INVASIVE ALIEN PLANT SPECIES MONITORING, CONTROL AND ERADICATION PLAN ONRUS RIVER CATCHMENT

2025

Cover photo: André de Villiers

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2025

Report prepared for:

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EXECUTIVE SUMMARY

Introduction

Invasive alien plant (IAP) species are defined as plant species introduced outside their natural range that establish, spread, and cause ecological, economic, or social harm (Elton, 2020). IAPs are one of the most severe threats to South Africa's ecological integrity and water security, particularly within riparian and wetland systems. Extensive research has shown that IAPs drive biodiversity loss, degrade water resources, reduce rangeland productivity, and compromise essential ecosystem services. The national economic burden of managing IAPs is substantial, with estimated control costs of R230 billion and annual government expenditure of approximately R310 million through the Working for Water programme. Hydrological impacts are particularly concerning, with current reductions in national streamflow estimated at 1.44–2.44 billion m^3 annually — projected to exceed 3 billion m^3 if invasions remain unmanaged.

Riparian and wetland ecosystems are disproportionately affected. IAPs replace diverse indigenous vegetation with dense monocultures, altering nutrient cycling, increasing riverbank instability, reducing water infiltration, and disrupting flow regimes. Furthermore, woody invasives such as Pines and Wattles intensify fire risk and post-fire erosion, degrading catchment hydrology and accelerating wetland desiccation. This was evidenced in the Onrus wetland, where alien-driven fire spread ignited and degraded peatlands, severely compromising wetland function and resulting in substantial loss of wetland habitat during the September 2023 1-in-100-year flood event.

The Onrus River catchment (situated in the quaternary catchment G40H), situated near Hermanus in the Western Cape, is hydrologically and ecologically critical. It supports high-value peatland wetlands in its upper reaches and supplies potable and agricultural water via the De Bos Dam. However, much of its riparian corridor is heavily invaded by alien woodland. The lower Onrus River, including the main wetland and estuary, provides high ecological sensitivity and essential ecosystem services, but is at elevated risk due to ongoing IAP-driven hydrological alteration.

Given escalating water security concerns in the Western Cape, and the critical ecological and socio-economic importance of the Onrus system, urgent and strategic IAP management within the catchment is required to prevent further hydrological degradation and loss of ecosystem function. In response to this need, this management plan has been prepared and sets out an Invasive Alien Species Monitoring, Control and Eradication Plan for the Onrus River catchment to provide a structured framework for the control, removal, and long-term management of invasive alien plant species within this ecologically important area.

Legislative Framework

The management of IAP species in South Africa is governed primarily by two key legislative instruments: the Conservation of Agricultural Resources Act (CARA; Act 43 of 1983) and the National Environmental Management: Biodiversity Act (NEM:BA; Act 10 of 2004). These Acts collectively establish the legal basis for the classification, control, eradication, and regulated use or trade of IAPs, and impose a statutory duty on all landowners to actively manage invasive species on their properties.

CARA focuses on controlling declared weeds and invader species to conserve agricultural resources and productivity. It controls 198 declared weeds and invader plants through a three-tier categorisation system.

- Category 1a species must be eradicated immediately, and may not be propagated or traded.
- Category 1b species must be controlled to prevent further spread.
- Category 2 species may only be cultivated in legally demarcated areas under permit conditions.
- Category 3 species may remain where already established but are prohibited in ecologically sensitive areas such as wetlands and riparian zones.

NEM:BA addresses invasive species more broadly, aiming to protect biodiversity and ecosystem integrity. NEM:BA, through its Alien and Invasive Species Regulations (2020), expands on the CARA framework by listing 383 invasive species and classifying them into four regulatory categories:

- Category 1a: compulsory eradication.
- Category 1b: ongoing control to prevent further spread, with mandatory control plans.
- Category 2: restricted activities permitted only under licence.
- Category 3: restricted use — existing plants allowed outside riparian areas but no further propagation.

The NEM:BA regulations, effective from 1 October 2014, supersede CARA in cases involving biodiversity conservation, as legally confirmed under Section 8(1)(a) of the Act. Both laws remain concurrently in force, but NEM:BA prevails where conflict arises.

For regulatory compliance, all Category 1a, 1b, and 2 species, as well as Category 3 species within riparian zones, must be removed or controlled within project areas.

Overview of Invasive Alien Species in the Onrus River catchment

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. 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.

Invasive Alien Species Control Methods

This chapter outlines the integrated management approach required to control IAP species, with specific reference to methods that would be most applicable to the Onrus River catchment. It should be noted that no single method is universally effective due to species-specific differences in morphology, reproductive strategies, and ecological impacts. Three primary control strategies are applied, i.e., mechanical, chemical, and biological control, each with distinct advantages and limitations.

Mechanical methods include hand-pulling, slashing, cut stump, ring-barking, strip-barking, and frilling, and are best suited for small plants or sparsely infested areas. While effective, mechanical control is labour-intensive and may cause soil disturbance if poorly implemented. Chemical control relies on selective or non-selective herbicides and is primarily used in follow-up operations to suppress regrowth and eliminate seedlings emerging from soil-stored seedbanks. Application methods—such as foliar spraying, handheld spraying, and injection—must be species-specific, environmentally sensitive, and legally compliant under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947). Initial clearing operations are most effective when combining mechanical removal with targeted herbicide application to ensure complete removal of rootstock and reduce resprouting. Biological control offers the most sustainable long-term solution, using host-specific natural enemies to reduce IAP vigour and spread. While highly effective in reducing plant density over time, it rarely results in complete eradication and must therefore complement mechanical and chemical interventions. Its use is limited to species for which suitable biological control agents have been developed. Overall, long-term IAP control requires an adaptive, targeted, and integrated approach, with control strategies tailored to species and life stage, supported by ongoing monitoring and follow-up interventions.

Planning and Budget

A comprehensive budget was formulated for the control of IAP species within the Onrus River catchment. This budget assessment quantifies the financial requirements for the initial control of woody IAP species across the Onrus River (G40H) catchment. Costing is driven primarily by species composition, percentage cover (density), size of each MU, clearing phase, and dominant size class of the invasive plants. All MUs in the catchment are currently classified as being in the initial clearing phase, with adult size classes dominating, which results in the highest cost intensity due to the greater effort and labour required for mature stands.

The five major invasive woody groups assessed, Gums, Wattles, Pines, Hakea spp. and Poplars, were mapped using GIS to determine spatial extent and percentage cover per MU. Labour requirements were derived using standardised person-day/ha estimates, which were then used to calculate rate-per-hectare values and total project costs. MUs with high-density infestations, steep terrain, or large area (>100 ha) correspondingly show the highest clearing costs.

For each MU, the budget incorporates:

- Person-days required based on density and dominant size class
- Rate per hectare, derived from person-days/ha
- Estimated duration (calendar days) for a 10-person clearing team
- Total cost per MU for the first clearing intervention

Initial clearing costs range widely — from under R5 000 for small, low-density units, to over R1 million for large, densely invaded units. High-density (>50%), large (>100 ha) MUs are the primary cost drivers. Follow-up and maintenance phases (not costed here) will be critical to prevent reinfestation and are expected to require 2–5 treatment cycles over 3–5 years, but at lower cost per hectare.

This budget establishes the financial foundation for implementing a phased, prioritised IAP clearing programme aligned with the National Environmental Management: Biodiversity Act. It enables decision-makers to rank MUs by ecological urgency and cost efficiency, and to secure funding for a multi-year, catchment-scale restoration strategy.

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GLOSSARY

Biodiversity: The variety and variability of all living organisms, including genetic, species, and ecosystem diversity, within a given area or globally.

Ecological Buffers: Zones of natural or semi-natural vegetation surrounding sensitive areas that reduce the impact of human activities and protect ecosystem functions.

Ecosystem Services: The benefits that humans obtain from ecosystems, including provisioning, regulating, supporting, and cultural services.

Follow-up clearing phase: conducted after initial clearing and targeting resprouting individuals and seedlings emerging from the seedbank. Multiple follow-up cycles are often required where persistent seedbanks are present.

G40H basin: A specific hydrological catchment area within the Breede River – Gouritz catchment area in the Western Cape, South Africa, defined by its drainage patterns, surface water flow, and associated ecosystems.

Initial clearing phase: undertaken where little to no previous clearing has occurred, and focused primarily on the removal of mature (adult) plants.

Invasive Alien Plant: Plant species introduced outside their natural range that establish, spread, and cause ecological, economic, or social harm

Maintenance phase: implemented once IAP populations have been largely eradicated, and typically limited to the removal of occasional individuals invading from adjacent areas.

Nutrient Cycling: The natural process by which essential elements like carbon, nitrogen, and phosphorus are exchanged between living organisms and the environment, sustaining ecosystem function.

Peatland Wetland: A wetland ecosystem characterized by the accumulation of partially decomposed organic matter (peat) under water-saturated conditions, supporting unique hydrology and biodiversity.

Water Bodies: Natural or artificial accumulations of water, such as rivers, dams, ponds, and reservoirs, that support aquatic ecosystems and provide water resources.

ABBREVIATIONS AND ACRONYMS

Anchor	Anchor Environmental Consultants
C2C	Onrus Catchment-to-Coast
IAP	invasive alien plant
ISMP	Invasive Species Management Programme
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
MUs	Management Units
NEMA	National Environmental Management Act (NEMA; Act 107 of 1998)
NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
SANBI	South African National Biodiversity Institute

1 INTRODUCTION

1.1 Invasive Alien Plants and Impacts

Invasive alien plant (IAP) species are defined as plant species introduced outside their natural range that establish, spread, and cause ecological, economic, or social harm (Elton, 2020). The impacts of IAP species on terrestrial and freshwater ecosystems in South Africa have been extensively studied and documented. Alien plants are regarded as one of the primary drivers of biodiversity loss in the country (Latimer et al., 2004; Rouget et al., 2003). Recent reviews confirm that these species significantly disrupt biodiversity, degrade water resources, reduce rangeland productivity, and impair other critical ecosystem services (Kotzé et al., 2025; van Wilgen et al., 2022). Moreover, economic assessments underscore the substantial costs associated with managing IAPs. Control efforts across South Africa require an estimated R 230 billion (based on 2022 values), while the government-run "Working for Water" programme has consistently allocated approximately R 310 million annually (2020 values) to manage IAP invasions across 2.7 million hectares (Kotzé et al., 2025). A key hydrological consequence of IAP invasion is increased transpiration and evaporative losses, leading to marked reductions in streamflow and annual runoff. The most recent estimates suggest losses of 1.44 to 2.44 billion m^3 annually, increasing to 2.59 to 3.15 billion m^3 annually if invasions are not controlled (Le Maitre et al., 2016). These effects are particularly acute in riparian and groundwater-accessible zones, where impacts on water supply reliability are magnified.

A critical component of river systems is the riparian zone, which functions as the transitional corridor between terrestrial and aquatic environments. The structure of riparian zones varies considerably, ranging from wide expanses in floodplain systems to narrow strips along steep riverbanks. Riparian vegetation differs markedly from adjacent terrestrial plant communities. Riparian and wetland systems, which function as ecological buffers and regulators for water quantity and quality, are particularly vulnerable to alien plant invasions. IAP invasion often results in the replacement of structurally and functionally diverse indigenous riparian vegetation with monospecific stands of alien species, triggering altered nutrient cycling, elevated decomposition rates, and shifts in riverbed morphology, ultimately disrupting flow regimes (Chamier et al., 2012; Modiba et al., 2017; van Wilgen et al., 2022). This shift diminishes biodiversity and disrupts the ecosystem services historically provided by indigenous vegetation.

Invasions by alien woody species also exacerbate fire risk by increasing aboveground biomass. The resultant fires burn at higher intensities, destroying native seed banks, enhancing soil water repellency, reducing infiltration, and accelerating erosion. These processes increase the severity of flood events and lead to greater damage to infrastructure and property (Richardson & Van Wilgen, 2004). Within Onrus for example, the presence of IAP within the Onrus wetland aided in the spreading of a fire which ignited the desiccated section of the peat wetland, which further increased the desiccation of the wetland (Grundling et al., 2019). The function of the wetland was almost completely lost due to the high level of desiccation and during a 1 in 100 flood event in September 2023 large section of the wetland was washed away.

One of the most detrimental impacts of invasive woody species, such as Australian Wattles and Pines, lies in their effect on hydrological functioning. Woody IAPs are often taller with deeper root systems than native vegetation (Le Maitre et al., 2015, 2016). This typically results in higher transpiration rates and deeper extraction compared to indigenous Fynbos vegetation, leading to reductions in soil moisture, decreased streamflow, and diminished reservoir yields. In the water-scarce Western Cape, where water security is an escalating concern, the urgency of managing alien invasions within catchments is therefore especially pronounced.

The Onrus Catchment-to-Coast (C2C) Rehabilitation & Restoration Programme was initiated under the auspices of the Overstrand Local Municipality among other stakeholders, with the objective of restoring the entire Onrus River Catchment, including the upstream peat wetland complex and the downstream estuarine system (Onrus Estuary). A key component of this programme is the control and removal of IAP species within the catchment. These invasive taxa threaten catchment water-security by increasing evapotranspiration and reducing runoff, and they elevate fuel loads in the landscape, thereby increasing wildfire risk and negatively impacting botanical biodiversity as well as the ecological integrity of the Onrus peat wetland and estuary.

1.2 STUDY AREA

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 the quaternary catchment G40H and forms part of the Breede-Gouritz Catchment Management Area (Breede-Gouritz Catchment Management Agency, 2017). Catchment G40H spans an area of approximately 59 km^2 and lies within the Overstrand Local Municipality, which is part of the Overberg District Municipality in the Western Cape Province (Figure 1.1).

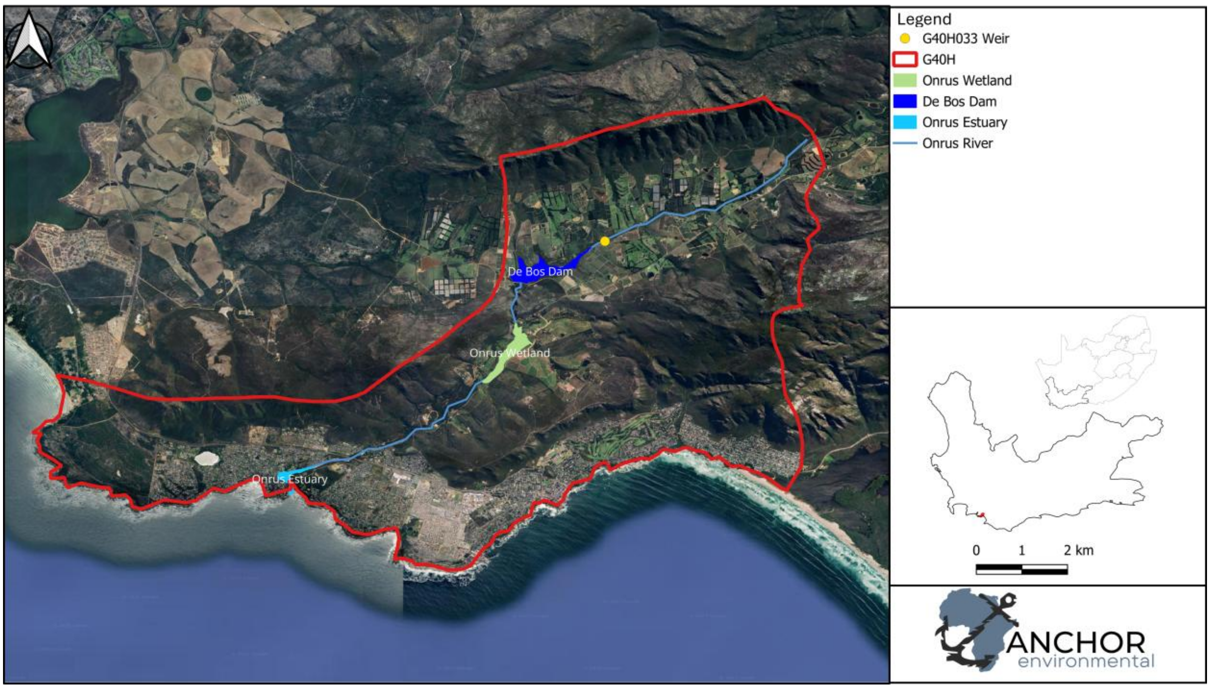

Figure 1.1. The G40H catchment and location of the Onrus river, G40H033 weir, De Bos dam, main Onrus Wetland and Onrus Estuary within this catchment.

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. In its upper reaches, the river supports extensive and ecologically important wetlands, including peatlands. For much of its middle reaches, the river consists of a single channel that flows through cultivated land with the riparian zone heavily invaded with alien woodland. It is in this reach that the river is impounded 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). At the confluence of these three watercourses, the Onrus River widens to form a wetland that has high ecological importance and sensitivity (Figure 1.1); includes peatland wetland; and provides important ecosystem services. Downstream of this point, the river passes through a narrow kloof, and then meanders across the coastal plain before discharging into the Onrus estuary at the coast (Figure 1.1).

Given the high ecological value of the Onrus River system and the extensive invasion of alien plant species within the catchment, effective and coordinated management of these invasions is critical to safeguarding local biodiversity, ecosystem services, and water resources.

In response to this need, this management plan has been prepared and sets out an Invasive Alien Species Monitoring, Control and Eradication Plan for the Onrus River catchment, to provide a structured framework for the control, removal, and long-term management of invasive alien plant species within this ecologically important area. The Monitoring, Control and Eradication Plan has been prepared for the G40H basin.

2 LEGISLATIVE FRAMEWORK

2.1 Legislative Context

In South Africa, the management, control, eradication, and regulation of the purchasing and trading of IAP species are primarily governed by two key legislative instruments: the Conservation of Agricultural Resources Act (CARA; Act No. 43 of 1983) and the National Environmental Management: Biodiversity Act (NEM:BA; Act No. 10 of 2004). Together, these Acts establish the legal framework for the classification of invasive species, prescribe control measures, and regulate activities associated with their utilisation. Importantly, both Acts place a statutory obligation on all landowners to actively manage and control IAP infestations occurring on their properties. Failure to comply with these legal requirements may result in enforcement action, including penalties or directives issued by the relevant authorities.

2.2 Conservation of Agricultural Resources Act (CARA; Act No. 43 of 1983)

This Act was promulgated in 1984 and subsequently amended in 1985 and 2001. The primary objective of the Act is to regulate the sustainable utilisation of South Africa's natural agricultural resources, while promoting the conservation of soil, water resources, and natural vegetation. A key component of CARA is the control and management of declared weeds and invader plants, which are recognised as significant threats to both agricultural productivity and ecological integrity.

CARA provides a regulatory framework that classifies 198 species of weeds and invader plants into three distinct categories, each with specific legal requirements:

- Category 1: Declared invader plants that must be removed and destroyed immediately. The propagation, sale, or trade of these species is strictly prohibited.
- Category 2: Invader plants that may be cultivated only under controlled conditions within demarcated and legally permitted zones. Trade in these species is prohibited.
- Category 3: Invader plants that may not be propagated, traded, or sold. However, existing individuals are not subject to mandatory removal, unless they occur within environmentally sensitive areas such as riparian zones, wetlands, or protected areas, where stricter measures may apply.

Through this categorisation, CARA establishes a tiered approach to invasive plant management, balancing eradication requirements with controlled use in specific cases, while prioritising the protection of natural resources from further ecological degradation.

2.3 National Environmental Management: Biodiversity Act (NEM:BA; Act No. 10 of 2004)

The NEM:BA provides for the protection and management of South Africa's biodiversity within the framework of the National Environmental Management Act (NEMA; Act 107 of 1998). It aims to conserve threatened species and ecosystems, promote the sustainable use of indigenous biological resources, and ensure equitable sharing of benefits derived from these resources. The Act also regulates alien and invasive species and, under certain circumstances, requires the preparation of an Invasive Species Management Programme (ISMP) to remove existing invasives, prevent their establishment, and monitor management effectiveness. The Alien and Invasive Species Regulations, 2020 (AIS Regulations) set out requirements for preventing the unauthorised introduction and spread of alien and invasive species.

The accompanying Alien and Invasive Species Lists,2020 (AIS Lists), identify 383 invasive plant species, which are classified into four regulatory categories. These categories determine the level of control, eradication and permitting required, and establish corresponding legal obligations for landowners and land managers.

- **Category 1a**: Species requiring compulsory eradication.
    - Landowners are legally obliged to combat or eradicate all Category 1a species occurring on their property. Obligations include:
    - Immediate implementation of eradication or control measures.
    - Granting access to authorised officials for inspection, monitoring, and assistance in implementing eradication measures.
    - Compliance with any approved ISMP developed for the species.
- **Category 1b**: Species requiring ongoing control.
    - These species must be controlled to prevent further spread. Requirements include:
    - Implementation of control measures in accordance with an approved ISMP, where applicable.
    - Allowing authorised officials to inspect property and monitor compliance.
    - Submission of a Category 1b Control Plan to the Minister upon request. Such a plan must include: (a) species identification; (b) extent of invasion; (c) control measures; (d) a time-bound action plan; (e) an assessment of possible utilisation as biomass; and (f) any additional information required by the Minister.
- **Category 2**: Species requiring permits for restricted activities.
    - A permit is required to carry out any restricted activity (e.g., cultivation, trade, or transport) involving Category 2 species. Landowners or permit holders must ensure that these species do not spread beyond the area specified in the permit. If Category 2 species occur outside permitted areas, they are legally reclassified as Category 1b and must be controlled accordingly. Both individuals and organs of state have a duty to prevent the spread of Category 2 species beyond the authorised land.

- **Category 3**: Species subject to restricted use.
    - Category 3 species may not be propagated, traded, or planted, but existing individuals outside riparian areas may remain in place. Importantly, where Category 3 species occur within riparian zones, they are automatically reclassified as Category 1b and must be controlled under those provisions.

The NEM:BA AIS Regulations, 2020 supersede the earlier CARA regulations in matters concerning biodiversity management. However, as CARA has not been formally repealed, both pieces of legislation currently remain in force. In the event of any conflict, Section 8(1)(a) of NEM:BA explicitly provides that NEM:BA prevails over other national legislation in relation to biodiversity conservation.

Accordingly, all Category 1a, 1b, and 2 species must be removed from the Onrus project areas, in addition to Category 3 species occurring in riparian zones, in order to ensure compliance with the statutory framework.

3 OVERVIEW OF INVASIVE ALIEN PLANT SPECIES IN THE ONRUS RIVER CATCHMENT

3.1 DATA SOURCES AND METHODS FOR ASSESSING IAP EXTENT AND COMPOSITION

The extent and composition of IAP species within the Onrus River catchment were determined through a combination of existing datasets, field observations, and GIS-based mapping methods, as detailed below:

- Historical IAP cover data for the years 2018, 2021, and 2024 were obtained from Lorentz et al. (2024).
- The most recent 2024 distribution of IAPs within the G40H quaternary basin was sourced from Rebelo and Coertze (2024).

A field survey was conducted on 22–23 September 2025 to ground-truth these GIS datasets (Lorentz et al., 2024; Rebelo & Coertze, 2024). Field observations were used to estimate the extent of each IAP species within individual management units (MUs), expressed as percentage cover. For the purpose of this assessment, MUs were delineated using cadastral erf boundaries of individual properties within the G40H basin. Residential erven were excluded, as the focus of the study is restricted to natural and semi-natural areas.

Three standardised size classes were adopted for the categorisation of invasive individuals, serving as a guideline for field assessments:

- Seedling: Individuals <40 cm in height and with stem diameters <1 cm.
- Young: Individuals 40 cm–1 m in height and with stem diameters 1–5 cm; these plants have not reached reproductive maturity and do not produce flowers or seeds.
- Mature: Individuals >1 m in height and with stem diameters >5 cm; these plants are reproductively mature and capable of flowering and seed production.

For this assessment, only mature individuals were considered, as the majority of clearing activities have not yet been undertaken, and the MUs are dominated by mature IAPs.

All spatial analyses and mapping were conducted using QGIS v3.42.3 (QGIS Development Team, 2025) Species were classified according to their NEM:BA / CARA Alien and Invasive Species (AIS) categories, enabling prioritisation of management and control interventions. This dataset was subsequently used to determine the composition, density, and spatial distribution of IAP species within each MU.

3.2 OVERVIEW OF IAPS

IAPs have been introduced both intentionally for forestry, ornamental planting and dune stabilisation, and unintentionally through agricultural and urban expansion (Richardson et al., 1997). The G40H quaternary basin has undergone substantial invasion by alien plant species, which threaten the integrity of its terrestrial, riparian, and wetland ecosystems. The basin has experienced a substantial tenfold increase in IAP cover, expanding from 0.82 km^2 in 2018 to 8.6 km^2 in 2024 (Figure 3.1)(Lorentz et al., 2024). Current estimates indicate that 15.7% of the G40H quaternary basin is invaded by IAPs, with large sections of the Onrus River catchment affected (Figure 3.1; (Lorentz et al., 2024)). The most heavily infested areas are concentrated in the middle and lower reaches of the Onrus River catchment, as well as in the degraded wetland upstream of the estuary (Figure 3.1)(Lorentz et al., 2024).

The IAPs within the G40H catchment include woody, herbaceous, and grass taxa, with five woody groups dominating amongst these IAP species within the G40H basin, namely Gums, Hakea, Pine, Poplar and Wattle (Figure 3.2)(Rebelo & Coertze, 2024). Together, these groups comprise approximately 15 woody species that collectively account for the majority of IAP cover within the basin. The highest densities of Gums and Wattles occur in close proximity to watercourses, which is expected given their high water-use efficiency and preference for riparian habitats (Figure 3.2). Pine and Hakea infestations are most prominent in mountainous areas, reflecting their adaptation to nutrient-poor, well-drained soils, and the likely spread from historical Pine plantations which were predominantly established in upland regions (Figure 3.2). Elevated Wattle densities are also recorded along the coastal zone, attributed to their ability to establish and proliferate in sandy, nutrient-poor coastal soils (Figure 3.2). Poplar densities are highest on agricultural properties, where these species were likely intentionally planted for ornamental purposes or as windbreaks between cultivated fields (Figure 3.2).

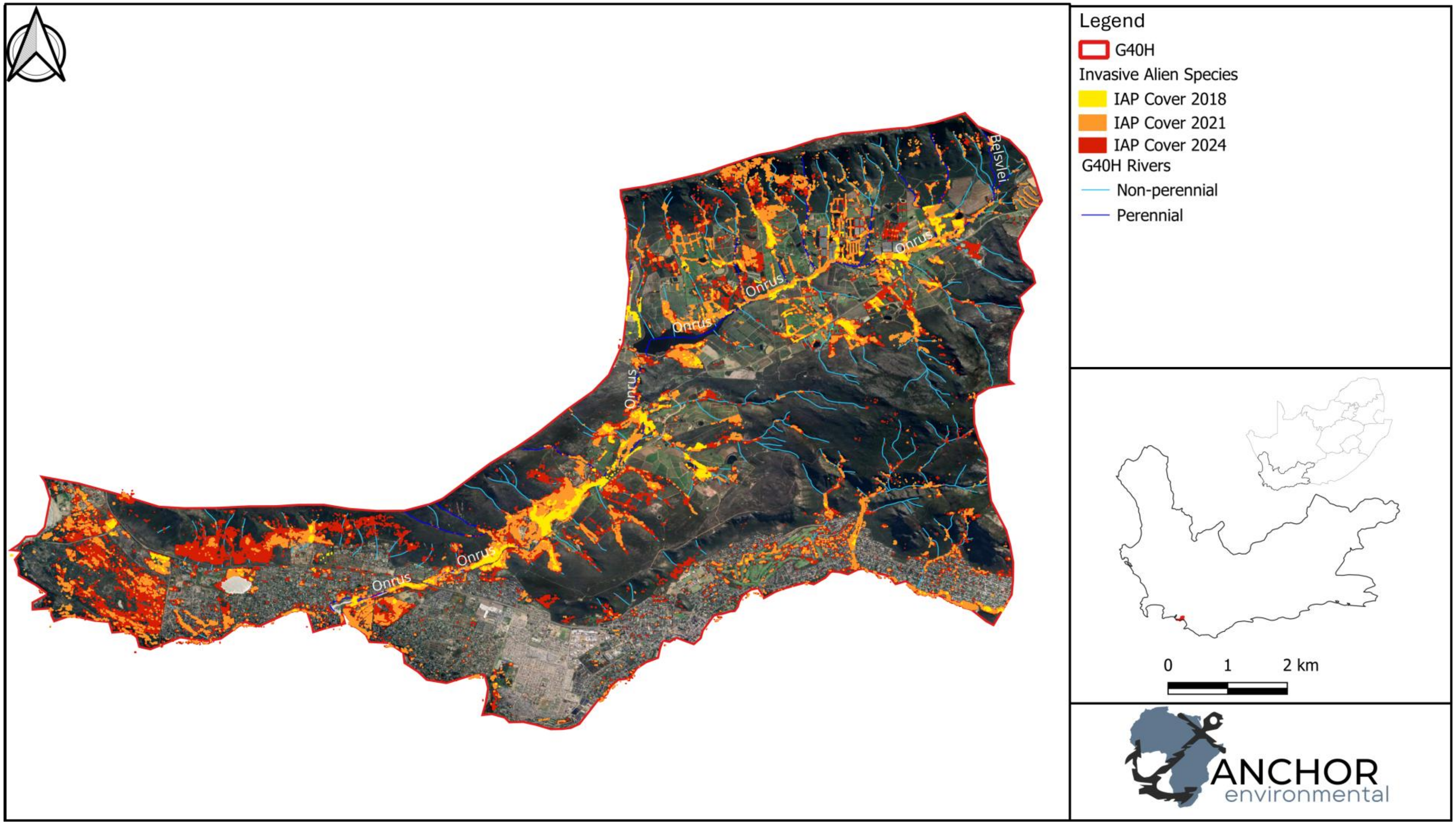

Figure 3.1. Invasive alien plant species cover over time in the G40H quaternary basin. Yellow indicates the IAP cover in 2018 (Lorentz et al., 2024), orange the IAP cover in 2021 (Lorentz et al., 2024) and red the IAP cover in 2024 (Lorentz et al., 2024).

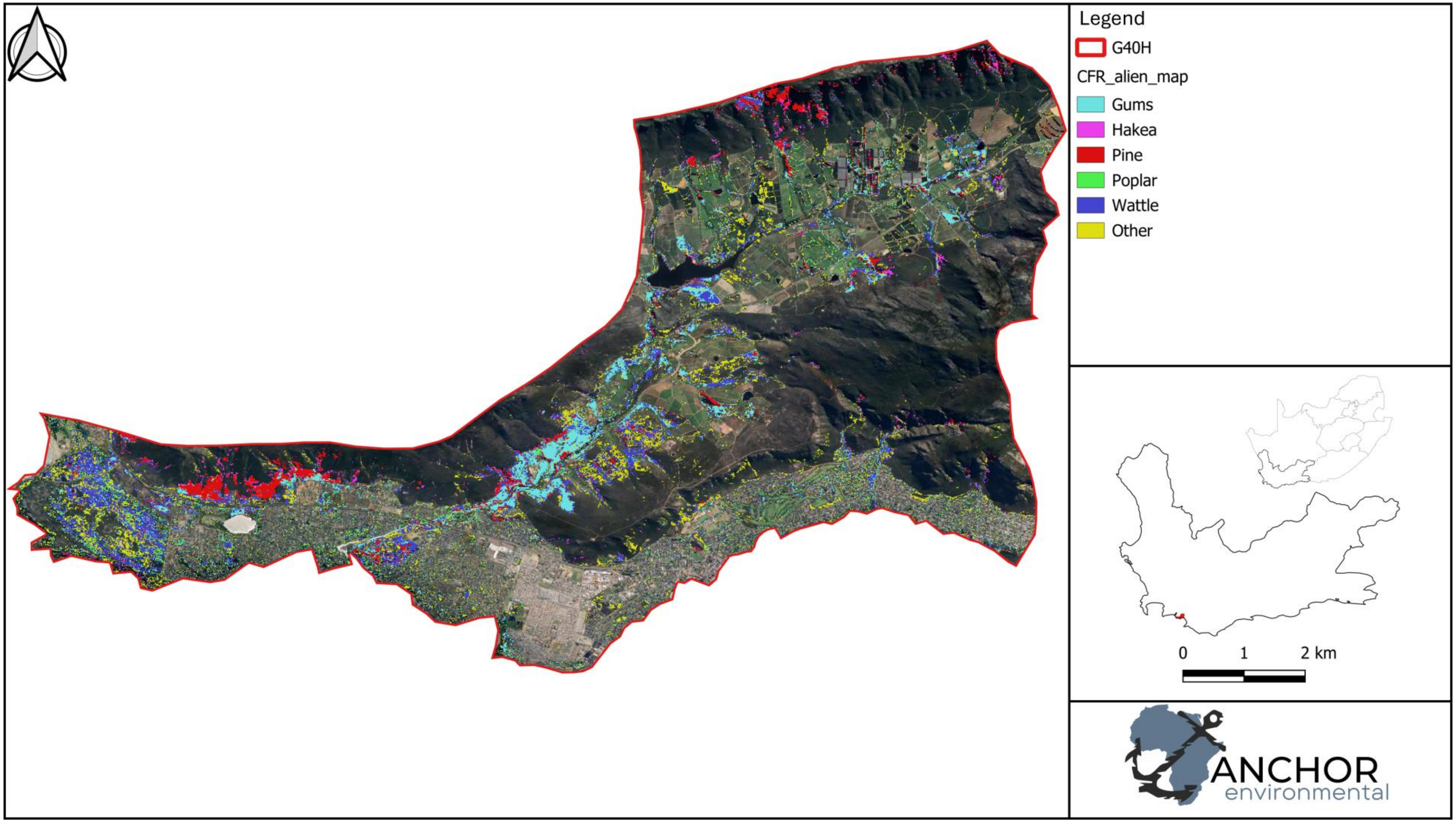

Figure 3.2. The 2024 invasive alien plant species distribution within the G40H quaternary basin (Rebelo & Coertze, 2024). Turquoise indicates the gum (eucalyptus) trees, pink represent Hakeas, red represent Pine trees, lime represent Poplar trees, blue represent Wattles and moss green represent the remaining IAPs.

3.3 Species Size Classes and Densities

For the purposes of this assessment, emphasis is placed on the 15 most prevalent woody IAPs from the five plant groups (Gums, Hakea, Pine, Poplar and Wattle) occurring along the Onrus River catchment. These species are listed in Table 3.1 along with each species' NEM: BA and CARA category.

Table 3.1. The 15 most prevalent woody IAP species present along the Onrus River Catchment. The NEMBA and CARA category is given for each species

Species	Common Name	NEMBA Category	CARA Category
Acacia cyclops	Rooikrans Wattle	1b	2
Acacia longifolia	Longleaf Wattle	1b	1
Acacia mearnsii	black wattle	2	2
Acacia saligna	Port Jackson Wattle	1b	2
Eucalyptus cladocalyx	sugar gum	a) Category 1b within- i. riparian areas; ii. a Protected Area declared in terms of the Protected Areas Act; or, iii. within a Listed Ecosystem or an ecosystem identified for conservation in terms of a Bioregional Plan or Biodiversity Management Plans published under the Act. b) Not listed within Nama-Karoo, Succulent Karoo and Desert biomes, excluding within any area mentioned in (a) above. c) Category 1b in Fynbos, Grassland, Savanna, Albany Thicket, Forest and Indian Ocean Coastal Belt biomes, but- i. Category 2 for plantations, woodlots, bee-forage areas, wind-rows and the lining of avenues. ii. Not listed within cultivated land that is at least 50 metres away from untransformed land, but excluding within any area in (a) above. iii. Not listed within 50 metres of the main house on a farm, but excluding in (a) above. iv. Not listed in urban areas for trees with a diameter of more than 400 mm at 1000 mm height at the time of publishing of this Notice, but excluding in (a) above.	2
Eucalyptus conferruminata	Spidergum	a) Category 1b within- i. riparian areas; ii. a Protected Area declared in terms of the Protected Areas Act; or, iii. within a Listed Ecosystem or an ecosystem identified for conservation in terms of a Bioregional Plan or Biodiversity Management Plans published under the Act. b) Not listed within Nama-Karoo, Succulent Karoo and Desert biomes, excluding within any area mentioned in (a) above.	

Species	Common Name	NEMBA Category	CARA Category
		c) Category 1b in Fynbos, Grassland, Savanna, Albany Thicket, Forest and Indian Ocean Coastal Belt biomes, but- i. Category 2 for plantations, woodlots, bee-forage areas, wind-rows and the lining of avenues. ii. Not listed within cultivated land that is at least 50 metres away from untransformed land, but excluding within any area in (a) above. iii. Not listed within 50 metres of the main house on a farm, but excluding in (a) above. iv. Not listed in urban areas for trees with a diameter of more than 400 mm at 1000 mm height at the time of publishing of this Notice, but excluding in (a) above.	
Eucalyptus camaldulensis	River red gum	a) Category 1b within- i. riparian areas; ii. a Protected Area declared in terms of the Protected Areas Act; or, iii. within a Listed Ecosystem or an ecosystem identified for conservation in terms of a Bioregional Plan or Biodiversity Management Plans published under the Act. b) Not listed within Nama-Karoo, Succulent Karoo and Desert biomes, excluding within any area mentioned in (a) above. c) Category 1b in Fynbos, Grassland, Savanna, Albany Thicket, Forest and Indian Ocean Coastal Belt biomes, but- i. Category 2 for plantations, woodlots, bee-forage areas, wind-rows and the lining of avenues. ii. Not listed within cultivated land that is at least 50 metres away from untransformed land but excluding within any area in (a) above. iii. Not listed within 50 metres of the main house on a farm, but excluding in (a) above. (iv) Not listed in urban areas for trees with a diameter of more than 400 mm at 1000 mm height at the time of publishing of this Notice, but excluding in (a) above.	2
Hakea drupacea	Sweet hakea	1b	1
Hakea gibbosa	Rock hakea	1b	1
Hakea salicifolia	Willow hakea	a) 1b in Western Cape. b) Not listed elsewhere.	
Hakea sericea	Silky hakea	1b	1
Pinus pinaster	cluster pine	a) 2 for plantations and wind-rows. b) 1b elsewhere. c) National Heritage Trees or National Monument Trees in terms of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), are not listed. d) Except for "a" above, specimens with a circumference greater than 1.256 m at a height of 1000 mm at the date of the first publication of this	2

Species	Common Name	NEMBA Category	CARA Category
		Notice (August 2014) are not listed for urban areas in Cape Town, the Overberg District Council and Winelands District Council, except i. when in a riparian area, or ii. when in a protected area or any property directly abutting a protected area, or iii. where they are ruled to pose a wildfire risk, where they remain listed as Category 1b. e) All specimens with a smaller circumference are Category 1b.	
Pinus radiata	Radiata pine	a) 2 for plantations and wind-rows. b) 1b elsewhere. c) National Heritage Trees or National Monument Trees in terms of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), are not listed. d) Except for “a” above, specimens with a circumference greater than 1.256 m at a height of 1000 mm at the date of the first publication of this Notice (August 2014) are not listed for urban areas in Cape Town, the Overberg District Council and Winelands District Council, except i. when in a riparian area, or ii. when in a protected area or any property directly abutting a protected area, or iii. where they are ruled to pose a wildfire risk, where they remain listed as Category 1b. e) All specimens with a smaller circumference are Category 1b.	2
Populus x canescens	Grey Poplar	2	2
Populus alba	white poplar	2	2

The IAP density for each MU is illustrated in Figure 3.3. Wattles were the most dominant species with the higher densities within the G40H basin (Figure 3.4), followed by Gums (Figure 3.5), Pines (Figure 3.6), Poplars (Figure 3.7), and Hakeas (Figure 3.8). The majority of the management units are currently within the initial clearing phase, and therefore the IAP community is predominantly composed of mature (adult) individuals. This study is accordingly restricted to adult IAP plants and specifically addresses the completion of the initial clearing phase.

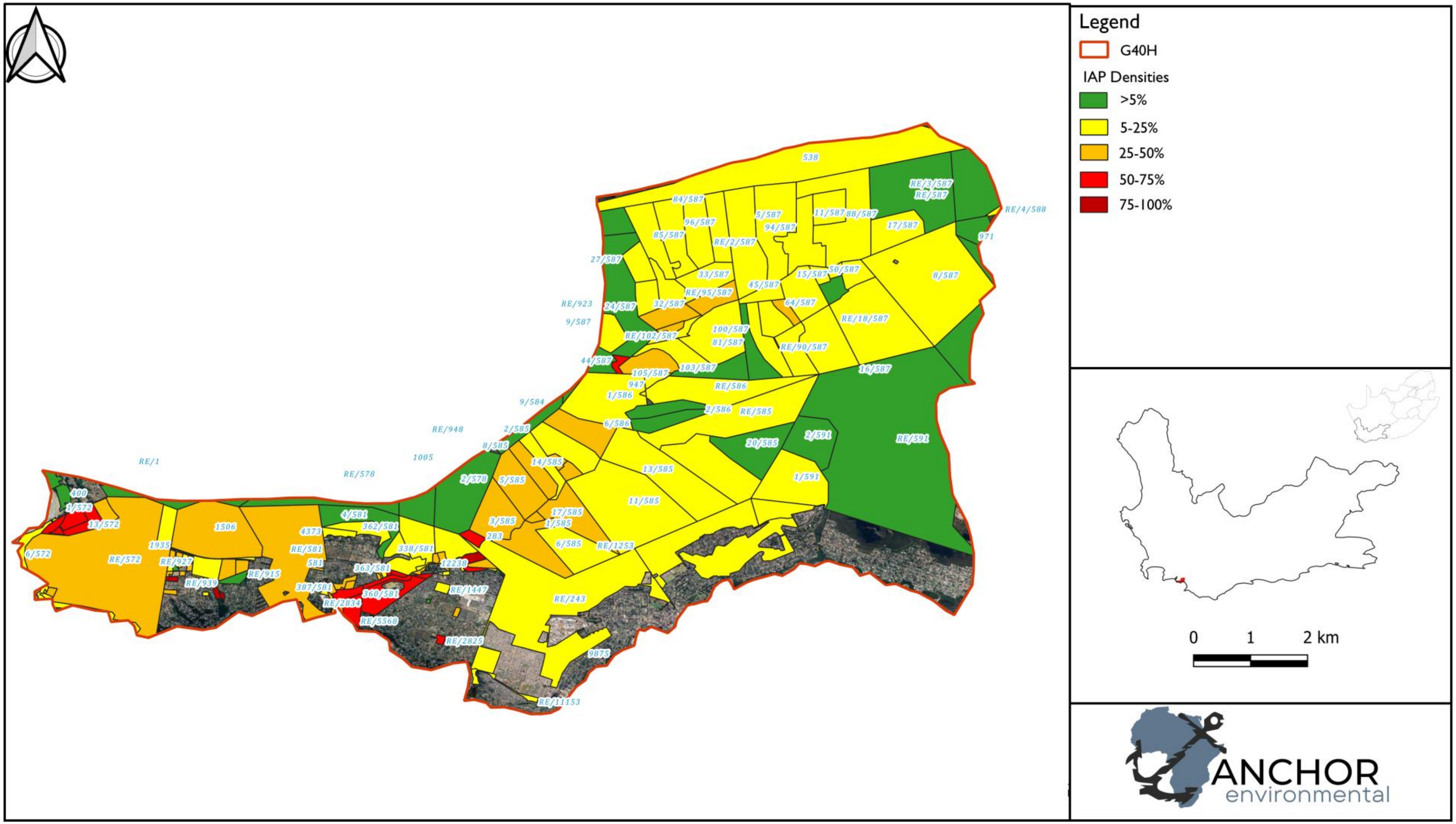

Figure 3.3. The IAP densities for each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

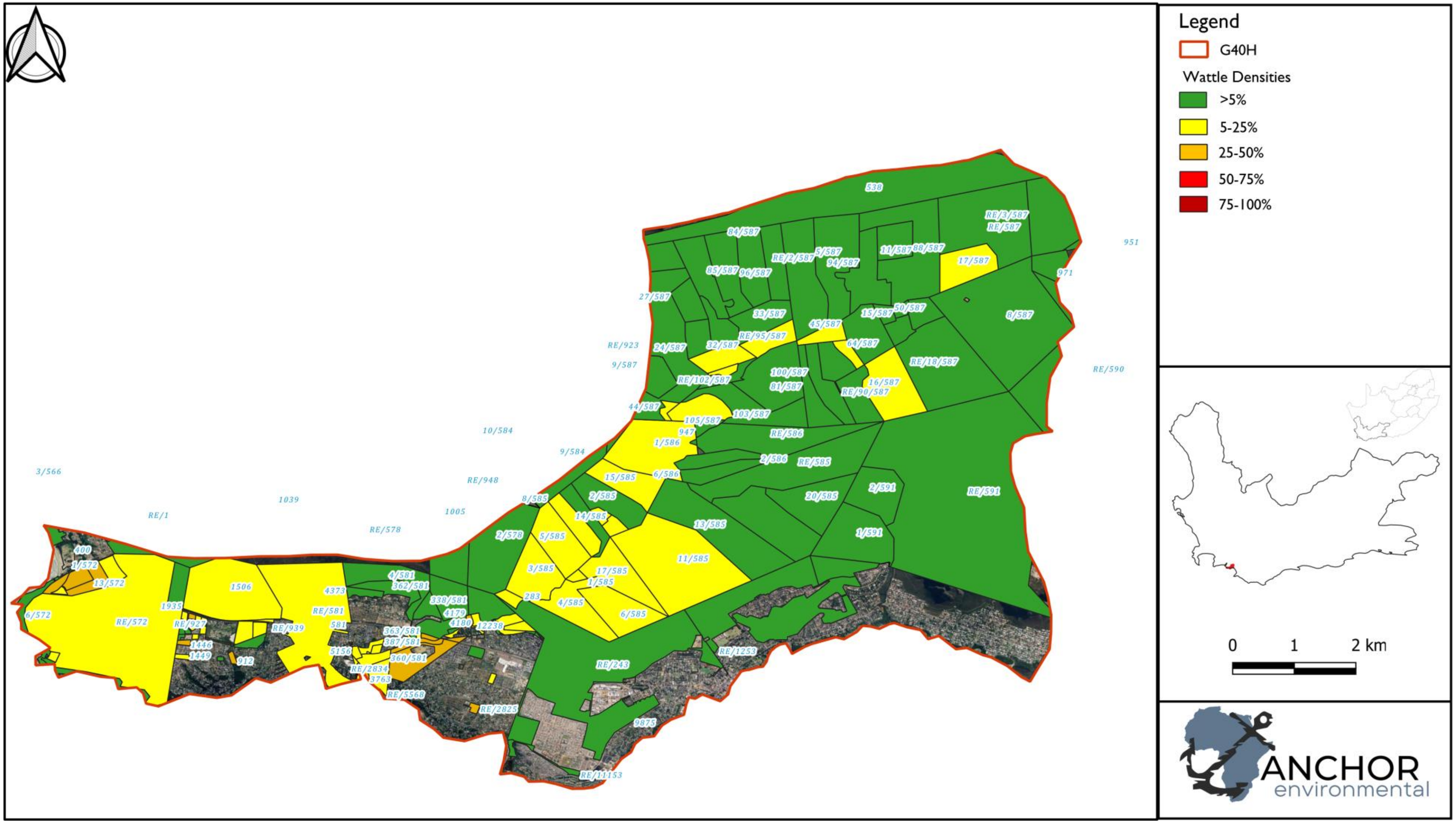

Figure 3.4. The densities of Wattles species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

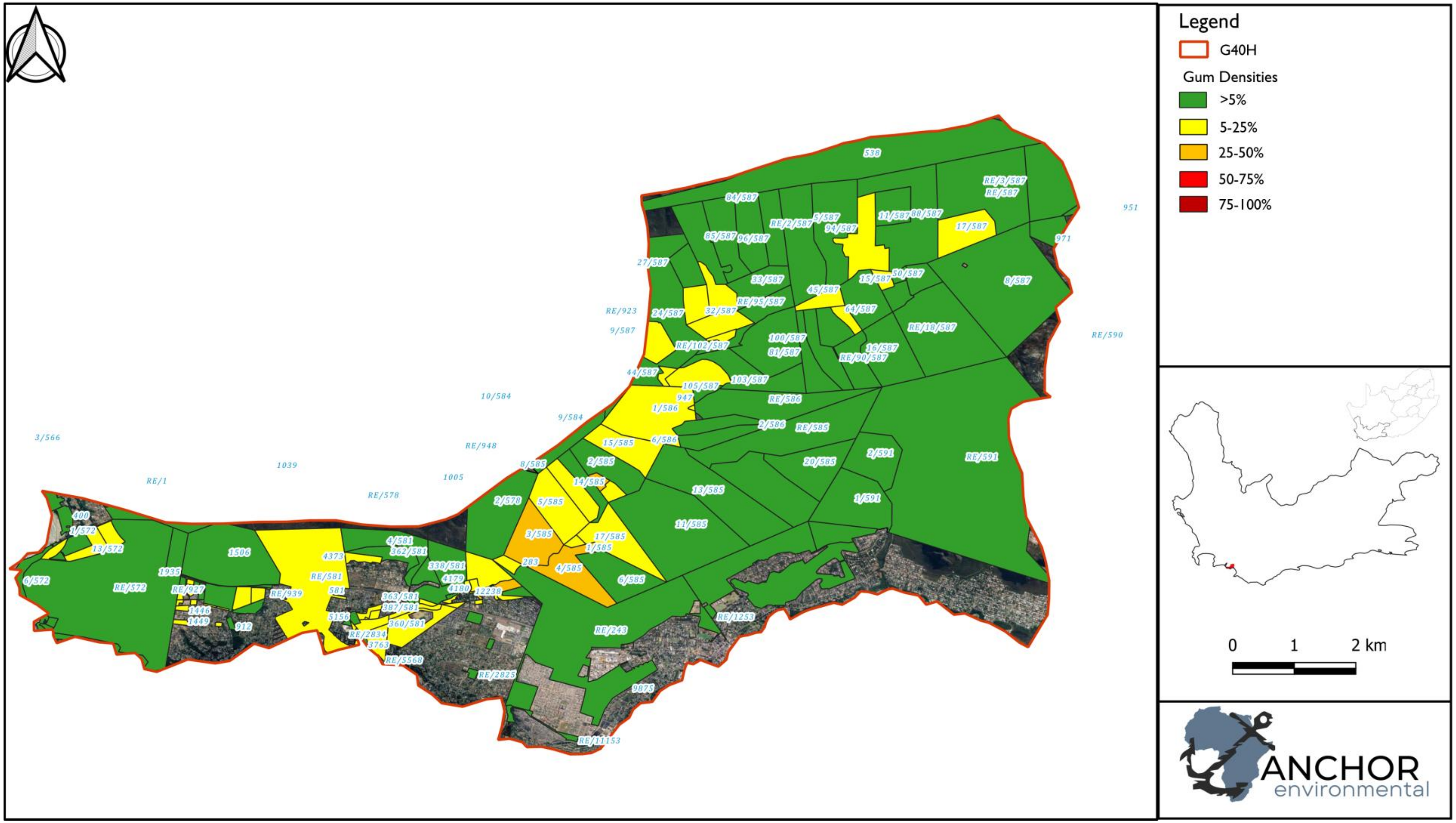

Figure 3.5. The densities of Gum species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

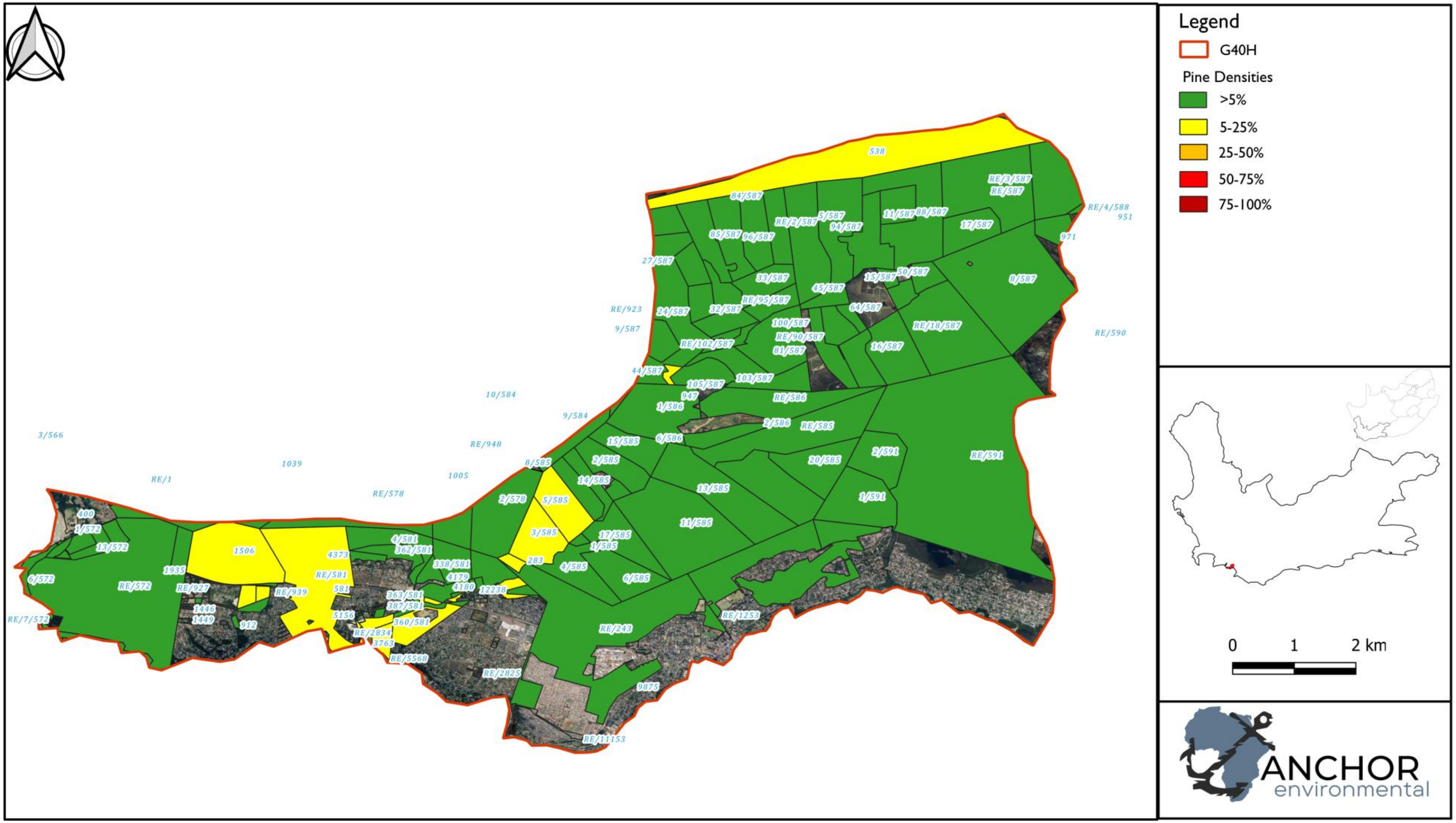

Figure 3.6. The densities of Pine species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

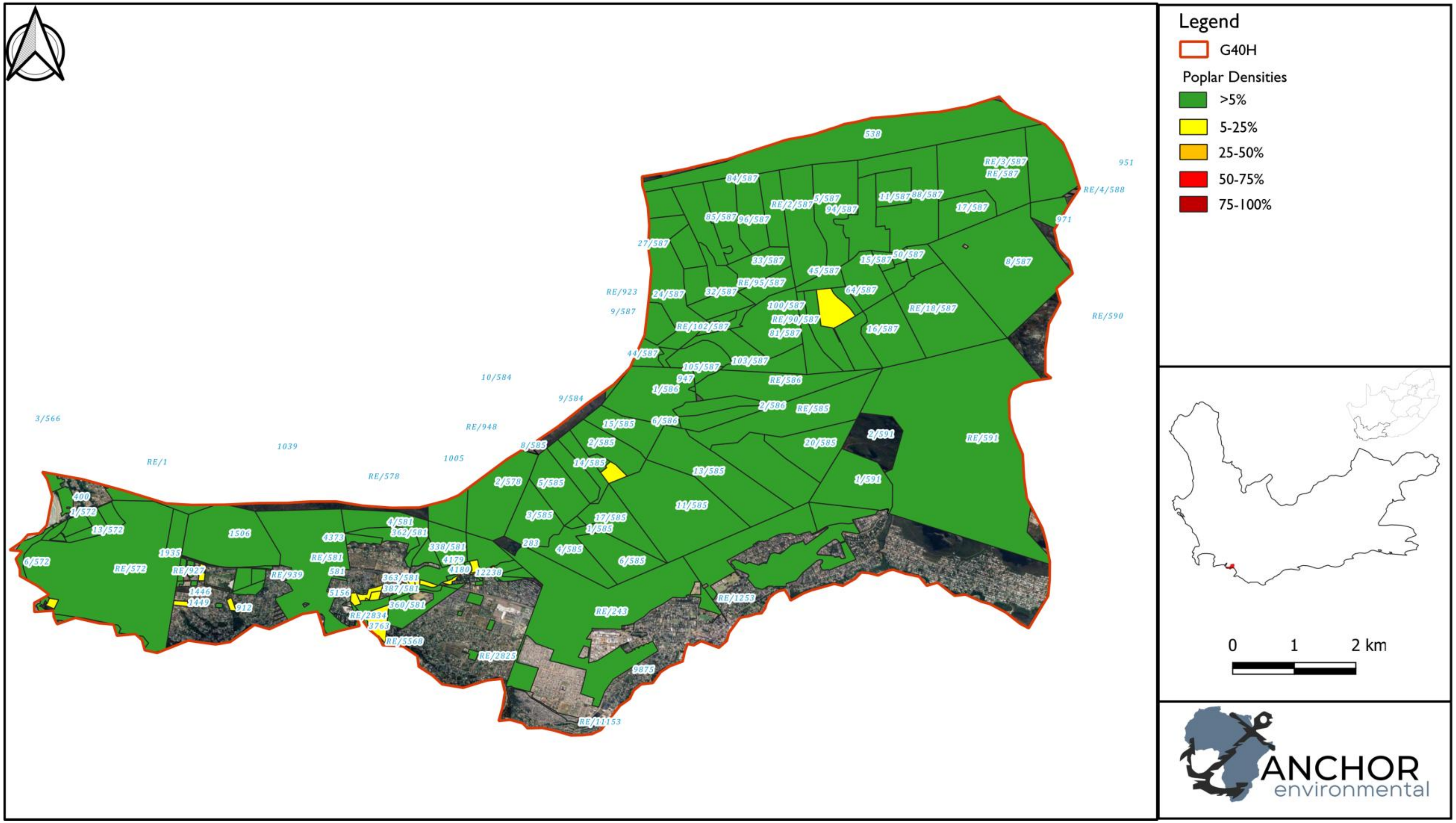

Figure 3.7. The densities of Poplar species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

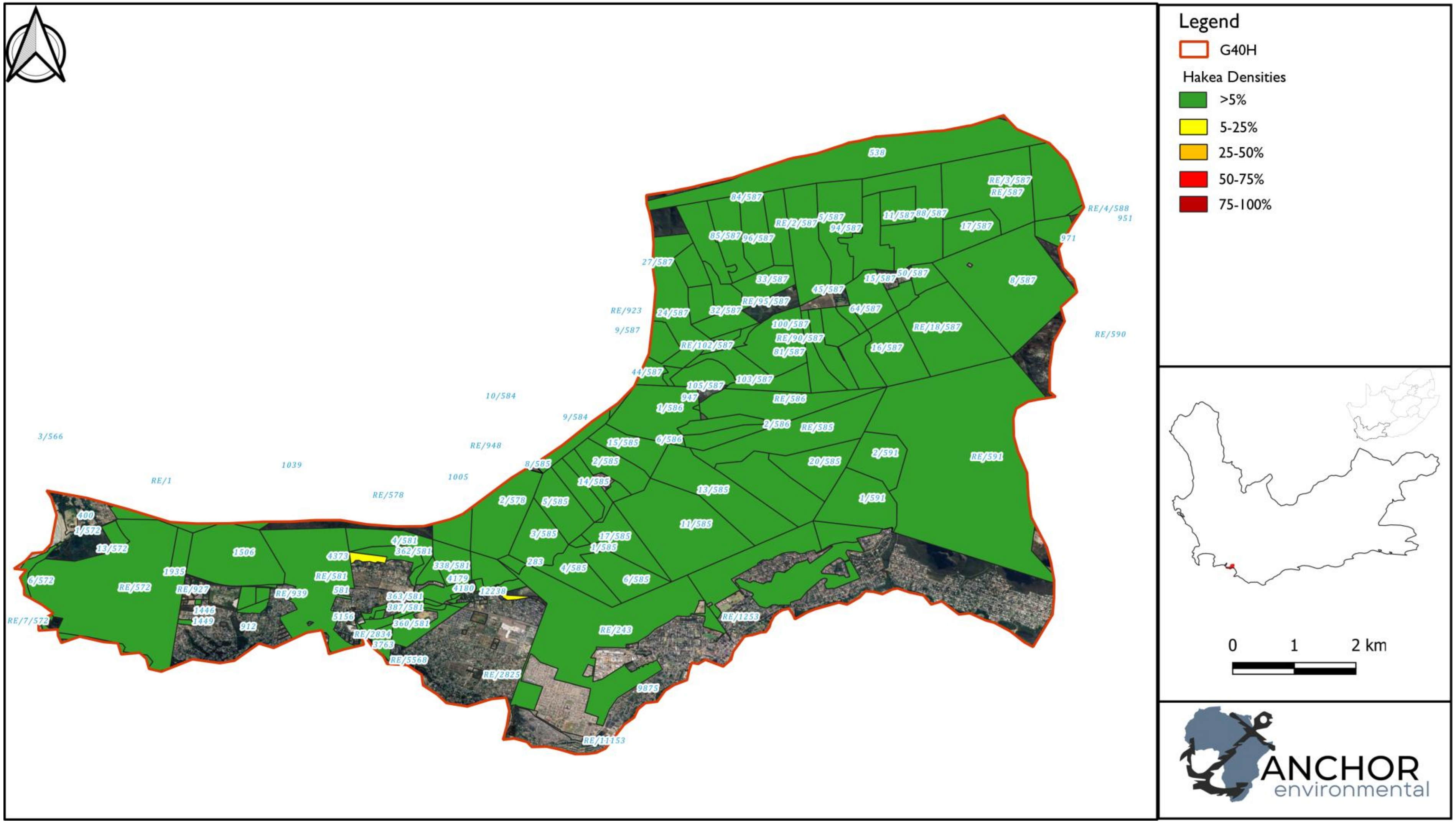

Figure 3.8. The densities of *Hakea* species within each management unit. Densities below 5% is represented in green, densities between 5 and 25% is represented in yellow, densities between 25 and 50% is represented in orange, densities between 50 and 75% is represented in red, and densities above 75% is represented in dark red.

4 INVASIVE ALIEN SPECIES CONTROL METHODS

4.1 Description of Control Methods

This chapter outlines the integrated management approach required to control IAP species, with specific reference to methods that would be most applicable to the Onrus River catchment.

Different IAP species require species-specific control interventions, as their morphology, reproductive strategies, and ecological impacts vary. In general, three broad control methodologies are applied: mechanical, chemical, and biological control, each with its own distinct advantages and limitations.

The clearing phase determines the extent and intensity of control required. Three primary clearing phases are recognised:

- Initial clearing phase — undertaken where little to no previous clearing has occurred, and focused primarily on the removal of mature (adult) plants.
- Follow-up clearing phase — conducted after initial clearing and targeting resprouting individuals and seedlings emerging from the seedbank. Multiple follow-up cycles are often required where persistent seedbanks are present.
- Maintenance phase — implemented once IAP populations have been largely eradicated, and typically limited to the removal of occasional individuals invading from adjacent areas.

For initial clearing operations, a combination of mechanical removal with the targeted application of herbicides is recommended. This integrated approach reduces reliance on herbicides by minimising chemical input while ensuring effective eradication of rootstock and regrowth. Follow-up treatments are typically more reliant on chemical control to suppress resprouting individuals and to eliminate seedlings germinating from soil-stored seedbanks. For long-term, sustainable management, biological control provides the most cost-effective solution. However, suitable biological control agents have not yet been developed for all IAP species, and implementation is therefore species-dependent. The control of IAPs generally requires an integrated management approach that combines at least two of the three available methods. Furthermore, control strategies should be adapted to the size class distribution of target species, as seedlings, young individuals, and mature plants respond differently to control techniques.

Species-specific control recommendations were primarily sourced from the Working for Water Programme (2007). Where species were not listed in the programme's database, recommended methods were extracted from relevant literature.

4.1.1 Mechanical Control

Mechanical control refers to the physical removal or destruction of invasive alien plants and includes techniques such as hand-pulling, ring-barking, cut stump, slashing, strip-barking, and frilling. The choice of method is determined by the species involved, the level of infestation, and site-specific conditions such as slope and accessibility. Mechanical control is generally most effective when plants are still small (e.g., seedlings), when target species do not coppice after cutting, and where infestations are sparse and spatially restricted. However, it is a labour-intensive method that can cause soil disturbance and erosion, and therefore requires careful planning, implementation, and post-treatment monitoring. Common mechanical methods include:

- Hand-pulling: Complete removal of the plant, including roots, by hand. Effective for seedlings, juveniles, herbs, and small shrubs, particularly in damp or soft soils. Recommended for sparsely infested sites.
- Ring-barking: Removal of bark and cambium in a horizontal band (~30 cm wide, ~50 cm above ground) to kill large trees. Herbicide application to the exposed surface is recommended immediately after treatment.
- Cut stump: Cutting trees as close to ground level as possible using saws, chainsaws, or cane knives. Immediate herbicide application to the cut surface is essential to prevent regrowth.
- Slashing: Removal of annuals or seed stalks before seed maturation using tools such as machetes, slashers, or brush cutters. This reduces seed set and subsequent seasonal germination.
- Strip-barking: Removal of bark from waist height to the base of the trunk with an axe or cane knife, followed by immediate herbicide application.
- Frilling: Cutting angled grooves into the bark and cambium around the tree trunk, into which herbicide is applied. This is effective for small trees and more efficient than ring-barking or strip-barking.

4.1.2 Chemical Control

Chemical control uses herbicides to kill or suppress invasive species. Herbicides fall into two main groups: selective herbicides, which target specific plant groups (e.g., broadleaf plants) and non-selective herbicides, which kill all plants on contact and are unsuitable for use in areas containing indigenous vegetation. The choice of herbicide and method of application must be species-specific and environmentally appropriate, particularly near sensitive ecosystems such as wetlands and rivers. Herbicide use is regulated under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947), and all contractors applying herbicides must hold the appropriate permits. Common chemical application methods include:

- Foliar spraying: Application of herbicide to plant leaves (for plants <1 m tall) using knapsack sprayers until the point of runoff. This method is cost-effective for treating large areas, though it requires substantial volumes of clean water. Operators must be trained and certified.
- Handheld spraying: Use of small, portable sprayers with adjustable nozzles to apply herbicide to cut stumps, ring-barked areas, or frilled/strip-barked wounds. This method is accurate and inexpensive but requires proper operator training.

- Injection: Direct introduction of herbicide into the plant by drilling or punching angled holes into the trunk circumference, followed by injection of herbicide into each cavity. This method is highly targeted and reduces chemical waste.

4.1.3 Biological Control

Biological control involves the introduction or use of a plant's natural enemies (e.g., insects, pathogens, or fungi) to reduce its competitive advantage and suppress vigour. While highly effective in reducing invasive plant densities and slowing spread, biological control seldom results in complete eradication. Instead, it is generally used as a long-term management strategy to complement mechanical and chemical control. The effectiveness of this method depends on the availability of host-specific control agents, which are not yet developed for all invasive alien species.

4.2 Species Specific Control Methods

Table 4.1 provides the most effective control methods for each life stage of the 15 most prevalent IAP species identified in the study area. Where available, the recommended herbicide and dosage rates are specified. In certain cases, however, chemical control is not effective or ecologically desirable. For example, *Hakea* species do not respond well to herbicide application, and such treatments may result in increased environmental degradation; therefore, no herbicide recommendations are provided for these species. Instead, the unique "fell-and-burn" technique has proven to be the most effective method of control. It is important to note that while fire can be a valuable tool for controlling Hakea, frequent or poorly timed burns may negatively impact indigenous vegetation and overall ecosystem functioning. As such, prescribed burning must be carefully planned, implemented under controlled conditions, and integrated with follow-up monitoring and control. Where available, biological control agents for specific IAP species are also indicated in Table 4.1, as these provide a valuable long-term management tool to reduce plant vigour and spread.

Table 4.1. The suggested control methods, herbicide dosages and applicable bio control agents for the 15 most prevalent IAP species (Working for Water, 2007a, 2007b) (a.i. = as indicated).

Species	Common Name	Treatment detail			Application detail				Planning detail			Bio-Control Agent
		Size class	**Treatment**	**Herbicide**	**Dosage**	**a.i. Litres**	**Mix Litres**	**% Mix a.i.**	**Density**	**Estimated Product Litres / Ha (or kg)**	**if Mix volume Litres / Ha**	
Acacia cyclops	Rooikrans Wattle	Seedlings	Hand pull	None								*Dasineura dielsi* (Cecidomyiidae) *Melanterius servulus* (Curculionidae)
		Seedlings, saplings and coppice	Foliar spray	**clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL** *Confront 360 SL (L7314)*	50ml / 10 Litres water and 0.5% Wetter & Dye	**0,05**	**10**	0,5	Closed / Dense	**1,50**	300	
				fluroxypyr 200 g/L EC *Starane 200 EC (L4918), Tomahawk 200 EC (L6652), Voloxypyr 200 EC (7776)*	25ml / 10 Litres water and 0.5% Wetter & Dye	**0,025**	**10**	0,25	Closed / Dense	**0,75**	300	
				triclopyr (butoxy ethyl ester) 240 g/L EC *Ranger 240 EC adjuvant incl. (L6179)* **NB: add buffer for ph 5-6**	100ml / 10 Litres water and 0.1% Dye	**0,1**	**10**	1	Closed / Dense	**3,00**	300	
				triclopyr (butoxy ethyl ester) 480 g/L EC *Garlon 4 EC (L3249) & 480 EC (L4916), Triclon EC (L6661), Viroaxe EC (L6663)*	50ml / 10 Litres water and 0.5% Wetter & Dye	**0,05**	**10**	0,5	Closed / Dense	**1,50**	300	
		Mature/Adult	Fell	None								
			Cut stump / Frill ***NB: for trial, not registered***	**triclopyr (-amine salt) 360 g/L SL** *Lumberjack 360 SL (L7295), Timbrel 360 SL (L4917)*	300ml / 10 Litres Water and 0.5% Wetter & Dye	**0,3**	**10**	3	Closed / Dense	**6,00**	200	

Species	Common Name	Treatment detail			Application detail				Planning detail			Bio-Control Agent
		Size class	Treatment	Herbicide	Dosage	a.i. Litres	Mix Litres	% Mix a.i.	Density	Estimated Product Litres / Ha (or kg)	if Mix volume Litres / Ha	
Acacia longifolia	Longleaf Wattle	Seedlings	Hand pull	None								*Melanterius ventralis* (Curculionidae) *Trichilogaster acaciaelongifoliae* (Pteromalidae)
		Seedlings, saplings and coppice	Foliar spray	**clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL** *Confront 360 SL (L7314)*	50ml / 10 Litres water and 0.5% Wetter & Dye	**0,05**	**10**	0,5	Closed / Dense	**1,50**	300	
				triclopyr (butoxy ethyl ester) 240 g/L EC *Ranger 240 EC adjuvant incl. (L6179)*	120ml / 10 Litres water and 0.1% Dye	**0,12**	**10**	1,2	Closed / Dense	**3,60**	300	
				triclopyr (butoxy ethyl ester) 480 g/L EC *Garlon 4 EC (L3249) & 480 EC (L4916), Triclon EC (L6661), Viroaxe EC (L6663)*	60ml / 10 Litres water and 0.5% Wetter & Dye	**0,06**	**10**	0,6	Closed / Dense	**1,80**	300	
		Mature/Adult	Cut stump / Frill ***NB: for trial, not registered***	**triclopyr (-amine salt) 360 g/L SL** *Lumberjack 360 SL (L7295), Timbrel 360 SL (L4917)*	300ml / 10 Litres Water and 0.5% Wetter & Dye	**0,3**	**10**	3	Closed / Dense	**6,00**	200	
Acacia saligna	Port Jackson Wattle	Seedlings	Hand pull	None								*Melanterius compactus* (Curculionidae) *Uromycladium tepperianum* (Basidiomycetes, Uredinales)
		Seedlings, saplings and coppice	Foliar spray	**clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL** Confront *360 SL (L7314)*	70ml / 10 Litres water and 0.5% Wetter & Dye	**0,07**	**10**	0,7	Closed / Dense	**2,10**	300	
				fluroxypyr 200 g/L EC *Tomahawk 200 EC (L6652)*	25 ml / 10 Litres water and 0.5%Wetter & Dye	**0,025**	**10**	0,25	Closed / Dense	**0,75**	300	

Species	Common Name	Treatment detail			Application detail				Planning detail			Bio-Control Agent
		Size class	Treatment	Herbicide	Dosage	a.i. Litres	Mix Litres	% Mix a.i.	Density	Estimated Product Litres / Ha (or kg)	if Mix volume Litres / Ha	
				glyphosate (ammonium) 680 g/kg WG *Roundup Max 680 WG (L6790)*	80gr / 10 Litres water and 0.1% Dye	**0,08**	**10**	0,8	Closed / Dense	**2,40**	300	
				glyphosate (isopropylamine) 360 g/L SL *Glyph 360 SL (L4767), Mamba 360 SL (L4817), Roundup 360 SL (L407), Springbok 360 SL (L6719)*	150ml / 10 Litres water and 0.1% Wetter & Dye	**0,15**	**10**	1,5	Closed / Dense	**4,50**	300	
				glyphosate (isopropylamine) 450 g/L SL *RoundUp Turbo 450 SL (L7166)*	120ml / 10 Litres water and 0.1% Dye	**0,12**	**10**	1,2	Closed / Dense	**3,60**	300	
				glyphosate (isopropylamine) . 480 g/L SL *Mamba Max 480 SL (L7714)*	110ml / 10 Litres water and 0.1% Dye	**0,11**	**10**	1,1	Closed / Dense	**3,30**	300	
				glyphosate (potassium) 500 g/L SL *Touchdown Forte Hitech 500 SL adjuvant incl.(L7305)*	100ml / 10 Litres water and 0.1% Dye	**0,1**	**10**	1	Closed / Dense	**3,00**	300	
				glyphosate (sodium) 500 g/kg WG *Kilo 500 WSG (L7431)*	300gr / 10 Litres water and 0.5% Dye	**0,3**	**10**	3	Closed / Dense	**9,00**	300	
				triclopyr (butoxy ethyl ester) 240 g/L EC *Ranger 240 EC adjuvant incl. (L6179)*	100ml / 10 Litres water and 0.1% Dye	**0,1**	**10**	1	Closed / Dense	**3,00**	300	

Species	Common Name	Treatment detail			Application detail				Planning detail			Bio-Control Agent
		Size class	Treatment	Herbicide	Dosage	a.i. Litres	Mix Litres	% Mix a.i.	Density	Estimated Product Litres / Ha (or kg)	if Mix volume Litres / Ha	
				triclopyr (butoxy ethyl ester) 480 g/L EC *Garlon 4 EC (L3249), Triclon EC (L6661), Viroaxe EC (L6663)*	50ml / 10 Litres water and 0.5% Wetter & Dye	**0,05**	**10**	0,5	Closed / Dense	**1,50**	300	
		Mature / Adult	Cut stump / Frill ***NB: for trial, not registered***	**clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL** Confront *360 SL (L7314)*	250ml / 10 Litres water and 0.5% Wetter & Dye	**0,25**	**10**	2,5	Closed / Dense	**5,00**	200	
				glyphosate (ammonium) 680 g/kg WG *Roundup Max 680 WG (L6790)*	265gr / 10 Litres water and 0.1% Dye	**0,265**	**10**	2,65	Closed / Dense	**5,30**	200	
				picloram (potassium salt) 240 g/L SL *Access 240 SL (L4920), Browser 240 SL (L7357)*	200ml / 10 Litres Water and 0.5% Wetter & Dye	**0,2**	**10**	2	Closed / Dense	**4,00**	200	
				triclopyr (-amine salt) 360 g/L SL *Lumberjack 360 SL (L7295), Timbrel 360 SL (L4917)*	300ml / 10 Litres Water and 0.5% Wetter & Dye	**0,3**	**10**	3	Closed / Dense	**6,00**	200	
Acacia mearsii	black wattle	Seedlings	Hand pull	None								*Cylindrobasidium laeve* *Melanterius maculatus* (Curculionidae)
		Seedlings and up to 1 m tall	Foliar spray	**clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL** *Confront 360 SL (L7314)*	30ml / 10 Litres water and 0.5% Wetter & Dye	**0,03**	**10**	0,3	Closed / Dense	**0,90**	300	

Species	Common Name	Treatment detail			Application detail				Planning detail			Bio-Control Agent
		Size class	Treatment	Herbicide	Dosage	a.i. Litres	Mix Litres	% Mix a.i.	Density	Estimated Product Litres / Ha (or kg)	if Mix volume Litres / Ha	
				fluroxypyr 200 g/L EC *Starane 200 EC (L4918), Tomahawk 200 EC (L6652), Voloxypyr 200 EC (7776)*	12.5ml / 10 Litres water and 0.5% Wetter & Dye	**0,0125**	**10**	0,125	Closed / Dense	**0,38**	300	
				glyphosate (ammonium) 680 g/kg WG *Roundup Max 680 WG (L6790)*	80gr / 10 Litres water and 0.1% Dye	**0,08**	**10**	0,8	Closed / Dense	**2,40**	300	
				glyphosate (isopropylamine) 240 g/L SL *Tumbleweed 240 SL (L4781)*	112.5ml / 10 Litres water and 0.1% Dye	**0,1125**	**10**	1,125	Closed / Dense	**3,38**	300	
				glyphosate (isopropylamine) 360 g/L SL *Glyph 360 SL (L4767), Mamba 360 SL (L4817), Roundup 360 SL (L407), Springbok 360 SL (L6719)*	150ml / 10 Litres water and 0.1% Dye	**0,15**	**10**	1,5	Closed / Dense	**4,50**	300	
				glyphosate (isopropylamine) 450 g/L SL *RoundUp Turbo 450 SL (L7166)*	120ml / 10 Litres water and 0.1% Dye	**0,12**	**10**	1,2	Closed / Dense	**3,60**	300	
				glyphosate (isopropylamine) 480 g/L SL *Mamba Max 480 SL (L7714)*	110ml / 10 Litres water and 0.1% Dye	**0,11**	**10**	1,1	Closed / Dense	**3,30**	300	

Species	Common Name	Treatment detail			Application detail				Planning detail			Bio-Control Agent
		Size class	Treatment	Herbicide	Dosage	a.i. Litres	Mix Litres	% Mix a.i.	Density	Estimated Product Litres / Ha (or kg)	if Mix volume Litres / Ha	
				glyphosate (sodium) 500 g/kg WG *Kilo 500 WSG (L7431)*	100gr / 10 Litres water and 0.1% Dye	**0,1**	**10**	1	Closed / Dense	**3,00**	300	
				triclopyr (butoxy ethyl ester) 240 g/L EC *Ranger 240 EC adjuvant incl. (L6179)*	50ml / 10 Litres water and 0.1% Dye	**0,05**	**10**	0,5	Closed / Dense	**1,50**	300	
				triclopyr (butoxy ethyl ester) 480 g/L EC Garlon *4 EC (L3249) & 480 EC (L4916), Triclon EC (L6661), Viroaxe EC (L6663)*	25ml / 10 Litres water and 0.5% Wetter & Dye	**0,025**	**10**	0,25	Closed / Dense	**0,75**	300	
		Up to 2m tall & Coppice	Spot spray	**clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL** *Confront 360 SL (L7314)*	50ml / 10 Litres water and 0.5% Wetter & Dye	**0,05**	**10**	0,5	Closed / Dense	**1,50**	300	
				fluroxypyr / picloram 80 / 80 g/L ME *Plenum 160 ME (L7702)*	75ml / 10 Litres water and 0.5% Wetter & Dye	**0,075**	**10**	0,75	Closed / Dense	**2,25**	300	
				glyphosate (isopropylamine) 240 g/L SL *Tumbleweed 240 SL (L4781)*	150ml / 10 Litres water and 0.1% Dye	**0,15**	**10**	1,5	Closed / Dense	**4,50**	300	

Species	Common Name	Treatment detail			Application detail				Planning detail			Bio-Control Agent
		Size class	Treatment	Herbicide	Dosage	a.i. Litres	Mix Litres	% Mix a.i.	Density	Estimated Product Litres / Ha (or kg)	if Mix volume Litres / Ha	
				glyphosate (potassium) 500 g/L SL *Touchdown Forte Hitech 500 SL adjuvant incl.(L7305)*	100ml / 10 Litres water and 0.1% Dye	**0,1**	**10**	1	Closed / Dense	**3,00**	300	
				triclopyr (butoxy ethyl ester) 240 g/L EC *Ranger 240 EC adjuvant incl. (L6179)*	150ml / 10 Litres water and 0.1% Dye	**0,15**	**10**	1,5	Closed / Dense	**4,50**	300	
				triclopyr (butoxy ethyl ester) 480 g/L EC *Garlon 4 EC (L3249) & 480 EC (L4916), Triclon EC (L6661), Viroaxe EC (L6663)*	75ml / 10 Litres water and 0.1% Wetter & Dye	**0,075**	**10**	0,75	Closed / Dense	**2,25**	300	
		Mature	Bark strip	None	Strip into the ground							
			Cut stump	**fluroxypyr / picloram 80 / 80 g/L ME** *Plenum 160 ME (L7702)*	200ml / 10 Litres water and 0.5% Wetter & Dye	**0,2**	**10**	2	Closed / Dense	**4,00**	200	
				imazapyr 100 g/L SL *Chopper 100 SL (L3444), Hatchet 100 SL (L7409)*	1000ml / 10 Litres Water and 0.1% Dye	**1**	**10**	10	Closed / Dense	**20,00**	200	

Species	Common Name	Treatment detail			Application detail				Planning detail			Bio-Control Agent
		Size class	Treatment	Herbicide	Dosage	a.i. Litres	Mix Litres	% Mix a.i.	Density	Estimated Product Litres / Ha (or kg)	if Mix volume Litres / Ha	
				picloram (potassium salt) 240 g/L SL Access *240 SL (L4920), Browser 240 SL (L7357)*	150ml / 10 Litres Water and 0.5% Wetter & Dye	**0,15**	**10**	1,5	Closed / Dense	**3,00**	200	
				triclopyr (-amine salt) 360 g/L SL *Lumberjack 360 SL (L7295), Timbrel 360 SL (L4917)*	300ml / 10 Litres Water and 0.5% Wetter & Dye	**0,3**	**10**	3	Closed / Dense	**6,00**	200	
			Frill	**picloram (potassium salt) 240 g/L SL** Access *240 SL (L4920), Browser 240 SL (L7357)*	600ml / 10 Litres Water and 2% Wetter & Dye	**0,6**	**10**	6	Closed / Dense	**12,00**	200	
Eucalyptus cladocalyx	sugar gum	Seedlings	Hand pull	None								None
		Mature plants	Cut stump	**fluroxypyr / picloram 80 / 80 g/L ME** *Plenum 160 ME (L7702)*	450ml / 10 Litres water and 0.5% Wetter & Dye	**0,45**	**10**	4,5	Closed / Dense	**9,00**	200	
Eucalyptus conferruminata	Spidergum	Seedlings	Hand pull	None								None
		All	Cut stump / Frill	**clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL** *Confront 360 SL (L7314)*	600ml / 10 Litres water and 0.5% Wetter & Dye	**0,6**	**10**	6	Closed / Dense	**12,00**	200	
		Seedlings	Hand pull	None								None

		Treatment detail			Application detail				Planning detail			
Species	**Common Name**	**Size class**	**Treatment**	**Herbicide**	**Dosage**	**a.i. Litres**	**Mix Litres**	**% Mix a.i.**	**Density**	**Estimated Product Litres / Ha (or kg)**	**if Mix volume Litres / Ha**	**Bio-Control Agent**
Eucalyptus camaldulensis	River red gum	Mature plants	Cut stump ***NB: for trial, not registered***	**fluroxypyr / picloram 80 / 80 g/L ME** *Plenum 160 ME (L7702)*	450ml / 10 Litres water and 0.5% Wetter & Dye	**0,45**	**10**	4,5	Closed / Dense	**9,00**	200	
Hakea drupacea	Sweet hakea	Seedlings	Hand pull	none								None
		All	Cut Stump NB cut below leaves	**Tebuthiuron**								
				triclopyr								
			Fell and burn	none								
Hakea gibbosa	Rock hakea	Seedlings	Hand pull	none								*Aphanasium australe* (Cerambycidae) *Erytenna consputa* (Curculionidae)
		All	Cut Stump NB cut below leaves	**Tebuthiuron**								
			Fell and burn	none								
Hakea salicifolia	Willow hakea	Seedlings	Hand pull	none								None
		All	Fell and burn	none								
Hakea sericea	Silky hakea	Seedlings	Hand pull	none								*Aphanasium australe* (Cerambycidae) *Carposina autologa* (Carposinidae) *Colletotrichum gloeosporioides* (asexual anamorph of *Glomerella* sp.) (Ascomycetes) *Cydmaea binotata* (Curculionidae)

Species	Common Name	Treatment detail			Application detail				Planning detail			Bio-Control Agent
		Size class	Treatment	Herbicide	Dosage	a.i. Litres	Mix Litres	% Mix a.i.	Density	Estimated Product Litres / Ha (or kg)	if Mix volume Litres / Ha	
		All	Fell and burn	none								*Erytenna consputa* (Curculionidae)
Pinus pinaster & *Pinus radiata*	cluster pine & Radiata pine	All	Cut down low	None								
			Ring bark	None								
		All	Frill ***NB: for trial, not registered***	**glyphosate (sodium) 500 g/kg WG** *Kilo 500 WSG (L7431)*	2,000 grams / 10 Litres water	**2**	**10**	20	Closed / Dense	**40,00**	200	
Populus x canescens	Grey Poplar	All	Cut stump / Frill	**imazapyr 100 g/L SL** *Chopper 100 SL (L3444) Hatchet 100 SL (L7409)*	500ml / 10 Litres Water	**0,5**	**10**	5	Closed / Dense	**10,00**	200	
				picloram (potassium salt) 240 g/L SL *ccess 240 SL (L4920), Browser 240 SL (L7357)*	200ml / 10 Litres Water and 0.5% Wetter & Dye	**0,2**	**10**	2	Closed / Dense	**4,00**	200	
				triclopyr (-amine salt) 360 g/L SL *Lumberjack 360 SL (L7295), Timbrel 360 SL (L4917)*	600ml / 10 Litres Water and 0.1% Wetter & Dye	**0,6**	**10**	6	Closed / Dense	**12,00**	200	

5 PLANNING AND BUDGET

5.1 CONTEXT

A comprehensive budget was formulated for the control of IAP species within the Onrus River catchment. In formulating this budget, several critical parameters must be systematically evaluated to ensure ecological efficacy, cost-effectiveness, and regulatory compliance. Key considerations include:

- Vegetation species composition: encompassing the identification of invasive taxa such as *Acacia mearnsii* and *Eucalyptus* species, alongside their density (e.g., stems per hectare), areal coverage (measured in hectares via GIS mapping), growth stage (e.g., seedling, sapling, or mature), and precise geospatial location to prioritise intervention zones.

- Terrain attributes: such as slope steepness (quantified in degrees or percentages) and site accessibility (e.g., via footpaths or vehicular routes), which directly influences requisite transport logistics, and the selection of control methods—whether manual, mechanical, or chemical—and the equipment deployed, such as chainsaws, brush cutters, or herbicide applicators.

- Labor requirements: necessitates the assessment of workforce skill levels (skilled for specialised tasks like herbicide mixing versus unskilled for basic clearing), optimal crew size, task rates (expressed as person-days per hectare) (Table 5.1), unit costs per individual (incorporating wages, protective gear, and accommodations like camping for remote sites if warranted), and seasonal availability to mitigate scheduling constraints.

- Methodology: the choice between chemical methods (e.g., foliar spraying or cut-stump application) and mechanical approaches (e.g., hand-pulling or ring-barking) must account for environmental impacts, with equipment maintenance (e.g., routine servicing to prevent breakdowns) and associated costs factored in to sustain operational efficiency.

- For chemical interventions, herbicide selection (e.g., glyphosate or triclopyr formulations), procurement costs, compatibility with the surrounding ecosystem (to minimize non-target effects on native flora and fauna), and climatic variables (e.g., rainfall patterns influencing application timing and efficacy) are paramount.

Ultimately, the program budget must encapsulate the total projected cost (aggregated from aforementioned elements), anticipated duration (e.g., initial clearing phase spanning 6–12 months), and the number of follow-up treatments (typically 2–5 over 3-5 years) required to achieve sustained eradication and prevent re-infestation, thereby aligning with integrated catchment management objectives under frameworks like the NEM: BA.

Table 5.1. The estimated person days/Ha required for the initial and 1st follow up treatment for the listed IAP species (Working for Water, 2007b).

Plant Type	Specie Example	Size Class	Clearing	Person Days/Ha (Initial & Follow Up @100% Density)
Seedlings	All species	Young	Foliar	5.10
			Hand pull	6.38
Non Sprouting Trees	Pines, Hakea, Rooikrans	Young	Lopping/Pruning	15.56
		Adult	Frilling	13.69
		Adult	Felling (Cut Stump)	25.5
Sprouting Trees	Wattle, Gums, Poplars	Young	Lopping/Pruning	22.5
		Adult	Frilling	19.84
		Adult	Felling (Cut Stump)	36.98

5.2 Budget Requirements for the Control of IAP species in the Study Area

Cost estimates for the control of IAP species are influenced by several key factors, including the species present, their density, the clearing phase (i.e. initial, follow-up, or maintenance), and the dominant size class of the individuals. Different IAP species require different control methods, which vary in effort, cost, and effectiveness. As such, the specific species composition of a MU has a direct impact on the total clearing cost. The clearing phase determines the extent and intensity of control required. Three primary clearing phases are recognised:

- Initial clearing phase
- Follow-up clearing phase
- Maintenance phase

Each clearing phase requires a different level of effort, and therefore incurs different costs. Similarly, different size classes require different control methods, with costs increasing with plant maturity. Initial clearing phases are generally the most expensive, as adult plants tend to dominate.

This study focuses on the 15 most prevalent woody IAP species recorded within the G40H catchment. These species were grouped into five woody invasive plant groups: Gums, Hakeas, Pines, Poplars, and Wattles. The density of each plant group per MU is visually represented in Figure 3.4–Figure 3.8. All management units within the G40H catchment are currently classified as being in the initial clearing phase, as clearing efforts to date have been largely confined to the Onrus River corridor. Field observations confirmed the dominance of mature stands; accordingly, the adult size class was used for costing purposes.

The budget breakdown for each MU is presented in Table 5.2. The costing approach accounts for both the size of each MU and the percentage cover (density) of the five invasive alien plant groups. These variables are used to calculate the number of person-days required to complete the initial IAP clearing for each MU. From this, the number of person-days required per hectare is derived. The person-days per hectare are then used to estimate the cost rate per hectare, which is subsequently applied to determine the total estimated cost of clearing the respective MU.

Table 5.2. The estimated budget for the initial IAP clearing of each management unit (MU). The density (in percentage IAP cover), the intervention type of the MU, the number of person days required to clear the MU, the estimated calendar days it will take a team of 10 people to clear the MU, the number of person days to clear a single hectare of the MU, the clearing rate per hectare for the specific MU, the size of the MU in hectares, and the total cost to do the initial clearing of the MU is provided.

Management unit	Density (% IAP Cover)	Intervention type (Initial/ follow-up)	Person-days	Estimated Calendar Days for a clearing Team of 10 People	Person-days/ha	Rate/ha	Size (ha)	Total cost of intervention
283	59,476%	Initial	540	53	65	R16 257,56	8,30593	R135 034,19
400	2,357%	Initial	51	5	5	R1 250,58	10,1817	R12 733,05
538	10,618%	Initial	7886	788	20	R5 002,33	394,312	R1 972 477,67
581	37,323%	Initial	88	8	35	R8 754,07	2,49177	R21 813,14
614	92,841%	Initial	78	7	85	R21 259,89	0,915548	R19 464,45
795	8,154%	Initial	17	1	10	R2 501,16	1,717	R4 294,50
905	4,888%	Initial	264	26	15	R3 751,75	17,5929	R66 004,08
912	82,690%	Initial	173	17	80	R20 009,31	2,1647	R43 314,15
927	9,756%	Initial	3	0,3	5	R1 250,58	0,614981	R 769,08
947	11,945%	Initial	48	4	5	R1 250,58	9,54403	R11 935,59
971	3,368%	Initial	650	65	10	R2 501,16	65,0185	R162 621,91
1000	43,640%	Initial	290	29	45	R11 255,24	6,43905	R72 473,03
1446	75,144%	Initial	151	15	70	R17 508,15	2,15586	R37 745,11
1449	40,314%	Initial	88	8	40	R10 004,65	2,20765	R22 086,78
1486	43,767%	Initial	30	3	20	R5 002,33	1,50799	R7 543,46
1487	47,153%	Initial	52	5	45	R11 255,24	1,1452	R12 889,50
1488	18,233%	Initial	30	3	20	R5 002,33	1,48082	R7 407,55
1490	29,238%	Initial	49	4	30	R7 503,49	1,64168	R12 318,33

Management unit	Density (% IAP Cover)	Intervention type (Initial/ follow-up)	Person-days	Estimated Calendar Days for a clearing Team of 10 People	Person-days/ha	Rate/ha	Size (ha)	Total cost of intervention
1492	42,453%	Initial	76	7	45	R11 255,24	1,69598	R19 088,66
1494	0,839%	Initial	6	1	5	R1 250,58	1,1146	R1 393,90
1495	16,736%	Initial	21	2	15	R3 751,75	1,37427	R5 155,91
1498	28,710%	Initial	37	3	35	R8 754,07	1,04493	R9 147,39
1506	37,349%	Initial	5321	532	35	R8 754,07	152,0244	R1 330 832,65
1735	26,114%	Initial	36	3	20	R5 002,33	1,7998	R9 003,19
1811	3,566%	Initial	3	0,3	5	R1 250,58	0,560927	R701,49
1916	18,291%	Initial	13	1	15	R3 751,75	0,874744	R3 281,82
1935	22,940%	Initial	90	9	30	R7 503,49	3,00783	R22 569,23
1940	39,293%	Initial	22	2	35	R8 754,07	0,636251	R5 569,79
2351	42,904%	Initial	26	2	40	R10 004,65	0,652621	R6 529,25
2570	9,511%	Initial	15	1	35	R8 754,07	0,420581	R3 681,80
3720	44,918%	Initial	36	3	40	R10 004,65	0,890507	R909,21
3763	38,557%	Initial	119	11	45	R11 255,24	2,64546	R29 775,28
4179	48,313%	Initial	106	10	50	R12 505,82	2,13191	R26 661,28
4180	42,867%	Initial	133	13	45	R11 255,24	2,96265	R33 345,33
4362	49,364%	Initial	150	15	50	R12 505,82	2,9981	R37 493,69
4363	61,451%	Initial	29	2	55	R13 756,40	0,520743	R7 163,55
4364	59,810%	Initial	15	1	50	R12 505,82	0,300952	R3 763,65
4365	44,528%	Initial	7	1	25	R6 252,91	0,269493	R1 685,12
4366	25,981%	Initial	8	1	20	R5 002,33	0,423389	R2 117,93
4373	17,388%	Initial	221	22	25	R6 252,91	8,85676	R55 380,52
5025	5,593%	Initial	490	49	20	R5 002,33	24,4951	R122 532,51

Management unit	Density (% IAP Cover)	Intervention type (Initial/ follow-up)	Person-days	Estimated Calendar Days for a clearing Team of 10 People	Person-days/ha	Rate/ha	Size (ha)	Total cost of intervention
5156	31,374%	Initial	73	7	25	R6 252,91	2,93236	R18 335,78
8035	14,533%	Initial	7	1	10	R2 501,16	0,688104	R1 721,06
8036	3,541%	Initial	3	0,3	5	R1 250,58	0,564884	R706,43
8074	15,193%	Initial	37	3	20	R5 002,33	1,84296	R9 219,09
9875	21,014%	Initial	253	25	15	R3 751,75	16,8936	R63 380,49
12238	47,492%	Initial	225	22	35	R8 754,07	6,42219	R56 220,32
1/572	49,343%	Initial	663	66	50	R12 505,82	13,2542	R165 754,62
1/585	27,651%	Initial	138	13	30	R7 503,49	4,59288	R34 462,63
1/586	17,982%	Initial	3163	316	25	R6 252,91	126,518	R791 105,55
1/591	5,988%	Initial	538	53	5	R1 250,58	107,552	R134 502,58
10/585	40,103%	Initial	254	25	40	R10 004,65	6,35855	R63 615,10
100/587	13,538%	Initial	867	86	20	R5 002,33	43,3592	R216 896,91
103/587	44,454%	Initial	1948	194	50	R12 505,82	38,9619	R487 250,44
104/587	15,216%	Initial	765	76	20	R5 002,33	38,2486	R191 332,01
105/587	3,123%	Initial	189	18	5	R1 250,58	37,7877	R47 256,61
11/585	23,641%	Initial	5957	595	25	R6 252,91	238,274	R1 489 905,66
11/587	10,634%	Initial	3799	379	25	R6 252,91	151,968	R950 242,09
13/572	72,621%	Initial	705	70	55	R13 756,40	12,8199	R176 355,67
13/585	8,168%	Initial	2450	244	15	R3 751,75	163,32	R612 735,07
14/572	67,965%	Initial	76	7	35	R8 754,07	2,17758	R19 062,69
14/585	37,244%	Initial	343	34	35	R8 754,07	9,80029	R85 792,45
15/585	26,852%	Initial	1448	144	25	R6 252,91	57,9097	R362 104,09
15/587	10,749%	Initial	66	6	10	R2 501,16	6,60516	R16 520,59

Management unit	Density (% IAP Cover)	Intervention type (Initial/ follow-up)	Person-days	Estimated Calendar Days for a clearing Team of 10 People	Person-days/ha	Rate/ha	Size (ha)	Total cost of intervention
16/587	20,205%	Initial	1818	181	20	R5 002,33	90,9177	R454 800,09
17/585	40,699%	Initial	1770	176	25	R6 252,91	70,7887	R442 635,31
17/587	24,330%	Initial	1776	177	30	R7 503,49	59,187	R444 109,12
2/578	2,433%	Initial	806	80	5	R1 250,58	161,117	R201 489,99
2/585	12,182%	Initial	882	88	15	R3 751,75	58,7766	R220 514,84
2/586	1,784%	Initial	151	15	5	R1 250,58	30,2774	R37 864,37
20/585	2,399%	Initial	427	42	5	R1 250,58	85,467	R106 883,48
24/587	11,383%	Initial	403	40	15	R3 751,75	26,8824	R100 855,92
27/587	14,029%	Initial	300	30	10	R2 501,16	30,0089	R75 057,17
3/572	5,354%	Initial	433	43	20	R5 002,33	21,6661	R108 380,92
3/585	47,352%	Initial	3919	391	55	R13 756,40	71,2533	R980 188,90
32/587	26,727%	Initial	471	47	15	R3 751,75	31,4289	R117 913,23
33/587	20,230%	Initial	496	49	10	R2 501,16	49,5799	R124 007,44
338/581	18,266%	Initial	798	79	25	R6 252,91	31,9174	R199 576,60
349/581	22,611%	Initial	17	1	25	R6 252,91	0,663408	R4 148,23
360/581	51,766%	Initial	508	50	50	R12 505,82	10,1612	R127 074,12
362/581	8,883%	Initial	223	22	5	R1 250,58	44,6931	R55 892,38
363/581	70,237%	Initial	136	13	60	R15 006,98	2,26378	R33 972,51
366/581	21,301%	Initial	42	4	25	R6 252,91	1,69009	R10 567,98
368/581	56,347%	Initial	48	4	50	R12 505,82	0,958349	R11 984,94
374/581	77,396%	Initial	535	53	80	R20 009,31	6,69287	R133 919,70
377/581	41,993%	Initial	32	3	35	R8 754,07	0,904905	R7 921,60
378/581	48,993%	Initial	45	4	55	R13 756,40	0,816437	R11 231,23

Management unit	Density (% IAP Cover)	Intervention type (Initial/ follow-up)	Person-days	Estimated Calendar Days for a clearing Team of 10 People	Person-days/ha	Rate/ha	Size (ha)	Total cost of intervention
383/581	14,018%	Initial	10	1	10	R2 501,16	0,99874	R2 498,01
387/581	39,281%	Initial	113	11	25	R6 252,91	4,50598	R28 175,48
4/581	2,249%	Initial	556	55	10	R2 501,16	55,5786	R139 011,17
4/585	41,007%	Initial	2777	277	40	R10 004,65	69,4277	R694 600,15
44/587	62,541%	Initial	306	30	50	R12 505,82	6,12401	R76 585,76
45/587	8,306%	Initial	602	60	10	R2 501,16	60,2009	R150 572,30
49/587	26,018%	Initial	231	23	20	R5 002,33	11,5306	R57 679,83
5/585	38,716%	Initial	2820	281	40	R10 004,65	70,488	R705 208,09
5/586	18,147%	Initial	19	1	25	R6 252,91	0,771477	R4 823,98
5/587	16,660%	Initial	2965	296	25	R6 252,91	118,605	R741 626,28
50/587	14,975%	Initial	194	19	20	R5 002,33	9,68311	R48 438,09
6/572	6,841%	Initial	545	54	10	R2 501,16	54,5218	R136 367,94
6/585	13,666%	Initial	1411	141	20	R5 002,33	70,5426	R352 877,17
6/586	4,657%	Initial	326	32	10	R2 501,16	32,6413	R81 641,23
64/587	17,915%	Initial	512	51	25	R6 252,91	20,4853	R128 092,72
65/587	12,744%	Initial	869	86	20	R5 002,33	43,4715	R217 458,67
7/585	13,658%	Initial	410	40	15	R3 751,75	27,3106	R102 462,42
70/587	9,841%	Initial	155	15	10	R2 501,16	15,5465	R38 884,34
8/572	65,078%	Initial	1619	161	60	R15 006,98	26,9832	R404 936,39
8/585	49,445%	Initial	1438	143	40	R10 004,65	35,9592	R359 759,37
8/587	10,860%	Initial	6339	633	20	R5 002,33	316,948	R1 585 477,62
81/587	4,276%	Initial	388	38	10	R2 501,16	38,8196	R97 094,17
84/587	12,423%	Initial	969	96	20	R5 002,33	48,4603	R242 414,28

Management unit	Density (% IAP Cover)	Intervention type (Initial/ follow-up)	Person-days	Estimated Calendar Days for a clearing Team of 10 People	Person-days/ha	Rate/ha	Size (ha)	Total cost of intervention
85/587	5,991%	Initial	626	62	10	R2 501,16	62,5984	R156 568,84
88/587	7,190%	Initial	586	58	15	R3 751,75	39,0802	R146 618,96
9/587	8,438%	Initial	596	59	15	R3 751,75	39,7023	R148 952,92
94/587	22,167%	Initial	1781	178	25	R6 252,91	71,2316	R445 404,72
96/587	11,759%	Initial	1673	167	25	R6 252,91	66,9273	R418 490,32
97/587	12,332%	Initial	1531	153	25	R6 252,91	61,2217	R382 813,72
RE/1	1,646%	Initial	1592	159	5	R1 250,58	318,4255	R398 217,14
RE/102/587	7,442%	Initial	987	98	10	R2 501,16	98,7611	R247 017,67
RE/11153	6,579%	Initial	82	8	10	R2 501,16	8,20848	R20 530,75
RE/1253	11,609%	Initial	1095	109	10	R2 501,16	109,5703	R274 053,25
RE/1291	68,036%	Initial	476	47	50	R12 505,82	9,52433	R119 109,54
RE/1447	16,911%	Initial	71	7	15	R3 751,75	4,78987	R17 970,37
RE/1489	32,342%	Initial	36	3	35	R8 754,07	1,05127	R9 202,89
RE/1496	25,021%	Initial	19	1	20	R5 002,33	0,999173	R4 998,19
RE/18/587	7,023%	Initial	1996	199	15	R3 751,75	133,107	R499 383,58
RE/19/585	8,026%	Initial	3420	342	30	R7 503,49	114,011	R855 480,50
RE/2/587	10,955%	Initial	2261	226	20	R5 002,33	113,099	R565 758,21
RE/243	8,180%	Initial	4083	408	10	R2 501,16	408,3313	R1 021 303,40
RE/25/587	27,194%	Initial	970	97	30	R7 503,49	32,3597	R242 810,71
RE/2702	6,519%	Initial	5	1	5	R1 250,58	1,07381	R1 342,89
RE/2825	54,301%	Initial	108	10	40	R10 004,65	2,70714	R27 084,00
RE/2834	65,055%	Initial	2369	236	60	R15 006,98	39,4896	R592 619,71
RE/3/587	3,811%	Initial	540	54	5	R1 250,58	108,108	R135 197,90

Management unit	Density (% IAP Cover)	Intervention type (Initial/ follow-up)	Person-days	Estimated Calendar Days for a clearing Team of 10 People	Person-days/ha	Rate/ha	Size (ha)	Total cost of intervention
RE/364/581	8,389%	Initial	25	2	10	R2 501,16	2,50322	R6 260,96
RE/370/581	42,093%	Initial	95	9	35	R8 754,07	2,73202	R23 916,30
RE/4/588	8,208%	Initial	52	5	15	R3 751,75	3,533	R13 254,92
RE/4780	15,600%	Initial	497	49	15	R3 751,75	33,1413	R124 337,72
RE/5057	14,506%	Initial	792	79	25	R6 252,91	31,7106	R198 283,50
RE/5568	54,419%	Initial	890	89	50	R12 505,82	17,8062	R222 681,10
RE/572	40,822%	Initial	18034	1803	40	R10 004,65	450,857	R4 510 668,53
RE/581	36,772%	Initial	5520	552	35	R8 754,07	157,729	R1 380 771,14
RE/585	14,267%	Initial	2535	253	15	R3 751,75	169,066	R634 292,60
RE/586	9,518%	Initial	1188	118	10	R2 501,16	118,826	R297 203,27
RE/587	4,028%	Initial	1866	186	10	R2 501,16	186,694	R466 952,24
RE/591	1,925%	Initial	4419	441	5	R250,58	883,843	R1 105 317,99
RE/7/572	39,510%	Initial	51	5	20	R5 002,33	2,55632	R12 787,55
RE/7/587	19,787%	Initial	576	57	25	R6 252,91	23,046	R144 104,54
RE/8034	55,862%	Initial	194	19	50	R12 505,82	3,88457	R48 579,73
RE/90/587	15,713%	Initial	466	46	15	R3 751,75	31,1217	R116 760,70
RE/915	4,528%	Initial	37	3	5	R1 250,58	7,50824	R9 389,67
RE/923	4,756%	Initial	2300	230	10	R2 501,16	230,047	R575 385,19
RE/927	10,386%	Initial	307	30	15	R3 751,75	20,5088	R76 943,80
RE/939	64,840%	Initial	352	35	60	R15 006,98	5,87604	R88 181,63
RE/95/587	17,678%	Initial	607	60	20	R5 002,33	30,376	R151 950,69
RE/9935	15,748%	Initial	2026	202	20	R5 002,33	101,349	R506 980,87

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