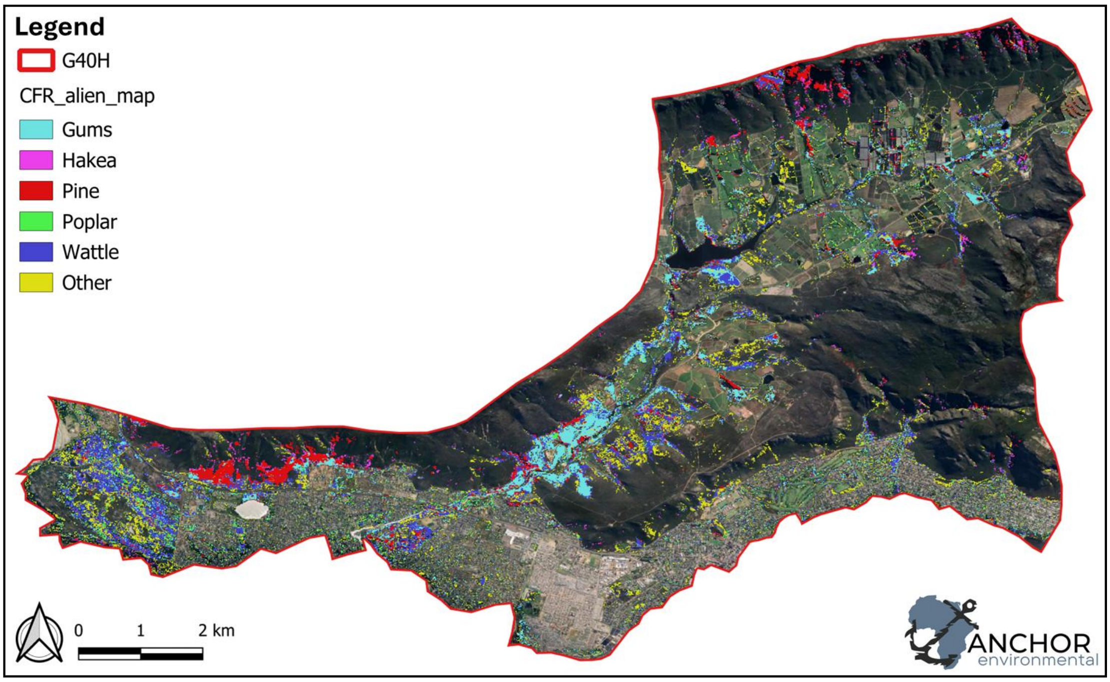

Figure 3-13. The 2024 invasive species distribution within the G40H quaternary basin (Rebelo & Coertze, 2024). Turquoise indicates the gum (eucalyptus) trees, pink represent hakeas, red represent pine trees, lime represent poplar trees, blue represent wattles and moss green represent the remaining IAPs.

The ecological impacts of IAPs in the basin are multifaceted. Dense stands of woody invasives displace indigenous vegetation, reducing plant species richness and altering community composition (van Wilgen et al., 2001). They also increase fuel loads, thereby elevating fire intensity and frequency, which can lead to further loss of native species and soil degradation (Le Maitre et al., 2016). Hydrologically, invasive trees exhibit higher evapotranspiration rates than native fynbos vegetation The ecological impacts of IAPs in the basin are multifaceted. Dense stands of woody invasives displace indigenous vegetation, reducing plant species richness and altering community composition (van Wilgen et al., 2001). They also increase fuel loads, thereby elevating fire intensity and frequency, which can lead to further loss of native species and soil degradation (Le Maitre et al., 2016). Hydrologically, invasive trees exhibit higher evapotranspiration rates than native fynbos vegetation (Bosch & Hewlett, 1982; Dye & Jarmain, 2004; Le Maitre et al., 2016), resulting in reduced surface water flows and groundwater recharge. Lorentz et al. (2024) demonstrated that the presence of IAPs negatively impacts the mean annual runoff (MAR) of the Onrus River catchment. In the degraded Onrus wetland, IAP colonisation has exacerbated peat desiccation, which in turn has increased the vulnerability of the system to high-intensity fires. In 2019, an uncontrolled fire penetrated the wetland and ignited desiccated peat layers, leading to significant loss of organic matter and alteration of wetland hydrology (Grundling et al., 2019). Around the estuary, IAPs have replaced much of the indigenous riparian vegetation with dense monospecific stands dominated by wattle and eucalyptus species, which shade out understory plants and alter habitat suitability for native fauna (Figure 3-14).

The combined hydrological, ecological, and fire-related impacts of IAPs pose a significant threat to the resilience of the G40H quaternary basin. Without targeted and sustained control, these invasions are expected to expand further, undermining ongoing restoration efforts and accelerating biodiversity loss. Strategic interventions—including mechanical clearing, biological control, and follow-up maintenance—are essential to reduce the extent and impacts of IAPs in the catchment.

Figure 3-14. Dense monospecific stands, dominated by gum and wattle trees, which has replaced most of the indigenous vegetation around the estuary.

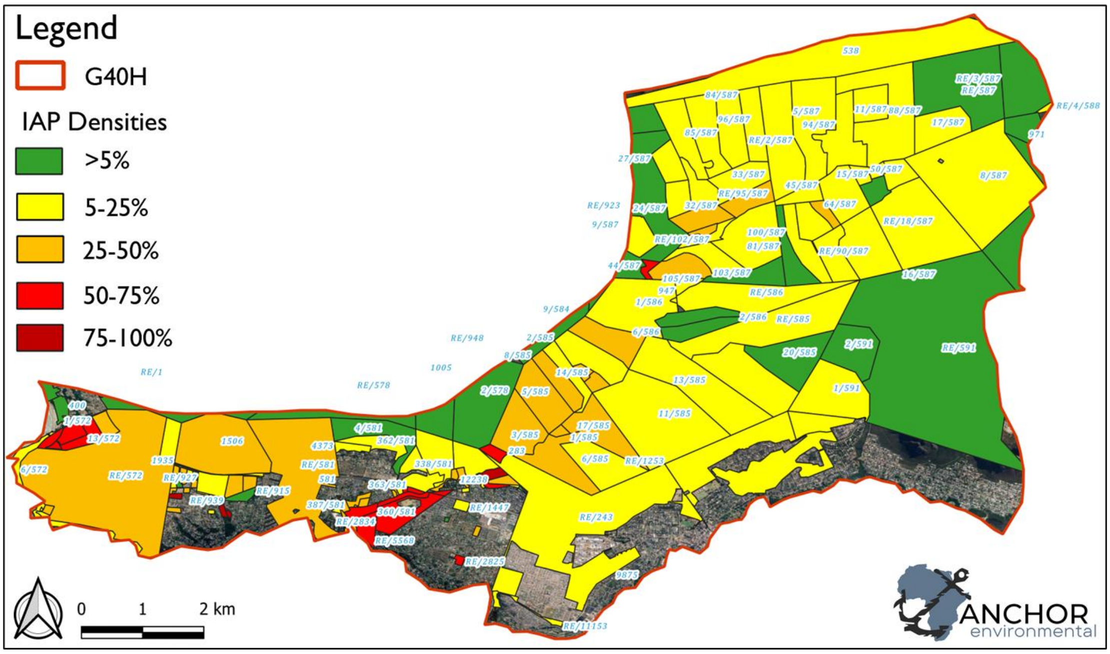

Figure 3-15. The IAP densities for each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

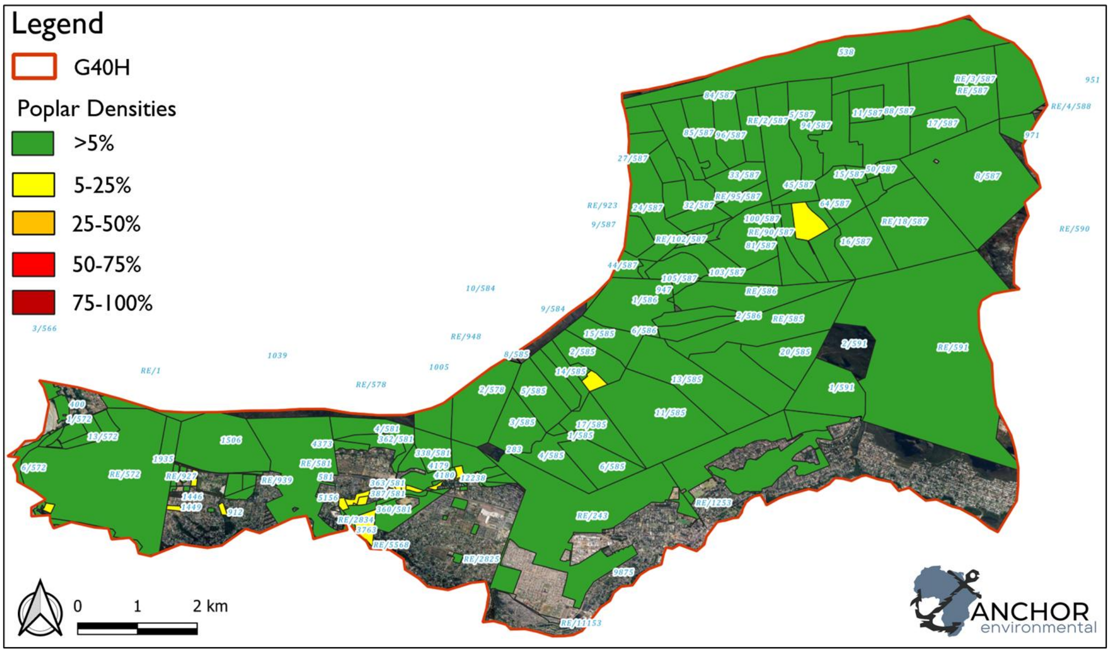

Figure 3-16. The densities of Poplar species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

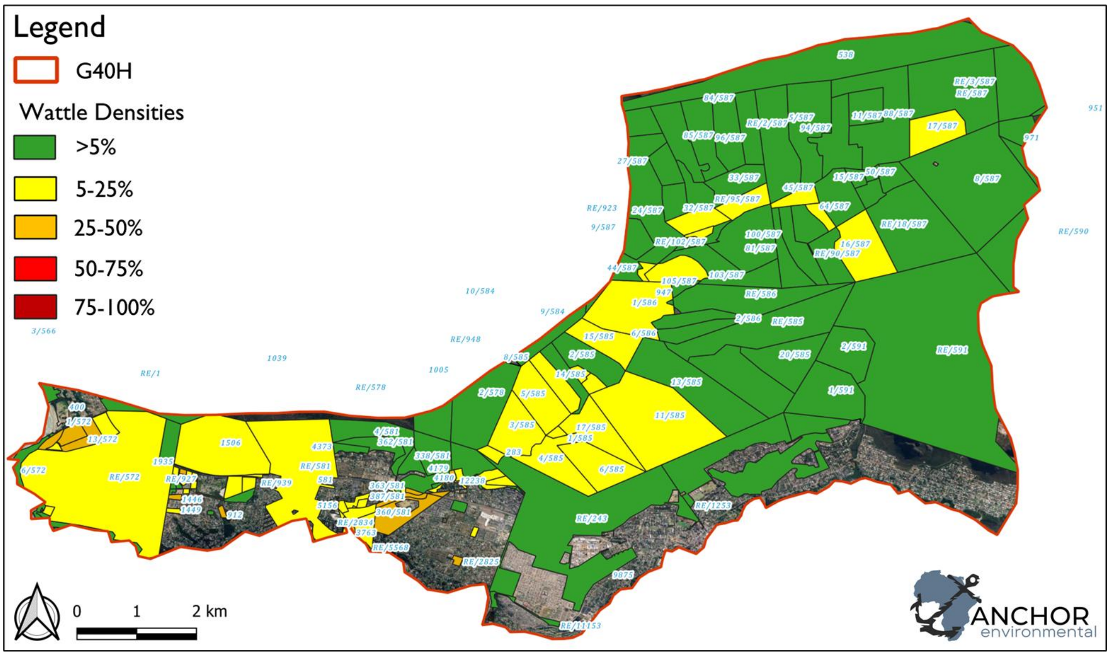

Figure 3-17. The densities of wattles species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

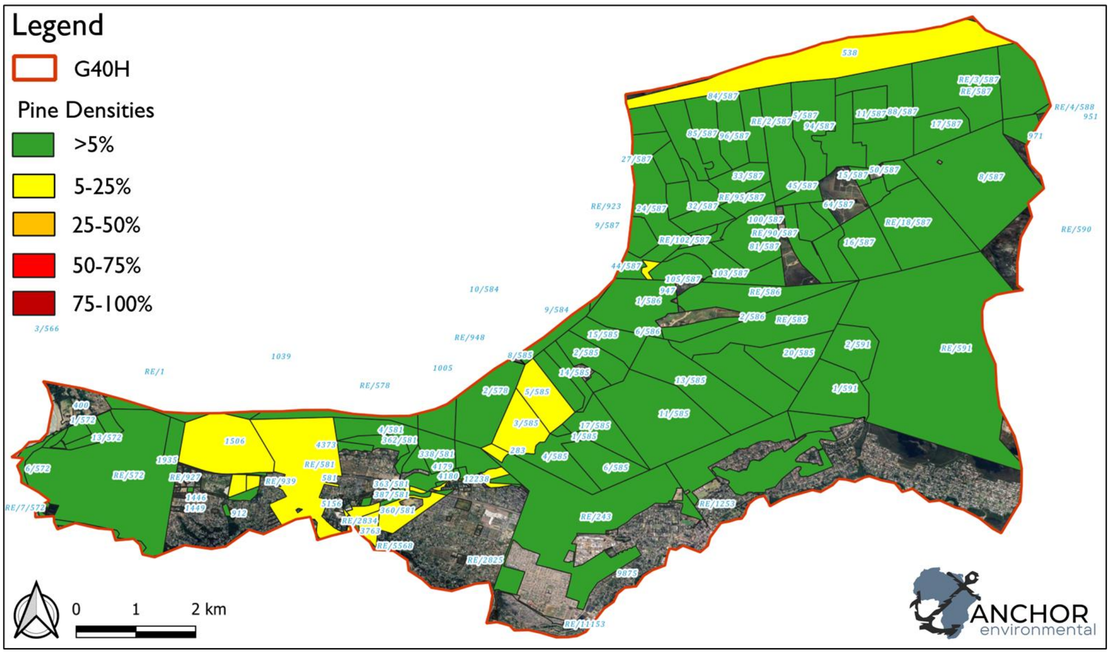

Figure 3-18. The densities of Pine species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

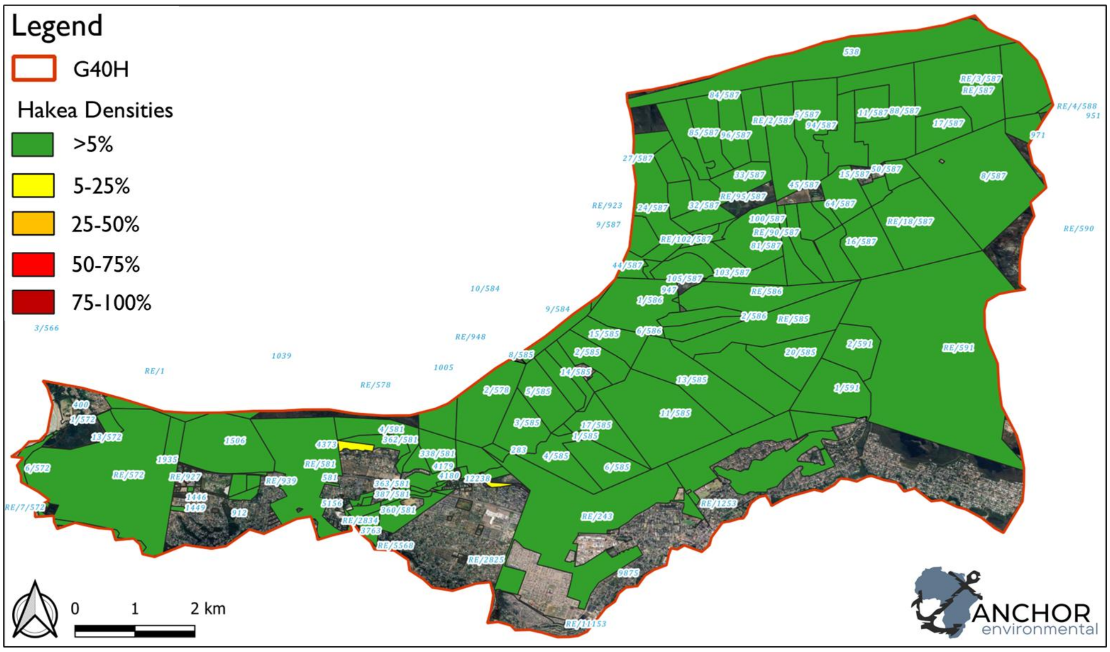

Figure 3-19. The densities of Hakea species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

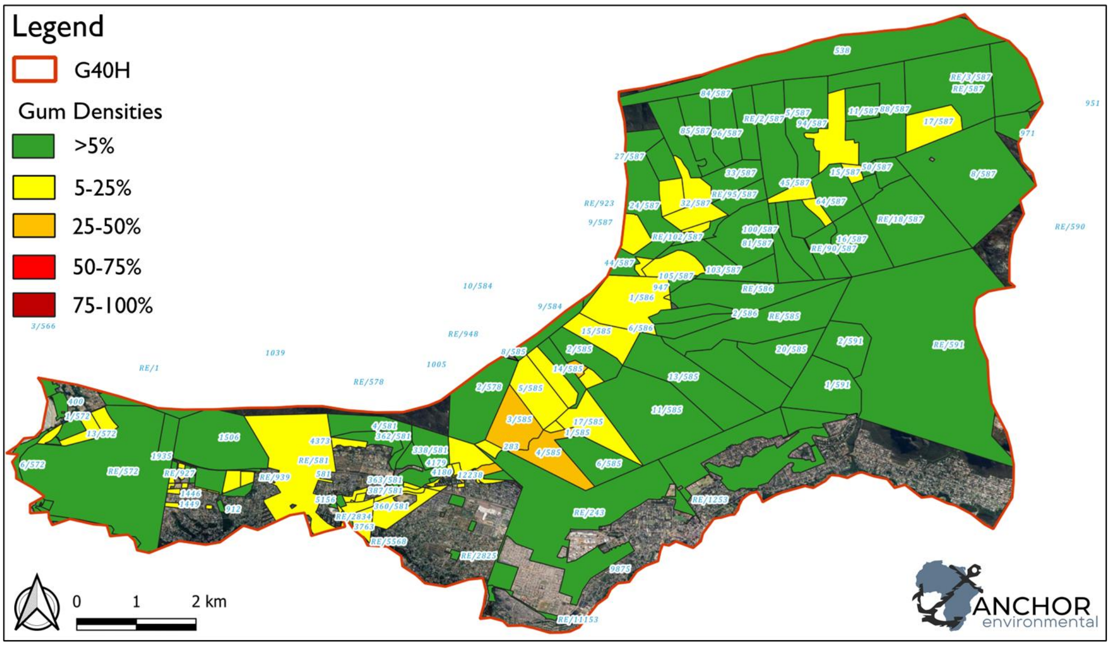

Figure 3-20. The densities of Gum species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

3.9 Fauna

3.9.1 Invertebrates

Currently there is only data on the invertebrate assemblages of the Onrus estuary, however there is no data for the remainder of the Onrus river system, the wetlands or the De Bos Dam.

Estuarine invertebrates can be divided into a number of sub-groups based on where they reside in the estuary. Zooplankton live mostly in the water column, benthic organisms live in the sediments on the bottom and sides of the estuary channel, and hyperbenthic organisms live just above the sediment surface. Benthic organisms are frequently further subdivided into intertidal (those living between the high and low water marks on the banks of the estuary) and sub-tidal groups (those living below the low water mark).

There is no available information on the Zooplankton inhabiting the Onrus Estuary and very limited information on benthic and hyperbenthic invertebrates. The invertebrate information is restricted to the 1983 CSIR report on the Estuaries of the Cape (Heinecken & Damstra, 1983) and forms the baseline description of the Onrus Estuary. The 1979-1980 survey identified 23 benthic and hyperbenthic invertebrate species from six taxonomic classes (Heinecken & Damstra, 1983). The seaward end of Onrus Estuary was predominantly inhabited by the sandprawn *Callichirus kraussi* in shallow areas, while Crown crabs, *Hymenosoma orbiculare* occurred in slightly deeper water. Amphipods, polychaetes, tanaids and chironomid larvae were also present in this area.

The upper parts of the estuary were reportedly characterised by muddy substrate which was inhabited by Amphipods, polychaetes and chironomid larvae but in relatively low numbers. Mussels (*Brachidontes virgiliae*) attach to waterlogged branches and submerged rocks. In the upper reaches the amphipod, *Americorrophium triaeonyx* and tanaid, *Tanais stanfordi* were abundant, with polychaetes, amphipods, isopods Corixidae sp. and Chironomid larvae being present. The anoxic blind arm supported populations of the polychaete, *Ceratonereis keiskama*; amphipod, *Americorrophium triaeonyx*; along with Chironomid larvae. The submerged algae Chara and macrophyte *Potamageton pectinatus*, provided habitat for several species of invertebrates (Heinecken & Damstra, 1983), although there were no noted submerged macrophytes in July 2016, which indicated the loss of this habitat type. Additionally, the island of *Scirpus littoralis* provided habitat for amphipods, isopods and numerous insect larvae while the Phragmites spp. reed beds hosted a similar suite of invertebrates as well as two species of Arachnida.

Clark et al. (2024) sampled invertebrates at six stations up the length of the estuary in October 2024. Sampling was conducted with a hand corer which samples an area of 0.025 m^2 and volume of 0.76 m^3. Three replicate cores were collected at each site. Numbers of invertebrate taxa and their abundance in the estuary was extremely low. A total of only nine taxa and 31 individuals were recorded with more than half of the samples (11 out of 18) being completely empty. Most of the taxa recorded were freshwater species which is consistent with very low salinity levels recorded in the estuary. The absence of sandprawns *Callichirus kraussi* is noteworthy. This represents a very dramatic reduction in health status of the invertebrate community in the estuary relative to that recorded by Heineken & Damstra (1983). The recent flood and resultant deposition of sediment in the system has all but eliminated benthic invertebrate fauna from the estuary. Species that remain are mostly of freshwater origin.

DWS (2017) scored the health of the invertebrate community at 55% (D category) but this has clearly got very much worse since that time. We suggest that invertebrate abundance has been most significantly affected (20%), followed by species richness (30%) and community composition (35%). This brings the overall health score for 2024 to 20% (minimum of these three metrics). Confidence in this assessment was rated as "Medium".

3.9.2 FISH

Data on the fish assemblages of the freshwater section of the Onrus River are limited. The most recent freshwater fish survey was conducted by Herdien et al. (2005), who reported the presence of three freshwater fish species: the Cape galaxias (*Galaxias zebratus*), Cape kurper (*Sandelia capensis*), and largemouth bass (*Micropterus salmoides*), the latter being an invasive alien species (IAS). Freshwater fish were collected only in the section between the estuary and the De Bos Dam; no fish were recorded in the section upstream of the De Bos Dam (Herdien et al., 2005). The absence of fish upstream of the dam was attributed to predation and competition pressure from trout that had invaded the river from the De Bos Dam (Herdien et al., 2005). No freshwater fish surveys have been conducted following the 1:100 flood event of September 2023, and the impacts of this event on the freshwater fish communities of the Onrus River remain unknown.

To date, no studies have characterised the fish assemblages of the De Bos Dam itself. However, it is expected that alien species commonly found in impoundments throughout the Western Cape are present. These likely include common carp (*Cyprinus carpio*) and largemouth bass (*M. salmoides*). Historically De Bos dam was stocked with rainbow trout (*Oncorhynchus mykiss*), however there has been no record of catches in the dam or in the river (pers. comm. Cheryl Heyns chairman of Hermanus Fly Fishing Club).

Historically 12 species were recorded in the Onrus river estuary: Silverside *Atherina breviceps* (J. K. Turpie & Clark, 2007), Cape galaxias *G. zebratus* (Heinecken & Damstra, 1983), Gilchrist's round herring *Gilchristella aestuaria* (Harrison, 1999; Heinecken & Damstra, 1983; J. K. Turpie & Clark, 2007), Southern mullet *Liza richardsonii* (Harrison, 1999; Heinecken & Damstra, 1983; J. K. Turpie & Clark, 2007), Flathead mullet *Mugil cephalus* (Harrison, 1999; J. K. Turpie & Clark, 2007), Freshwater mullet *Myxus capensis* (Harrison, 1999; J. K. Turpie & Clark, 2007), Knysna sandgobi *Psammagobius knysnaensis* (Harrison, 1999; Heinecken & Damstra, 1983; Turpie & Clark, 2007), White stumpnose *Rhabdosargus globiceps* (J. K. Turpie & Clark, 2007), Cape stumpnose *Rhabdosargus holubi* (Heinecken & Damstra, 1983), Cape kurper *S. capensis* (Heinecken & Damstra, 1983), and Mozambique tilapia *Oreochromis mossambicus* (J. K. Turpie & Clark, 2007). Following the September 2023 extreme flood event, large volumes of sediment were transported from the upper reaches of the Onrus River into the estuary. This substantial sediment load had a significant negative impact on estuarine fish communities. By October 2024, only four species were recorded; Gilchrist's round herring *G. aestuaria*, Knysna sandgoby *P. knysnaensis*, Southern mullet *C. richardsonii*, and Flathead mullet *M. cephalus* (Clark et al., 2024). Fish were confined to the lower section of the estuary, near the mouth, where water depth was sufficient to sustain them (Clark et al., 2024).

3.9.3 AMPHIBIANS

Globally, amphibian populations are undergoing more rapid declines than any other vertebrate group (Garcia-Gonzalez & Garcia-Vazquez, 2012). These declines are driven by multiple interacting factors, including habitat degradation and modification (Cushman, 2006), the emergence and spread of diseases and pathogens (Rollins-Smith, 2009), climate change (Pounds et al., 2006), physiological stress resulting from elevated concentrations of chemical contaminants in aquatic systems (Sowers et al., 2009), altered hydrological regimes, and reductions in water quality (Carey & Bryant, 1995; Welsh & Ollivier, 1998). Most anuran amphibians complete their early developmental stages in aquatic environments, where they are directly exposed to dissolved pollutants (Stebbins & Cohen, 1997). Due to their biphasic life cycle, spanning both aquatic and terrestrial environments, and their highly permeable skin, amphibians are particularly susceptible to declines in water quality (Boyer & Grue, 1995), especially those associated with urbanization.

Within the G40H quaternary basin, 18 amphibian species are likely to occur, of which two are classified as Near Threatened (NT) and one as Data Deficient (DD) by the IUCN (Table 3.1). At present, no data exist to confirm which of these species are dependent on the Onrus catchment. The reduced water quality of the catchment (Day 2025) and the predicted reduction in MAR (Lorentz et al., 2024) raises concern regarding its potential impact on the species richness and abundance of the local amphibian assemblage. Previous research has demonstrated that rivers with poorer water quality and altered hydrology regimes negatively affect amphibian species richness and abundance (Calderon et al., 2019; Carey & Bryant, 1995; Welsh & Ollivier, 1998). Furthermore, the encroachment of IAPs within the Onrus catchment is expected to alter local hydrological regimes (Scenario V3 Lorentz et al., 2024) which may indirectly affect amphibian species richness and abundance. Invasive tree species such as *Acacia* spp. (wattles) and *Eucalyptus* spp. have higher water-use rates compared to native vegetation (Bosch & Hewlett, 1982; Dye & Jarmain, 2004; Scott et al., 2000). This elevated water consumption can reduce surface and groundwater availability, thereby potentially decreasing the availability of suitable breeding habitats for amphibians and subsequently reducing breeding success.

3.9.4 REPTILES

The south-western Cape is characterized by high reptile diversity, with 142 recorded species (Cape Nature, 2023). Of these, 42 species are potentially present within the G40H quaternary basin (Table 3.3). One species, the Cape Dwarf Chameleon (*Bradypodion pumilum*), is classified as NT, while two species, the Southern Adder (*Bitis armata*) and the Loggerhead Sea Turtle (*Caretta caretta*), are classified as VU. At present, no data exist to confirm which of these species are dependent on the Onrus catchment. The only known freshwater-dependent reptile species in the area is the Cape Terrapin (*Pelomedusa galeata*), which prefers stagnant water bodies. While an increase in stagnant water habitats may benefit this species, pollution of these water bodies could negatively impact their abundance (Hofmeyr & Fritz, 2018). Although hydrological alterations and reduced water quality within the Onrus catchment may not directly influence overall reptile abundance and diversity, they could exert indirect effects by reducing invertebrate abundance and, consequently, food availability. Additionally, the encroachment of invasive alien plants (IAPs) may negatively affect reptile diversity, as previous research has shown that IAPs can reduce ectotherm abundance (Clusella-Trullas & Garcia, 2017).

Table 3.2. The amphibian species likely to occur within the G40H quaternary basin

Common Name	Species	IUCN Status
Raucous Toad	*Sclerophrys capensis*	LC
Cape River Frog	*Amietia fuscigula*	LC
Clicking Stream Frog	*Strongylopus grayii*	LC
Painted Reed Frog	*Hyperolius marmoratus*	LC
Southern Dainty Frog	*Cacosternum australis*	LC
De Villiers's Moss Frog	*Arthroleptella villiersi*	LC
Cape Sand Frog	*Tomopterna delalandii*	LC
Drewes' Moss Frog	*Arthroleptella drewesii*	NT
Mountain Rain Frog	*Breviceps montanus*	LC
Arum lily Frog	*Hyperolius horstockii*	LC
Common Platanna	*Xenopus laevis*	LC
Montane Marsh Frog	*Poyntonia paludicola*	NT
Cape Ghost Frog	*Heleophryne purcelli*	LC
Banded Stream Frog	*Strongylopus bonaespei*	LC
Moonlight Mountain Toadlet	*Capensibufo selenophos*	DD
Strawberry Rain Frog	*Breviceps acutirostris*	LC
Weale's Running Frog	*Semnodactylus wealii*	LC
Sand Toad	*Vandijkophrynus angusticeps*	LC

Table 3.3. The reptile species potentially occurring with the G40H quaternary basin.

Common Name	Species	IUCN Status
Angulate Tortoise	*Chersina angulata*	LC
Southern Rock Agama	*Agama atra*	LC
Marbled Leaf-toed Gecko	*Afrogecko porphyreus*	LC
Cape Dwarf Chameleon	*Bradypodion pumilum*	NT
Cape Girdled Lizard	*Cordylus cordylus*	LC
Common Slug-Eater	*Duberria lutrix*	LC
Red-sided Skink	*Trachylepis homalocephala*	LC
Rhombic Skaapsteker	*Psammophylax rhombeatus*	LC
Puffadder	*Bitis arietans*	LC
Berg Adder	*Bitis atropos*	LC
Ocellated Thicktoe Gecko	*Pachydactylus geitje*	LC
Cape Skink	*Trachylepis capensis*	LC
Parrotbeak Padloper	*Homopus areolatus*	LC
Mole Snake	*Pseudaspis cana*	LC
Yellow-throated Plated Lizard	*Gerrhosaurus flavigularis*	LC
Olive Snake	*Lycodonomorphus inornatus*	LC
Boomslang	*Dispholidus typus*	LC
Cape Legless Skink	*Acontias meleagris*	LC
Cross-marked Sand Snake	*Psammophis crucifer*	LC
Red-lipped Herald	*Crotaphopeltis hotamboeia*	LC
Cape Crag Lizard	*Pseudocordylus microlepidotus*	LC
Common Brown Water Snake	*Lycodonomorphus rufulus*	LC

Common Name	Species	IUCN Status
Cape Snake Lizard	*Chamaesaura anguina*	LC
Egg-eating Snake	*Dasypeltis scabra*	LC
Cape Cobra	*Naja nivea*	LC
Cape Terrapin	*Pelomedusa galeata*	LC
Leopard Tortoise	*Stigmochelys pardalis*	LC
Ringhals	*Hemachatus haemachatus*	LC
Spotted Harlequin Snake	*Homoroselaps lacteus*	LC
Short-legged Seps	*Tetradactylus seps*	LC
Sundevall's Shovel-Snout	*Prosymna sundevalli*	LC
Delalande's Beaked Blind Snake	*Rhinotyphlops lalandei*	LC
Common Dwarf Gecko	*Lygodactylus capensis*	LC
Cape Reed Snake	*Amplorhinus multimaculatus*	LC
Southern Adder	*Bitis armata*	VU
Cape House Snake	*Boaedon capensis*	LC
Karoo Sand Snake	*Psammophis notostictus*	LC
Yellow-bellied House Snake	*Lamprophis fuscus*	LC
Longtail Whip Lizard	*Tetradactylus tetradactylus*	LC
Green-striped Mountain Lizard	*Tropidosaura montana*	LC
Loggerhead Sea Turtle	*Caretta caretta*	VU
Spotted Rock Snake	*Alopecion guttatum*	LC

3.9.5 BIRDS

Currently there is only data on the bird assemblages of the Onrus estuary, however there is no data for the remainder of the Onrus river system, the wetlands or the De Bos Dam. A total of 307 bird species have been identified to potentially occur within the G40H basin (SABAP 2)(Appendix A). The Onrus catchment does however fall within the Cape Whale Coast Important Bird Area (IBA) (Figure 3-21) (Marnewick et al., 2015).

The Onrus Estuary is classified as a small, black water, sandy estuary, where few coastal bird species would be expected to occur, the lack of tidal influence means that the estuary is not particularly important for wader species (J. Turpie & Clark, 2007). A total of 143 bird species have been recorded over the last two decades in the estuary, of which 81 are considered water associated species. Sixty-five water associated bird species are resident in South Africa, thirteen are migratory, and two are exotic species (Mallard duck *Anas platyrhynchos* and its hybrids). The most species-rich taxa observed on the estuary in the past were the Charadriiformes (waders, gulls and terns) and Passeriformes (warblers, wagtails, bishops, canaries, weavers etc.). The Onrus Estuary is/ has been home to species that are fairly difficult to find in many parts of the Overberg such as the Little Bittern *Ixobrychus minutus*, Purple Heron Ardea purpurea, Black-crowned Night-Heron *Nycticorax nycticorax* and African purple swamphen Porphyrio madagascariensis, and Southern tchagra *Tchagra tchagra*. Furthermore, large numbers of Barn Swallows *Hirundo rustica* were known to roost in the reedbeds in summer, while the many eucalyptus trees and other exotics along the Onrus River are used for breeding by a variety of raptors that include African Goshawk *Accipiter tachiro*, African Harrier-Hawk *Polyboroides typus*, Black sparrowhawk *Accipiter melanoleucus* and Little sparrowhawk *Accipiter minullus* (Massie & Clark, 2016b).

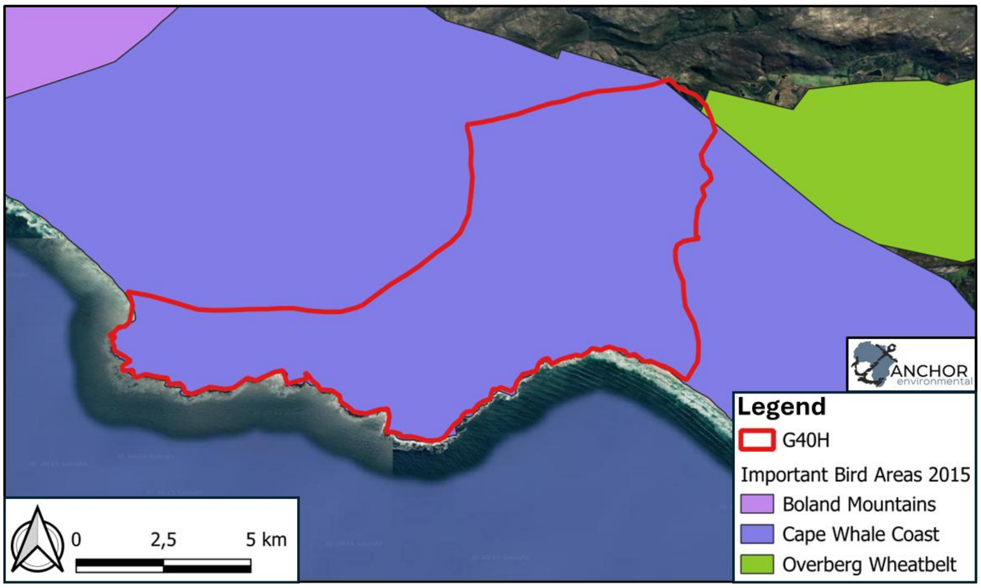

Figure 3-21. Location of the G40H quaternary basin within the Cape Whale Coast Important Bird Area (Marnewick et al., 2015)

Very little historic information is available on the avifauna of the Onrus Estuary. In November 1979 a total of 28 bird species were recorded by Damstra (1980) including the relatively uncommon Pied Avocet, Swift Tern and Water Thick-knee as well as Pied Kingfisher and Malachite Kingfisher. However, only one single count of all waterbirds exists for the estuary carried out by Underhill & Cooper (1983). During this count in January 1981 a total of 10 waterbirds from four species were counted including five Red-knobbed Coots, one Water Thick-knee, three Hartlaub's Gulls and one Cape Wagtail.

During a recent survey by Clark et al. (2024) recorded 39 water birds from nine species were recorded. This is very similar to the numbers of birds recorded by Underhill & Cooper (1983) but is very much more depauperate than the bird fauna recorded by Damstra (1980). This suggests that bird number and species composition has changed quite dramatically since the 1970s but possibly not as much since the 1980s. Alternatively, the survey by Underhill & Cooper (1983) may have been conducted under suboptimal conditions. Low numbers of waders and absence of wading birds on the estuary is consistent with the poor (or absence of any) tidal exchange and low invertebrate and fish biomass in the estuary.

3.9.6 Mammals

There is currently no published data on mammal assemblages within the Onrus River catchment; however, 40 mammal species are expected to occur within the G40H quaternary basin (Table 3.4). Of these, two species are classified as VU, the bontebok (*Damaliscus pygargus pygargus*) and leopard (*Panthera pardus*), and two as NT, the grey rhebok (*Pelea capreolus*) and Cape clawless otter (*Aonyx capensis*). Among the threatened species, only the Cape clawless otter is dependent on the Onrus River catchment. A resident family of Cape clawless otters has been observed in the Onrus Estuary (Massie & Clark, 2016a). With the current state of the estuary it remains unlcear if this otter family is still present. The degraded condition of the estuary may negatively affect this species. Low fish and invertebrate abundance within the estuary reduces available prey for otters. While they may forage in adjacent marine environments, Cape clawless otters require a reliable freshwater source for bathing and drinking (Nel & Somers, 2007; C. Van Niekerk et al., 1998). Following the 2023 flood, much of the estuary became filled with sand originating primarily from the degraded upstream wetland (Clark et al., 2024). his infilling has lowered water levels to the extent that the estuary may no longer provide an adequate freshwater source for the otters.

Table 3.4. The mammals potentially occurring in the G40H quaternary basin. The IUCN status for each species is also given.

Family	Species	Common Name	IUCN
Bathyergidae	*Bathyergus suillus*	Cape Dune Molerat	LC
Bathyergidae	*Georychus capensis*	Cape Molerat	LC
Bovidae	*Damaliscus pygargus pygargus*	Bontebok	VU
Bovidae	*Oreotragus oreotragus*	Klipspringer	LC
Bovidae	*Pelea capreolus*	Grey Rhebok	NT
Bovidae	*Raphicerus melanotis*	Grysbok	LC
Bovidae	*Sylvicapra grimmia grimmia*	Cape Duiker	LC
Bovidae	*Tragelaphus sylvaticus sylvaticus*	Cape Bushbuck	LC
Canidae	*Otocyon megalotis*	Bat-eared Fox	LC
Cercopithecidae	*Chlorocebus pygerythrus pygerythrus*	Southern Vervet	LC
Cercopithecidae	*Papio ursinus*	Chacma Baboon	LC
Chrysochloridae	*Chrysochloris asiatica*	Cape Golden Mole	LC
Erinaceidae	*Atelerix albiventris*	African pygmy hedgehog	LC
Felidae	*Caracal caracal*	Caracal	LC
Felidae	*Panthera pardus*	Leopard	VU
Herpestidae	*Atilax paludinosus*	Marsh Mongoose	LC
Herpestidae	*Herpestes ichneumon*	Large Grey Mongoose	LC
Herpestidae	*Herpestes pulverulentus*	Cape Grey Mongoose	LC
Hystricidae	*Hystrix africaeaustralis*	Porcupine	LC
Leporidae	*Lepus saxatilis*	Scrub Hare	LC
Leporidae	*Pronolagus saundersiae*	Southern Red Rockrabbit	LC
Macroscelididae	*Elephantulus edwardii*	Cape Rock Sengi	LC
Muridae	*Mus minutoides*	Tiny Pygmy Mouse	LC
Muridae	*Otomys irroratus*	Southern Vlei Rat	LC
Muridae	*Otomys karoensis*	Saunders's vlei rat	LC
Muridae	*Rhabdomys pumilio*	Cape Striped Fieldmouse	LC
Mustelidae	*Aonyx capensis*	Cape Clawless Otter	NT
Mustelidae	*Ictonyx striatus*	Striped Polecat	LC
Mustelidae	*Mellivora capensis*	Ratel	LC
Mustelidae	*Poecilogale albinucha*	Striped Weasel	LC
Nesomyidae	*Dendromus mesomelas*	Brant's climbing mouse	LC
Nycteridae	*Nycteris thebaica*	Egyptian Slit-faced Bat	LC
Orycteropodidae	*Orycteropus afer*	Aardvark	LC
Procaviidae	*Procavia capensis*	Rock Dassie	LC
Soricidae	*Crocidura cyanea*	Reddish-gray Musk Shrew	LC
Suidae	*Potamochoerus larvatus koiropotamus*	Bush-pig	LC
Vespertilionidae	*Laephotis capensis*	Cape serotine	LC
Viverridae	*Genetta tigrina*	Cape Genet	LC

3.9.7 ALIEN INVASIVE SPECIES

The Cape Floristic Region (CFR) is globally recognised for its exceptional biodiversity and high level of endemism. However, the region faces significant threats from invasive animal species that disrupt ecosystem functioning, threaten native species, and alter habitat structure. Invasive fauna within the CFR includes a range of taxa such as mammals, birds, amphibians, reptiles, fish, and invertebrates, many of which have been introduced through human activities, either intentionally or accidentally. The impacts of invasive animal species in the CFR are compounded by habitat loss, climate change, and other anthropogenic pressures, creating synergistic effects that accelerate biodiversity decline. In many cases, the ecological changes induced by invasive fauna are irreversible without active management. Ongoing eradication and control programmes, including targeted trapping, poisoning (for rodents), biological control, and habitat restoration, have yielded localised successes, particularly on conservation islands. However, widespread and sustained management is required to mitigate the long-term impacts of these species on the CFR's unique biodiversity.

The G40H quaternary basin have roughly 17 invasive animal species which has become established within the basin (Table 3.5), posing direct and indirect threats to biodiversity, ecosystem functioning, and the integrity of wetland and riverine habitats. These species have either been intentionally introduced for agricultural or ornamental purposes or have spread into the area through human-mediated pathways.

Mammalian invasives present in the basin include the house mouse (*Mus musculus*), black rat (*Rattus rattus*), and domestic cat (*Felis catus*). Black rats and house mice are known to prey on the eggs and young of ground-nesting birds, compete with indigenous rodents for food resources, and act as vectors for disease (Angel et al., 2009). Feral and free-roaming domestic cats intensify predation pressure on small mammals, reptiles, and birds, particularly in peri-urban areas near the estuary (Loss et al., 2013).

Avian invasives, notably the common starling (*Sturnus vulgaris*) and house sparrow (*Passer domesticus*), are established in agricultural and urban habitats within the basin. These species compete with indigenous birds for nesting sites, displace smaller species, and exploit food resources more efficiently in human-modified landscapes (Peacock et al., 2007). Mallards (*Anas platyrhynchos*) is also present within the basin, which is of concern as it has been shown that mallards hybridize with yellow-billed ducks (Dean, 2000).

In the aquatic environment, alien fish species such as common carp (*Cyprinus carpio*), and largemouth bass (*Micropterus salmoides*) have been recorded in the onrus river (Herdien et al., 2005). Rainbow trout (*Oncorhynchus mykiss*) was historically introduced into the De Bos dam (pers. comm. Cheryl Heyns chairman of Hermanus Fly Fishing Club) and is currently stocked in nearby systems and may pose an invasion risk to the Onrus River through catchment connectivity and accidental introductions. These species outcompete and prey upon native freshwater fish and aquatic invertebrates, altering community composition and food web dynamics (Ellender & Weyl, 2014). Their presence also threatens the foraging efficiency of piscivorous birds and mammals, including the Cape clawless otter (*Aonyx capensis*) (Somers & Nel, 2003).

The combined effects of these invasive animal species exacerbate other ecological pressures within the basin, including habitat degradation, wetland desiccation, and reduced water quality. Without targeted management, their impacts are expected to increase, further compromising the ecological resilience of the Onrus River catchment.

Localised control measures—such as feral cat sterilisation, rodent management, invasive fish eradication, and Argentine ant suppression—are likely to be most effective when integrated into a broader catchment-wide biodiversity conservation strategy (Wilson et al., 2013).

Table 3.5. The Invasive animal species potentially occurring within the G40H quaternary basin. The NEM:BA category for each of the species is given

Species	Common Name	NEMBA Category
Sturnus vulgaris	Common starling	3
Passer domesticus	House sparrow	3
Anas platyrhynchos	Mallard	1b
Oryctolagus cuniculus	European rabbit	Not Listed (1b offshore islands)
Mus musculus	House mouse	1b
Felis catus	Domestic cat	Not Listed (1a offshore islands)
Pavo cristatus	Common peacock	exotic nuisance species
Columba livia domestica	Feral pigeon	3
Cypinus carpio	Common carp	2
Micropterus salmoides	Largemouth bass	1b
Oncorhynchus mykiss	Rainbow trout	2
Rattus rattus	House rat	1b

3.10 Ecological Status

The Present Ecological State (PES) represents the current condition of a river, wetland, or estuary relative to its natural, unmodified state, and is typically expressed in ecological categories ranging from A (natural) to F (critically modified). It provides a scientifically robust baseline describing the extent of hydrological, geomorphological, water quality, and biotic alterations that have occurred as a result of human activities. In contrast, the Recommended Ecological Category (REC) reflects the desired future ecological condition of the system, informed by ecological, social, and economic considerations, as well as legislative requirements such as the National Water Act and the National Water Resource Classification System. Together, the PES and REC form the foundation for setting management objectives, evaluating the acceptability of further development or abstraction, and guiding rehabilitation or conservation actions within a catchment.

The Onrus river catchment's overall PES is largely to seriously modified (D/E categories), driven by historical and ongoing pressures such as water abstraction, pollution, invasive species, and climate events. Recent assessments indicate deterioration, particularly post the September 2023 flood, but restoration initiatives are underway as of 2025.

The river's upper reaches are moderately modified (C), middle sections extensively to critically modified (E/F), and lower reaches largely modified (D), with the estuary declining from D (largely modified) in 2017 to E (seriously modified) in 2024. Water quality is poor, habitats are degraded, and biodiversity is impacted, though the system retains some functionality for species like endemic fish and birds. Trends show negative trajectories without intervention, but projects like the Onrus Catchment2Coast River Rehabilitation aim for improvement.

Component	PES Category/Score	REC	Source
Overall Catchment	D/E (largely to seriously modified)	D	2017–2024
River: Upper Reaches	C (moderately modified)	-	2010
River: Middle Reaches	E/F (extensively/critically modified)	-	2010–2018
River: Lower Reaches	D (largely modified)	-	2010–2018
Estuary Overall	E	D (40%)	(Clark et al., 2024)
Hydrology	D (48%)	-	2024
Hydrodynamics	F (13%)	-	2024
Water Quality	E (36%; poor)	-	2016–2024
Physical Habitat	F (15%)	-	2024
Microalgae	E (20%, severely degraded)	-	2024
Macrophytes/Flora	D/E (30%)	-	2024
Invertebrates/Fauna	E (20%)	-	2024
Fish	E (25%)	-	2024
Birds	D/E (declining but recovering)	-	2024
Wetlands/Peatlands	High concern (vulnerable)	-	2023

An Environmental Health Assessment was completed for the Onrus estuary as part of the process of determining the freshwater reserve for all significant water resources in the Breede-Gouritz Water Management Area in 2017 (DWS, 2017). This assessment revealed that the estuary was in a "D" category (Largely modified), which is the lowest permissible state for any water resource in the country according to the National Water Act (1998). It is very likely, however, that the state of the estuary has dropped below this level now, given the level of destruction caused by the recent flood (Figure 1-4).

4 SOCIO-ECONOMIC CONTEXT

4.1 Catchment Land-use ad Economy

According to the most recent census data, the population of the Overstrand Municipal Area increased from 80,432 in 2011 to 132,495 in 2022, reflecting a significant demographic expansion (Overstrand Municipality, 2023). Projections estimate an annual population growth rate of approximately 2.7% for the period 2022 to 2027 (Overstrand Municipality, 2023). Notably, 15.2% of the population is aged 65 years or older, suggesting the municipality's appeal as a retirement destination (Overstrand Municipality, 2023).

The municipality comprises 59,980 households, of which 90.2% are classified as formal dwellings (Overstrand Municipality, 2023). Moreover, 99.8% of households have access to piped water within the dwelling, indicating a high level of basic service delivery (Overstrand Municipality, 2023). The official unemployment rate is reported at 21.5%, while the matriculation pass rate for 2022 was 81.6% (Overstrand Municipality, 2023).

Geographically, the municipal area includes approximately 200 km of coastline and derives economic benefit from its proximity to both the Cape Town metropolitan area and the interior regions of the Overberg District. Tourism constitutes a key economic sector, with a substantial proportion of properties serving as secondary or holiday homes. Consequently, the region experiences a marked seasonal population increase, reportedly up to fourfold, during holiday periods (Overstrand Municipality IDP, 2012).

Agricultural activity within the catchment is predominantly focused on viticulture. Additional land uses include the cultivation of orchards, olive groves, wheat, and livestock farming. The inception of viticulture in the region dates to 1975, when Tim Hamilton Russell acquired land for this purpose. Presently, the area supports at least 22 wine producers, with approximately 300 hectares under vine. The Hemel-en-Aarde Wine Route has emerged as a notable agri-tourism attraction, offering multiple wineries and culinary establishments. The R320 route, which traverses the valley toward Caledon, is also designated as a scenic drive.

Land use data were derived from the 2022 South African National Land Cover dataset (1190-2022). The Onrus River catchment area exhibits a high degree of anthropogenic alteration. Agricultural activities dominate the Hemel-en-Aarde Valley, while residential and commercial developments are concentrated in the low-lying coastal zones (Figure 4-1). Furthermore, the catchment is significantly impacted by invasive alien vegetation, classified under the "Dense Forest and Woodland" category in the referenced land cover data (Figure 4-1).

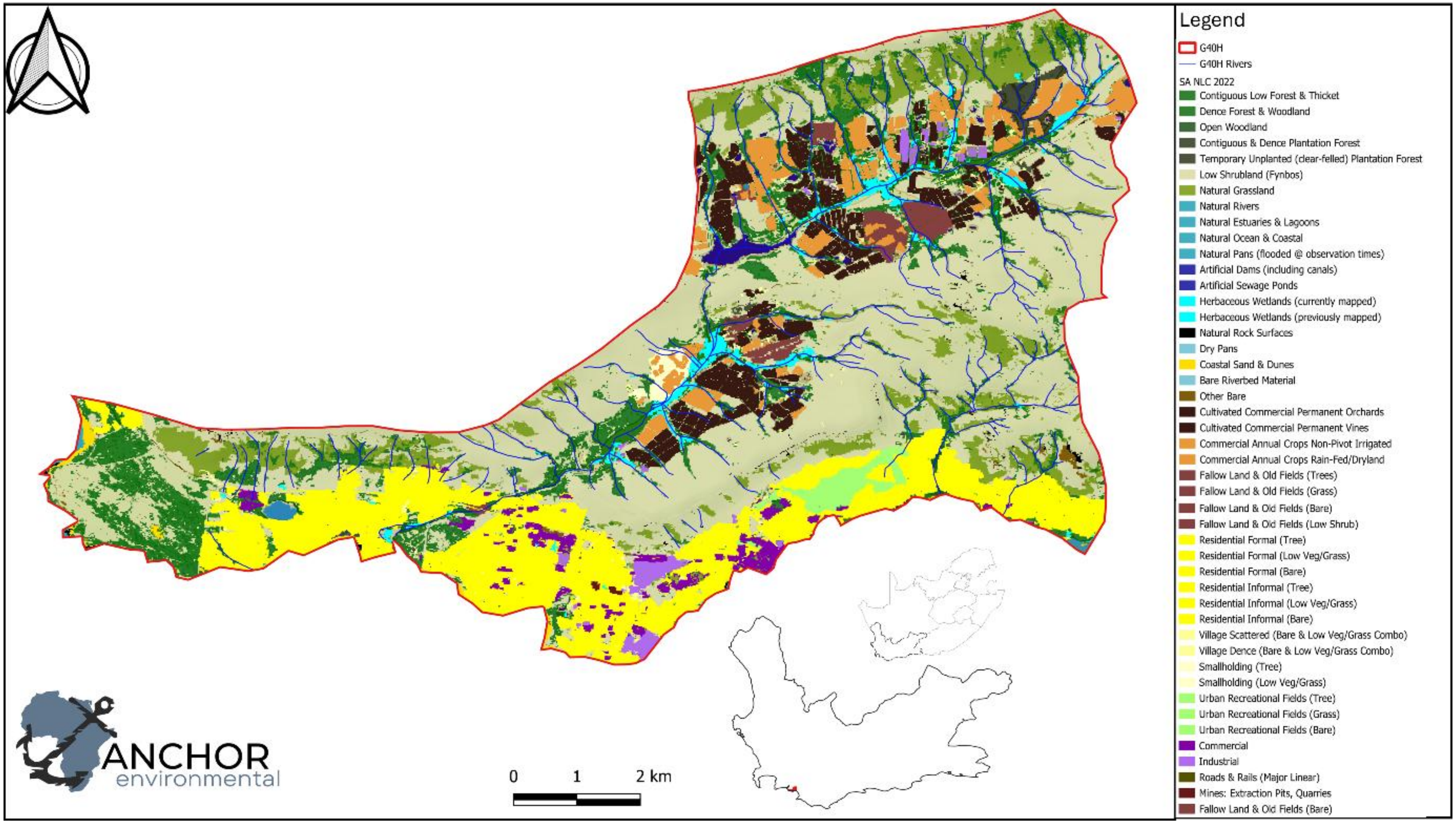

Figure 4-1. The 2022 land cover of the G40H catchment areas extracted from the 2022 National Land Cover (1990-2022)

5 ECOSYSTEM SERVICES

5.1 What are Ecosystem Goods and Services?

Ecosystems can be viewed as natural capital which contributes to economic production. They provide goods, services and attributes, collectively known as ecosystem services that contribute to human welfare (Barbier, 1994):

- Goods are harvested resources, such as fish.
- Services are processes that contribute to economic production or save costs, such as water purification.
- Attributes relate to the structure and organisation of biodiversity, such as beauty, rarity or diversity, and generate less tangible values such as spiritual, educational, cultural and recreational value.

The Millennium Ecosystem Assessment (2003) recently re-categorized the services obtained from ecosystems as follows:

- Provisioning services such as food and water;
- Regulating services such as flood and disease control;
- Cultural services such as spiritual, recreational, and cultural benefits; and
- Supporting services, such as nutrient cycling, which maintain the conditions for life on earth.

The first three align well with the definitions of goods, services and attributes described above, while the fourth underlies these and need only be considered inasmuch as changes in these affect the values of the first three (Turpie, 2007).

5.2 Provisioning Services

One of the primary ecosystem services provided by the Onrus River catchment is the supply of freshwater. The river, dam, and associated aquifers support small-scale domestic consumption, agricultural irrigation, and local industrial activities. The De Bos Dam is occasionally used by recreational anglers to target invasive fish species, such as Common Carp and Largemouth Bass, for sport or subsistence purposes. However, the Onrus River and lagoon are not considered significant sites for either subsistence or recreational fishing. The limited size and shallow depth of the waterbody restrict its capacity to sustain large fish populations, while concerns regarding water quality likely further discourage fishing activity. Anglers typically prefer the adjacent coastline or the more productive Klein and Bot estuaries. Bait collection is rare due to the absence of prawn populations, and there is no evidence of reed harvesting by local communities for construction materials (e.g., thatching) or craft production (e.g., mats, baskets).

5.3 Regulating Services

The Onrus River catchment provides a range of critical regulating ecosystem services that contribute to environmental stability and human well-being. Its wetlands and riparian vegetation act as natural flood buffers by absorbing and slowing runoff during high rainfall events, thereby reducing downstream flood risk. However, given the current deteriorated state of the Onrus wetland the flood attenuation ability is largely diminished as was shown during the floods in 2023 where sections of the wetland were washed away. Rehabilitation of the wetland is required to restore the flood attenuation of the wetland. According to Turpie (2007), temperate estuaries play little or no role in providing services such as flood attenuation, regulation of downstream flows and erosion control, since these systems are at the end of catchments and there is little in the way of downstream habitats that depend on them. The *Phragmites* reed beds do, however, help protect the estuary's shoreline from erosion during floods.

Studies have shown that the high biomass production of Phragmites reed beds favours carbon sequestration but also enhances methane emissions, particularly in oligohaline (salinity 0.5-5 ppt) wetlands (Brix et al., 2001; Poffenbarger et al., 2011). The relative role of Phragmites-dominated wetlands as a source or sink of carbon over different time scales renders their importance to greenhouse gas regulation unclear, but Onrus Lagoon's small size means that it would make a negligible contribution to climate regulation in any event.

Wastewater effluent is not deliberately discharged into Onrus river catchment for water purification purposes, although polluted water emanating from catchment practices and accidental sewage spills is likely cleansed to some extent before it flows into the sea. However, the marine environment has greater assimilative capacity than the estuary.

5.4 Cultural Services

Majority of the data on the cultural services of the Onrus river catchment is mainly focussed around the estuary. The area's scenic beauty, biodiversity, and tranquillity contribute Nature-based tourism linked to the estuary and its fynbos-covered catchment generates significant economic benefits for local businesses, including accommodation, restaurants, and tour operators.

Onrus Lagoon and its beach together represent a popular recreational area, although its use is somewhat constrained by concerns about its pollution status. The shallow waters in the outlet channel provide a safe area for children to play and swim, while the main waterbody can be explored using craft such as lilos, pedalos, canoes and rowing boats. There is no demand for larger boats or kitesurfing due to the estuary's small size and sheltered location. The Onrus beach on the other hand provides youngsters and adults the opportunity to swim, body surf and surf in the sea. The Onrus Lagoon and beach therefore represent a recreational destination for all members of a family and poor water quality are likely to impact on the cultural service provided by both the lagoon and the beach.

The Onrus beach currently does not have Blue Flag Status, which is an international award that is given to beaches, boats and marina's that meet excellence in the areas of safety, amenities, cleanliness and environmental standards. The strict criteria of the programme are set by the international coordinators of the Blue Flag campaign in Europe, the Foundation for Environmental Education (FEE). Obtaining this status could improve recreational value of both the beach and the estuary, thereby also attracting a greater number of international visitors to the Onrus Town with economic benefits to the wider Hermanus area.

A zonation plan that provided designated areas for swimming, canoeing and a bird sanctuary was proposed by the CSIR in 1993. The zonation plan was adopted for a while but not enforced as it was considered unnecessary given the low level of recreational boating and the lack of user conflict.

Local residents have a sense of ownership over and responsibility for the estuary and it provides an important sense of place for holidaymakers, many of whom have a long family history of association with the area. A restaurant and beach bistro/kiosk overlooks the water. The estuary is used for adventure activities during Jewish Youth and Zionist summer camps held at the nearby Habonim Campsite and Conference Centre. In addition, it is occasionally used for African Zionist baptism ceremonies. Zwelihle is approximately 4 km walk along the coast, but there are also taxis operating between the township and Onrus Main Road. The estuary is visited by birdwatchers, attracting ‘twitchers’ for species that are otherwise hard to find in the Overberg (A. Odendaal, pers. comm.). Following the demarcation of a bird sanctuary on the eastern shore in the 1990s, a bird hide was constructed at the northern end shore with funding by WWF through the Rowland and Leta Hill Trust. In 2002, the hide was repaired by the Onrus Lagoon Trust after being vandalised and partially burnt down in 1999. The Trust also constructed the boardwalk and path leading to the hide, and conducted alien-clearing on the property, which originally belonged to the municipality but was donated to WWF

The hide was subsequently vandalised again, and today only the platform remains, while the wooden boardwalks to the hide are in a serious state of disrepair and are a safety hazard. The Onrus Lagoon Trust does not consider the structures worth repairing given that dense reed growth in the vicinity of the hide renders it obsolete for bird-watching, and has recommended that they be removed.

However, the path to the bird hide offers scenic views of the estuary and passes through diverse strandveld that supports a rich birdlife. Apart from its recreational and environmental educational potential, this is an asset that has importance from a biodiversity conservation perspective. Maintenance work is needed to ensure that the path does not become overgrown and that the property is kept clear of invasive alien vegetation.

5.5 Supporting Services

The Onrus River catchment provides a suite of critical supporting services that underpin all other ecosystem functions. These fundamental ecological processes maintain ecosystem integrity and resilience, yet they are increasingly threatened by anthropogenic pressures and environmental degradation.

Primary production forms the basis of the system’s ecological functioning. Aquatic plants and phytoplankton contribute substantially to biomass generation through photosynthesis, with extensive reed beds dominated by *Phragmites australis* acting as key primary producers. However, the monoculture dominance of these reed beds has reduced overall ecosystem productivity relative to more structurally and taxonomically diverse plant communities (Du Preez, 2019; Massie & Clark, 2016a). Upstream, the peatland wetland supports a unique assemblage of vegetation, including the endemic palmiet (*Prionium serratum*), which makes a significant contribution to primary production.

Nutrient cycling is another essential supporting service within the catchment. Reed beds function as natural filters and nutrient sinks, regulating nitrogen, phosphorus, and other elements critical to aquatic health (Howard-Williams, 1985). This service has been shaped by human activity: sewage discharges and agricultural runoff have increased nutrient loading, yet reed beds continue to mitigate impacts by trapping nutrients and limiting downstream eutrophication (Howard-Williams, 1985).

The catchment further provides essential physical habitat for diverse fauna. The estuary supports 81 water-associated bird species and 11 fish species, with reed beds offering important nesting and breeding habitat for species such as the Southern Red Bishop (*Euplectes orix*), Cape Weaver (*Ploceus capensis*), and various waterfowl (Massie & Clark, 2016a). Despite its small size, the estuary plays a vital role in sustaining both resident estuarine species and marine-dependent taxa under different mouth states. However, the ecological role of the estuary has been diminished by the extensive sediment infilling that followed the 2023 flood, which reduced open water area, depth, flow, and seawater intrusion (Clark et al., 2024).

Historically, among the most significant supporting services was long-term soil formation within the Onrus peat wetland. This system contained peat deposits over 10,000 years old, which reflect millennia of organic matter accumulation and contribute to both hydrological and ecological functioning (Tooth & McCarthy, 2007). However, the integrity of this service has been severely undermined by the 2019 peat fire and the flood in 2023, which destroyed most of the wetland (Grundling et al., 2019; Le Roux et al., 2023). Closely linked to soil formation is carbon storage. Peat wetlands represent globally important carbon sinks (Adhikari et al., 2009; Belyea & Malmer, 2004; Dargie et al., 2017; Kayranli et al., 2010), with South African peatlands collectively storing between 4.2 and 431.5 million tons of carbon (Grundling et al., 2021). The Onrus wetland historically contributed to this service by sequestering atmospheric carbon, though the 2019 fire and 2023 flood reversed this process by releasing significant quantities of stored carbon back into the atmosphere (Grundling et al., 2019).

The catchment also plays a regulatory role in the hydrological cycle. Through evapotranspiration and water retention in wetlands, it contributes to groundwater recharge and maintains baseflows. The peat wetland in particular functions as a natural sponge, storing water during wet periods and gradually releasing it during dry periods (Holden, 2006). This function, however, has been disrupted by the construction of the De Bos Dam, which has altered natural flow regimes and attenuated seasonal flood cycles (Lorentz et al., 2024).

Finally, the system contributes to sediment processing through deposition, filtration, and stabilization. Reed beds trap sediments and reduce erosion, while the estuary acts as a natural settling basin. The De Bos Dam further traps sediment originating from the upper reaches of the catchment, but in doing so it significantly modifies sediment supply and flow dynamics downstream (Lorentz et al., 2024).

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APPENDIX A — BIRD SPECIES OF G40H

Order	Species	Common Name
Accipitriformes	Accipiter melanoleucus	Black Sparrowhawk
Accipitriformes	Accipiter rufiventris	Rufous-breasted Sparrowhawk
Accipitriformes	Accipiter tachiro	African Goshawk
Passeriformes	Acrocephalus baeticatus	African Reed Warbler
Passeriformes	Acrocephalus gracilirostris	Lesser Swamp Warbler
Passeriformes	Acrocephalus palustris	Marsh Warbler
Passeriformes	Acrocephalus scirpaceus	Common Reed Warbler
Charadriiformes	Actitis hypoleucos	Common Sandpiper
Accipitriformes	Aerospiza tachiro	African Goshawk
Accipitriformes	Aerospiza tachiro tachiro	African Goshawk
Anseriformes	Alopochen aegyptiaca	Egyptian Goose
Charadriiformes	Anarhynchus leschenaultii	Greater sand plover
Charadriiformes	Anarhynchus marginatus	White-fronted plover
Charadriiformes	Anarhynchus pecuarius	Kittlitz's plover
Anseriformes	Anas capensis	Cape Teal
Anseriformes	Anas erythrorhyncha	Red-billed Teal
Anseriformes	Anas hottentota	Hottentot Teal
Anseriformes	Anas platyrhynchos	Mallard
Anseriformes	Anas smithii	Cape Shoveler
Anseriformes	Anas sparsa	African Black Duck
Anseriformes	Anas undulata	Yellow-billed Duck
Passeriformes	Andropadus importunus	Sombre Greenbul
Suliformes	Anhinga rufa	African Darter
Anseriformes	Anser anser	Greylag Goose
Passeriformes	Anthobaphes violacea	Orange-breasted Sunbird
Gruiformes	Anthropoides paradiseus	Blue Crane
Passeriformes	Anthus cinnamomeus	African Pipit
Passeriformes	Anthus leucophrys	Mountain Pipit
Passeriformes	Anthus nicholsoni	Nicholson’s Pipit
Passeriformes	Anthus similis	Long-billed Pipit
Passeriformes	Apalis thoracica	Bar-throated Apalis
Apodiformes	Apus affinis	Little Swift
Apodiformes	Apus apus	Common Swift
Apodiformes	Apus barbatus	White-rumped Swift
Apodiformes	Apus caffer	African Black Swift
Apodiformes	Apus horus	Horus Swift
Accipitriformes	Aquila verreauxii	Verreaux’s Eagle
Pelecaniformes	Ardea alba	Great Egret
Pelecaniformes	Ardea cinerea	Grey Heron
Pelecaniformes	Ardea goliath	Goliath Heron
Pelecaniformes	Ardea ibis	Cattle Egret

Pelecaniformes	Ardea intermedia	Intermediate Egret
Pelecaniformes	Ardea melanocephala	Black-headed Heron
Pelecaniformes	Ardea purpurea	Purple Heron
Procellariiformes	Ardenna gravis	Great Shearwater
Procellariiformes	Ardenna grisea	Sooty Shearwater
Pelecaniformes	Ardeola ralloides	Squacco Heron
Charadriiformes	Arenaria interpres	Ruddy Turnstone
Accipitriformes	Astur melanoleucus	Black Sparrowhawk
Passeriformes	Batis capensis	Cape Batis
Pelecaniformes	Bostrychia hagedash	Hadada Ibis
Pelecaniformes	Botaurus minutus	Little Bittern
Pelecaniformes	Botaurus sturmii	Dwarf Bittern
Passeriformes	Bradypterus baboecala	Little Rush Warbler
Strigiformes	Bubo africanus	Spotted Eagle-Owl
Strigiformes	Bubo capensis	Cape Eagle Owl
Pelecaniformes	Bubulcus ibis	Western Cattle Egret
Charadriiformes	Burhinus capensis	Spotted Thick-knee
Charadriiformes	Burhinus vermiculatus	Water Thick-knee
Accipitriformes	Buteo buteo	Common Buzzard
Accipitriformes	Buteo rufofuscus	Jackal Buzzard
Accipitriformes	Buteo trizonatus	Forest Buzzard
Anseriformes	Cairina moschata domestica	Domestic Muscovy Duck
Passeriformes	Calandrella cinerea	Red-capped Lark
Charadriiformes	Calidris canutus	Red Knot
Charadriiformes	Calidris ferruginea	Curlew Sandpiper
Charadriiformes	Calidris melanotos	Pectoral Sandpiper
Charadriiformes	Calidris minuta	Little Stint
Charadriiformes	Calidris pugnax	Ruff
Procellariiformes	Calonectris borealis	Cory's shearwater
Passeriformes	Campephaga flava	Black cuckooshrike
Piciformes	Campethera notata	Knysna Woodpecker
Caprimulgiformes	Caprimulgus pectoralis	Fiery-necked Nightjar
Passeriformes	Cecropis cucullata	Greater Striped Swallow
Cuculiformes	Centropus burchellii	Burchell's Coucal
Passeriformes	Cercotrichas coryphoeus	Karoo scrub robin
Coraciiformes	Ceryle rudis	Pied Kingfisher
Passeriformes	Chaetops frenatus	Cape Rockjumper
Passeriformes	Chalcomitra amethystina	Amethyst Sunbird
Charadriiformes	Charadrius hiaticula	Common Ringed Plover
Charadriiformes	Charadrius marginatus	White-fronted Plover
Charadriiformes	Charadrius pecuarius	Kittlitz's Plover
Charadriiformes	Charadrius tricollaris	Three-banded Plover
Charadriiformes	Chlidonias hybrida	Whiskered tern
Charadriiformes	Chlidonias leucopterus	White-winged Tern
Charadriiformes	Chlidonias niger	Black Tern
Charadriiformes	Chroicocephalus cirrocephalus	Grey-headed Gull

Charadriiformes	Chroicocephalus hartlaubii	Hartlaub's Gull
Cuculiformes	Chrysococcyx caprius	Diderick Cuckoo
Cuculiformes	Chrysococcyx klaas	Klaas's Cuckoo
Ciconiiformes	Ciconia ciconia	White Stork
Ciconiiformes	Ciconia nigra	Black Stork
Passeriformes	Cinnyris chalybeus	Southern Double-collared Sunbird
Accipitriformes	Circaetus cinereus	Brown Snake Eagle
Accipitriformes	Circus maurus	Black Harrier
Accipitriformes	Circus ranivorus	African Marsh Harrier
Passeriformes	Cisticola fulvicapilla	Neddicky
Passeriformes	Cisticola juncidis	Zitting Cisticola
Passeriformes	Cisticola subruficapilla	Grey-backed Cisticola
Passeriformes	Cisticola textrix	Cloud Cisticola
Passeriformes	Cisticola tinniens	Levaillant's Cisticola
Cuculiformes	Clamator jacobinus	Jacobin cuckoo
Passeriformes	Coccopygia melanotis	Swee Waxbill
Coliiformes	Colius colius	White-backed Mousebird
Coliiformes	Colius striatus	Speckled Mousebird
Columbiformes	Columba arquatrix	African Olive Pigeon
Columbiformes	Columba guinea	Speckled Pigeon
Columbiformes	Columba livia	Rock Dove
Coraciiformes	Coracias garrulus	European Roller
Passeriformes	Corvus albicollis	White-necked Raven
Passeriformes	Corvus albus	Pied Crow
Passeriformes	Corvus capensis	Cape Crow
Passeriformes	Corypha apiata	Cape Clapper Lark
Coraciiformes	Corythornis cristatus	Malachite Kingfisher
Passeriformes	Cossypha caffra	Cape robin-chat
Galliformes	Coturnix coturnix	Common quail
Passeriformes	Crithagra albogularis	White-throated Canary
Passeriformes	Crithagra flaviventris	Yellow Canary
Passeriformes	Crithagra gularis	Streaky-headed Seedeater
Passeriformes	Crithagra leucoptera	Protea Canary
Passeriformes	Crithagra sulphurata	Brimstone Canary
Passeriformes	Crithagra totta	Cape Siskin
Passeriformes	Cryptillas victorini	Victorin's warbler
Cuculiformes	Cuculus solitarius	Red-chested Cuckoo
Passeriformes	Curruca curruca	Lesser Whitethroat
Apodiformes	Cypsiurus parvus	African palm swift
Passeriformes	Delichon urbicum	Western house martin
Anseriformes	Dendrocygna bicolor	Fulvous Whistling Duck
Anseriformes	Dendrocygna viduata	White-faced Whistling Duck
Piciformes	Dendropicos fuscescens	Cardinal Woodpecker
Piciformes	Dendropicos griseocephalus	Olive Woodpecker
Passeriformes	Dessonornis caffer	Cape Robin-chat
Passeriformes	Dicrurus adsimilis	Fork-tailed Drongo

Pelecaniformes	Egretta garzetta	Little Egret
Accipitriformes	Elanus caeruleus	Black-winged Kite
Passeriformes	Emberiza capensis	Cape Bunting
Passeriformes	Emberiza impetuani	Lark-like Bunting
Passeriformes	Emberiza tahapisi	Cinnamon-breasted Bunting
Passeriformes	Estrilda astrild	Common Waxbill
Sphenisciformes	Eudyptes chrysolophus	Macaroni Penguin
Passeriformes	Euplectes capensis	Yellow Bishop
Passeriformes	Euplectes orix	Southern Red Bishop
Falconiformes	Falco biarmicus	Lanner Falcon
Falconiformes	Falco peregrinus	Peregrine Falcon
Falconiformes	Falco rupicolus	Rock Kestrel
Gruiformes	Fulica cristata	Red-knobbed Coot
Passeriformes	Galerida magnirostris	Large-billed Lark
Charadriiformes	Gallinago nigripennis	African Snipe
Gruiformes	Gallinula chloropus	Common Moorhen
Galliformes	Gallus gallus domesticus	Domestic Chicken
Piciformes	Geocolaptes olivaceus	Ground Woodpecker
Gruiformes	Grus paradisea	Blue crane
Charadriiformes	Haematopus moquini	African Oystercatcher
Charadriiformes	Haematopus ostralegus	Eurasian Oystercatcher
Coraciiformes	Halcyon albiventris	Brown-hooded Kingfisher
Accipitriformes	Haliaeetus vocifer	African fish eagle
Accipitriformes	Hieraaetus pennatus	Booted Eagle
Charadriiformes	Himantopus himantopus	Black-winged Stilt
Passeriformes	Hirundo albigularis	White-throated Swallow
Passeriformes	Hirundo dimidiata	Pearl-breasted Swallow
Passeriformes	Hirundo rustica	Barn Swallow
Procellariiformes	Hydrobates pelagicus	European storm petrel
Charadriiformes	Hydroprogne caspia	Caspian Tern
Accipitriformes	Icthyophaga vocifer	African Fish Eagle
Piciformes	Indicator minor	Lesser Honeyguide
Pelecaniformes	Ixobrychus minutus	Little bittern
Passeriformes	Lamprotornis bicolor	Pied Starling
Passeriformes	Laniarius ferrugineus	Southern Boubou
Passeriformes	Lanius collaris	Common Fiscal
Charadriiformes	Larus dominicanus	Kelp Gull
Ciconiiformes	Leptoptilos crumenifer	Marabou Stork
Procellariiformes	Macronectes giganteus	Southern Giant Petrel
Procellariiformes	Macronectes halli	Northern Giant Petrel
Passeriformes	Macronyx capensis	Cape longclaw
Coraciiformes	Megaceryle maxima	Giant Kingfisher
Passeriformes	Melaenornis silens	Fiscal flycatcher
Accipitriformes	Melierax canorus	Pale Chanting Goshawk
Coraciiformes	Merops apiaster	European Bee-eater
Suliformes	Microcarbo africanus	Reed Cormorant

Suliformes	Microcarbo coronatus	Crowned Cormorant
Accipitriformes	Milvus aegyptius	Yellow-billed Kite
Accipitriformes	Milvus migrans	Black Kite
Passeriformes	Mirafra apiata	Cape clapper lark
Passeriformes	Monticola explorator	Sentinel Rock-Thrush
Passeriformes	Monticola rupestris	Cape Rock-Thrush
Suliformes	Morus capensis	Cape Gannet
Passeriformes	Motacilla capensis	Cape Wagtail
Passeriformes	Motacilla cinerea	Grey Wagtail
Passeriformes	Motacilla flava	Western Yellow Wagtail
Passeriformes	Muscicapa adusta	African Dusky Flycatcher
Passeriformes	Muscicapa striata	Spotted Flycatcher
Passeriformes	Nectarinia famosa	Malachite Sunbird
Passeriformes	Neophedina cincta	Black-chested Prinia
Otidiformes	Neotis denhami	Denham's Bustard
Anseriformes	Netta erythrophthalma	Southern Pochard
Charadriiformes	Numenius arquata	Eurasian Curlew
Charadriiformes	Numenius phaeopus	Whimbrel
Galliformes	Numida meleagris	Helmeted Guineafowl
Pelecaniformes	Nycticorax nycticorax	Black-crowned Night Heron
Columbiformes	Oena capensis	Namaqua Dove
Passeriformes	Oenanthe familiaris	Familiar Chat
Passeriformes	Oenanthe pileata	Capped Wheatear
Passeriformes	Onychognathus morio	Red-winged Starling
Passeriformes	Oriolus oriolus	Eurasian Golden Oriole (rare visitor)
Anseriformes	Oxyura maccoa	Maccoa Duck
Accipitriformes	Pandion haliaetus	Osprey
Passeriformes	Passer diffusus	Southern Grey-headed Sparrow
Passeriformes	Passer domesticus	House Sparrow
Passeriformes	Passer melanurus	Cape Sparrow
Galliformes	Pavo cristatus	Indian Peafowl
Pelecaniformes	Pelecanus onocrotalus	Great White Pelican
Accipitriformes	Pernis apivorus	European Honey Buzzard
Suliformes	Phalacrocorax capensis	Cape Cormorant
Suliformes	Phalacrocorax carbo	Great Cormorant
Suliformes	Phalacrocorax lucidus	White-breasted Cormorant
Suliformes	Phalacrocorax neglectus	Bank Cormorant
Phoenicopteriformes	Phoeniconaias minor	Lesser Flamingo
Phoenicopteriformes	Phoenicopterus roseus	Greater Flamingo
Passeriformes	Phylloscopus trochilus	Willow Warbler (occurs as migrant)
Pelecaniformes	Platalea alba	African Spoonbill
Anseriformes	Plectropterus gambensis	Spur-winged Goose
Pelecaniformes	Plegadis falcinellus	Glossy Ibis
Passeriformes	Ploceus capensis	Cape Weaver
Passeriformes	Ploceus velatus	Southern Masked Weaver
Charadriiformes	Pluvialis squatarola	Grey Plover

Podicipediformes	Podiceps cristatus	Great Crested Grebe
Podicipediformes	Podiceps nigricollis	Black-necked Grebe
Accipitriformes	Polemaetus bellicosus	Martial Eagle
Accipitriformes	Polyboroides typus	African Harrier-Hawk
Gruiformes	Porphyrio madagascariensis	African Purple Swamphen
Passeriformes	Prinia maculosa	Karoo Prinia
Procellariiformes	Procellaria aequinoctialis	White-chinned Petrel
Passeriformes	Prodotiscus regulus	Yellow-bill
Passeriformes	Promerops cafer	Cape Sugarbird
Passeriformes	Psalidoprocne pristoptera	Black Saw-wing
Galliformes	Pternistis capensis	Cape Spurfowl
Passeriformes	Ptyonoprogne fuligula	Rock Martin
Procellariiformes	Puffinus puffinus	Manx Shearwater
Passeriformes	Pycnonotus capensis	Cape Bulbul
Passeriformes	Quelea quelea	Red-billed Quelea
Gruiformes	Rallus caerulescens	African Rail
Charadriiformes	Recurvirostra avosetta	Pied Avocet
Passeriformes	Riparia paludicola	South African Swallow
Charadriiformes	Rostratula benghalensis	Greater Painted-snipe
Accipitriformes	Sagittarius serpentarius	Secretarybird
Gruiformes	Sarothrura elegans	Buff-spotted Flufftail
Gruiformes	Sarothrura rufa	Red-chested Flufftail
Gruiformes	Sarothruraaffinis	Striped Flufftail
Passeriformes	Saxicola torquatus	African Stonechat
Galliformes	Scleroptila afra	Red-winged Francolin
Passeriformes	Serinus canicollis	Cape Canary
Passeriformes	Sigelus silens	Cape Rockjumper
Anseriformes	Spatula hottentota	Hottentot Teal
Anseriformes	Spatula smithii	Cape Teal
Sphenisciformes	Spheniscus demersus	African Penguin
Passeriformes	Sphenoeacus afer	Yellow-bellied Eremomela
Columbiformes	Spilopelia senegalensis	Laughing Dove
Passeriformes	Stenostira scita	Fairy Warbler
Charadriiformes	Stercorarius antarcticus	South Polar Skua
Charadriiformes	Stercorarius parasiticus	Arctic Skua
Charadriiformes	Stercorarius pomarinus	Pomarine Skua
Charadriiformes	Sterna dougallii	Roseate Tern
Charadriiformes	Sterna hirundo	Common Tern
Charadriiformes	Sterna paradisaea	Arctic Tern
Charadriiformes	Sterna vittata	Antarctic Tern / Brunette Tern
Charadriiformes	Sternula albifrons	Little Tern
Columbiformes	Streptopelia capicola	Cape Turtle Dove (Cape Dove)
Columbiformes	Streptopelia semitorquata	Red-eyed Dove
Struthioniformes	Struthio camelus	Ostrich
Passeriformes	Sturnus vulgaris	Common Starling
Passeriformes	Sylvietta rufescens	Rufous-vented Warbler

Podicipediformes	Tachybaptus ruficollis	Little Grebe
Apodiformes	Tachymarptis melba	Alpine Swift
Passeriformes	Tchagra tchagra	Southern Tchagra
Passeriformes	Telophorus zeylonus	Southern Boubou
Passeriformes	Terpsiphone viridis	African Paradise Flycatcher
Procellariiformes	Thalassarche carteri	Atlantic Yellow-nosed Albatross
Procellariiformes	Thalassarche cauta	Shy Albatross
Procellariiformes	Thalassarche chrysostoma	Grey-headed Albatross
Procellariiformes	Thalassarche melanophris	Black-browed Albatross
Charadriiformes	Thalasseus bergii	Swift Tern
Charadriiformes	Thalasseus elegans	Elegant Tern
Charadriiformes	Thalasseus sandvicensis	Sandwich Tern
Anseriformes	Thalassornis leuconotus	White-backed Duck
Charadriiformes	Thinornis dubius curonicus	Little Ringed Plover
Charadriiformes	Thinornis tricollaris	Three-banded Plover
Pelecaniformes	Threskiornis aethiopicus	African Sacred Ibis
Piciformes	Tricholaema leucomelas	White-eared Barbet
Charadriiformes	Tringa glareola	Wood Sandpiper
Charadriiformes	Tringa nebularia	Greenshank
Charadriiformes	Tringa stagnatilis	Marsh Sandpiper
Passeriformes	Trochocercus cyanomelas	Blue-mantled Flycatcher
Passeriformes	Turdus olivaceus	Olive Thrush
Charadriiformes	Turnix hottentottus	Fynbos Buttonquail
Columbiformes	Turtur tympanistria	Tambourine Dove
Coraciiformes	Tychaedon coryphoeus	Grey-headed Kingfisher
Strigiformes	Tyto alba	Barn Owl
Bucerotiformes	Upupa africana	African Hoopoe
Bucerotiformes	Upupa epops	Eurasian Hoopoe
Passeriformes	Urocolius indicus	Green Malkoha
Charadriiformes	Vanellus armatus	Blacksmith Lapwing
Charadriiformes	Vanellus coronatus	Crowned Lapwing
Passeriformes	Vidua macroura	Pin-tailed Whydah
Charadriiformes	Xema sabini	Sabine’s Gull
Charadriiformes	Xenus cinereus	Terek Sandpiper
Gruiformes	Zapornia flavirostra	Black Crake
Passeriformes	Zosterops virens	African Yellow White-eye

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