SCIENTIFIC TERRESTRIAL SERVICES

Part of the SAS Environmental Group of Companies

BIODIVERSITY OFFSET STRATEGY

FOR THE MACASSAR WASTEWATER TREATMENT WORKS (WWTW) EXPANSION PROJECT, MACASSAR, WESTERN CAPE.

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MANAGEMENT SUMMARY

The Macassar Wastewater Treatment Works (WWTW) Expansion Project aims to address the growing demand for wastewater treatment in the region, ensuring sustainable water resource management and improved environmental health. The proposed expansion will increase the plant's capacity from 30 Mega litres per day (Ml/day) to 80Ml/day, addressing current capacity constraints that have led to inadequate wastewater treatment and subsequent impacts on the Eerste River Estuary. The WWTW expansion is essential for safeguarding human and ecological health in the surrounding communities and ecosystems.

Desirability & Need for the Expansion Activities

The Macassar WWTW expansion project provides necessary infrastructure development that is required to meet the increasing demand for wastewater treatment from surrounding communities, including Khayelitsha, Somerset West, and Gordon's Bay. The expansion of the WWTW is considered pertinent for the following reasons:

- The expansion of the WWTW is essential to protect local water resources, ensuring that the Eerste River, which flows into the Helderberg MPA, maintains its ecological function; and
- From a socio-cultural perspective, the health and wellbeing of local communities are directly linked to the proper functioning of the WWTW.

Despite the socio-economic and environmental benefits of the project, the expansion activities will result in significant residual impacts on threatened ecosystems, including the loss of *Endangered (EN) Cape Flats Dune Strandveld* vegetation. To address this, a comprehensive **Biodiversity Offset Strategy** has been developed.

Candidate Offset Sites

Available like-for-like offset options (in terms of vegetation type) are limited due to the extensive development and urbanisation within the Cape Flats Dune Strandveld. Consequently, there is a scarcity of intact Cape Flats Dune Strandveld within the Cape region. This makes identifying suitable offset areas particularly challenging, especially when considering the need for large, contiguous sites and the difficulties associated with purchasing or establishing stewardship agreements with existing landowners. As such, trading up offsets were considered where necessary; the trading-up principle in biodiversity offsetting and compensation refers to a strategy where a loss of biodiversity in one area is compensated by conserving or enhancing biodiversity in another area with higher ecological value.

An alternatives analysis identified eight (8) potential offset sites. Three (3) sites (Options 1, 7, and 8) were selected based on their suitability for achieving biodiversity offset targets:

- **Option 1**: Located within the WWTW property, this site satisfies "like-for-like" criteria for Cape Flats Dune Strandveld vegetation. This option is located within the WWTW property thus negating the need for additional purchasing of property;
- **Option 7**: This option is located within the EN Cape Flats Dune Strandveld, thus satisfying the 'like-for-like' criteria pertaining to vegetation type. The property is also state-owned; and
- **Option 8**: Although Option 8 is not located within the same vegetation type as that of the WWTW (i.e., EN Atlantis Sand Fynbos and EN Swartland Granite Renosterveld *vs*. EN Cape Flats Dune Strandveld), the use of Option 8 as an offset is still considered acceptable as it involves an even trade of EN vegetation for EN vegetation. Available like-for-like offset options (in terms of vegetation type) are limited due to the extensive development and urbanisation within the Cape Flats Dune Strandveld. Consequently, there is a scarcity of intact Cape Flats Dune Strandveld within the Cape region. This makes identifying suitable offset areas particularly challenging, especially when considering the need for large, contiguous sites and the difficulties associated with purchasing or establishing stewardship agreements with existing landowners. Although the Swartland Granite Renosterveld and the Atlantis Sand Fynbos vegetation types are considered EN, they are under a higher degree of threat than that of the EN Cape Flats Dune Strandveld (56 % and 52 % vs 20 % respectively). Specifically, the vegetation types associated with Option 8 have the following threat trigger criteria as per the 2022 Red Listed

Ecosystem (RLE; SANBI, 2022[1]): (1) decline in extent between 1990 – 2040, (2) historical decline in extent (national and regional data), and (3) restricted distribution and a high rate of loss with the presence of threatening processes. The property is also state-owned. As with the Swartland Granite Renosterveld, the Atlantis Sand Fynbos offers a unique trading up scenario. This vegetation type has a REE % of 52 % (2023 Biodiversity Offset Guidelines). As with the EN Cape Flats Dune Strandveld, the Atlantis Sand Fynbos has the following threat trigger criteria (as per the 2022 RLE (SANBI, 2022)): Restricted distribution and a high rate of loss with the presence of threatening processes.

These options align with the **2023 Biodiversity Offset Guidelines**, addressing key principles such as ecological equivalence, conservation priorities, and spatial connectivity. **Note**: The exact extent at Paardevlei (Option 7) needs to be confirmed and it is currently unclear what may be available to contribute to the offset (depending on internal City of Cape Town (CoCT) departmental ownership). What is unavailable at Paardevlei will need to be added to the area allocated from Option 8.

Offset Ratios and Calculations

The Cape Flats Dune Strandveld in the WWTW Area of Influence is classified as EN, with a remaining extent of 56% and a protection level deemed Moderately Protected. Based on the conservation status and ecosystem threat level of the vegetation type, offset ratios were calculated. The calculated ratio reflects the high ecological value of the vegetation and the need for robust compensatory measures. Specific calculations included the determination of (1) Basic Offset Ratios and (2) Adjusted Offset Ratios.

Basic Offset Ratios:

- A **basic offset ratio of 2:1** was initially calculated based on the remaining extent and protection level of the Cape Flats Dune Strandveld;
- The 2023 Biodiversity Offset Guidelines recommend a **10:1 basic offset ratio** for EN ecosystems due to their high threat status; and
- Using the precautionary principle, the **higher ratio (10:1)** was applied.

Adjusted Offset Ratios:

- Offset ratios were further refined to account for **Critical Biodiversity Areas (CBAs)** and habitat sensitivity:
  - **High Sensitivity CBA Habitat**: Offset ratio adjusted by a factor of 2; and
  - **Medium Sensitivity CBA Habitat**: Offset ratio adjusted by a factor of 1.5.
- Low sensitivity areas, such as sediment and settling dam overflow ponds, were excluded from calculations as they do not support functioning CBA habitat.

Offset Requirements:

- Ground-truthing confirmed that habitats within the WWTW Area of Influence (excluding the settling ponds) are functioning CBA habitats, with ecological integrity varying by sensitivity.
- Based on the determined residual losses and adjusted offset ratios:
  - **High Sensitivity CBA Habitat:** 7.1 ha residual loss required an offset of 142.8 ha; and
  - **Medium Sensitivity CBA Habitat:** 2.2 ha residual loss required an offset of 33.5 ha.

Total Offset Requirement: 176.3 ha of Cape Flats Dune Strandveld or a suitable alternative of conservation significance is needed to comply with the 2023 Biodiversity Offset Guidelines.

The offset ratios applied in this biodiversity offset strategy were derived in alignment with the sensitivity and conservation significance of the impacted habitats within the WWTW Area of Influence. Instead of a uniform 30:1 ratio (as recommended by Boucher (2023)), varying ratios (**averaging a ratio of 18.8: 1**) were calculated based on the ecological sensitivity, protection levels, and threat statuses of the habitat types observed.

Offset Gains

[1] **SANBI. 2022.** *Detailed Red List Assessments for South African Terrestrial Ecosystems*. South African National Biodiversity Institute. Available at: https://opus.sanbi.org

The selected Offset Area (Options 1, 7, and 8) were evaluated for their ability to deliver meaningful conservation gains, including:

- **Ecological Equivalence**: The sites support comparable vegetation types (Cape Flats Dune Strandveld, Swartland Granite Renosterveld, and Atlantis Sand Fynbos) to those impacted by the project, ensuring alignment with "like-for-like" principles (in the case of the Cape Flats Dune Strandveld) and a special case of trading-up for the Swartland Granite Renosterveld;
- **Ecological Connectivity**: The offset areas are strategically located within broader ecological corridors, improving landscape connectivity and resilience;
- **Rehabilitation Potential**: Degraded portions of the offset sites provide opportunities for significant biodiversity gains through targeted rehabilitation, such as alien invasive species removal and revegetation; and
- **Protection of Species of Conservation Concern (SCC)**: The offset areas, particularly Option 8, supports numerous SCC, further enhancing their ecological value.

As an Additional Conservation Action (ACA), rehabilitation efforts that focus on the Eerste River, located immediately east of the WWTW will take place. This area is degraded, as evidenced by the presence of invasive species such as *Cenchrus clandestinus* (formerly *Pennisetum clandestinum*) and *Acacia cyclops*, as well as areas of erosion. Targeted rehabilitation activities in this area would significantly benefit the ecosystem, particularly as the river flows into the estuary.

Rehabilitation and Management Plan

A Rehabilitation and Management Plan has been designed to guide offset implementation. Key components include:

- **Erosion Control**: Measures such as brush packing, contouring, and gabion installation will stabilize soils and prevent further degradation;
- **Alien Invasive Plant Control**: Targeted removal of invasive species will improve habitat quality and support natural vegetation recovery;
- **Fire and Grazing Management**: Controlled burning and rotational grazing systems will be implemented to maintain ecosystem balance and prevent overutilization; and
- **Monitoring and Adaptive Management**: Long-term monitoring will assess rehabilitation success and guide adaptive strategies.

Across the Offset Areas, rehabilitation and management efforts will focus on enhancing the overall ecological condition and increasing the representation of floral species to reflect the reference vegetation type(s). It must however be noted that refinement of this concept plan will be required at the implementation phase and adaptive management principles must be applied. This will require the compilation of a more detailed offset implementation plan for each of the respective Offset Areas, as applicable.

Offset Budget

The specialist has provided the proponent, the CoCT, with a comprehensive and detailed budget for the implementation, management, and long-term sustainability of the Biodiversity Offset Strategy (including management activities as highlighted in the Rehabilitation and Management Plan). The proponent has reviewed and acknowledged the budget, demonstrating a clear understanding and acceptance of the associated financial commitment. CoCT has committed to allocating the necessary resources to ensure the successful implementation of the offset strategy, thereby supporting its long-term ecological and conservation goals in alignment with the 2023 Biodiversity Offset Guidelines.

Offset Conditions and Considerations

The Biodiversity Offset Strategy was developed to meet regulatory requirements and ensure the long-term success of the offsets. Key conditions and considerations include:

- **Offset Agreement**: A formal Offset Agreement is in place between the CoCT's Wastewater Treatment Branch and the Biodiversity Management Branch. The Agreement defines the roles, responsibilities, and commitments for the implementation and management of the Offset Areas;
- **Offset Site Legal Security**: The offset sites must be legally secured as conservation areas under appropriate legislative frameworks (e.g., the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA)) to ensure their long-term protection and management;

- **Rehabilitation and Management Requirements**: Offset sites will require ongoing management actions such as invasive species control, erosion control, and fire management to achieve the desired ecological outcomes;
- **Monitoring and Adaptive Management**: Long-term monitoring programs must be implemented to assess the effectiveness of the offsets. Adaptive management will address unforeseen challenges and refine interventions based on ecological feedback; and
- **Sustainability Considerations**: Offset activities must align with broader conservation goals, supporting the long-term sustainability of ecosystems, species, and ecological processes within the Area of Influence and beyond.

Conclusion

The proposed Biodiversity Offset Strategy ensures compliance with best practice guidelines and regulatory requirements, addressing residual impacts from the WWTW expansion. By leveraging suitable Offset Areas and implementing robust rehabilitation measures, the Offset Strategy supports both ecological sustainability and regional conservation goals. The WWTW expansion project will deliver necessary infrastructure improvements while demonstrating a commitment to balancing development with environmental stewardship.

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GLOSSARY OF TERMS

Ecological Condition	"Ecological condition" means the extent to which the composition, structure and function of an area or biodiversity feature has been modified from a reference condition of "natural".
Ecological Deficit (2023 Biodiversity Offset Guidelines)	The term **"ecologically deficient"** is used to describe habitats or ecosystems that have been significantly degraded or altered in such a way that they no longer function as they originally did or no longer support the biodiversity they once contained. These areas are typically characterized by altered ecosystem function, degraded habitat, loss of native species, and reduced capacity for rehabilitation.
Ecological Rehabilitation	The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed, aiming to restore ecological functionality, biodiversity, and natural processes, though not necessarily to its original state.
Functional Offset Targets	Functional offset targets in the context of offsets refer to measurable goals aimed at rehabilitating, enhancing, or maintaining the ecological functions and services of ecosystems (be it freshwater or terrestrial or both) to compensate for the loss or degradation caused by development or other impacts. These targets focus on ensuring that the offset areas not only replace the physical extent of the impacted ecosystem but also sustain or improve key ecological processes and services.
Mitigation Hierarchy	A framework used in environmental management and conservation to minimize negative impacts on biodiversity and ecosystems during development projects. It consists of a sequence of steps aimed at avoiding, minimizing, restoring, and offsetting environmental damage. The hierarchy is typically structured in four key stages, namely avoidance, minimisation, rehabilitation, and offsetting.
Net Positive Impact	Net Positive Impact represents an approach where development and/or mining projects contribute to a net gain for biodiversity and ecosystems rather than just mitigating or compensating for losses.
No Net Impact	No Net Impact refers to the concept in environmental management where development activities (such as mining or construction) are carried out in a manner that ensures the overall ecological integrity and biodiversity of the area are maintained. In practice, this means that any negative environmental impacts caused by the development are fully offset through mitigation measures or ecological restoration, so that there is no net loss of biodiversity, ecosystem services, or habitat functionality compared to the baseline conditions before the activity.
Residual Impacts	Residual impacts refer to the negative effects on the environment that remain after all feasible mitigation measures (such as avoidance, minimization, and restoration) have been implemented during a project. These are the impacts that cannot be fully eliminated or mitigated and persist after efforts have been made to reduce or repair the damage

LIST OF ACRONYMS

ACA	Additional Conservation Actions
AIP	Alien and Invasive Plant
AIPCP	Alien and Invasive Plant Control Plan
BMB	Biodiversity Management Branch
CBA	Critical Biodiversity Area
CoCT	City of Cape Town
CR	Critically Endangered
CR-PE	Critically Endangered, Possibly Extinct
DEA&DP	(Western Cape) Department of Environmental Affair and Development Planning
DFFE	Department of Forestry, Fisheries, and the Environment
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIS	Ecological Importance and Sensitivity
EMD	Environmental Management Department
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Area
GN	Government Notice
ha	hectares
km	kilometre
LC	Least Concern
ML/d	Megalitres per Day
MPA	Marine Protected Area
MV	Medium Voltage
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998) (as amended)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMPAA	National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)
NPAES	National protected Area Expansion Strategy
NT	Near Threatened
Ptn	Portion
REE %	Remaining Ecosystem Extent Percentage
SACAD	South African Conservation Areas Database
SAPAD	South African Protected Areas Database
STS	Scientific Terrestrial Services (Pty) Ltd
SCC	Species of Conservation Concern
VU	Vulnerable
WSD	Water and Sanitation Department
WWTB	Wastewater Treatment Branch
WWTW	Wastewater Treatment Works

1. INTRODUCTION

The existing Macassar Wastewater Treatment Works (WWTW) is located along the False Bay coastline at Macassar. The WWTW was constructed in ~ 1977 and is currently operated in terms of a water use licence (Reference 19/G22H/F/582) as issued by the then Department of Water Affairs and Forestry (now Department of Water and Sanitation (DWS)), dated 21 July 2011. The Macassar WWTW receives sewage from Gordon's Bay, Strand, Somerset West and Macassar via the existing Macassar pump station, located near to the WWTW. Due to significant development in the catchment area, the WWTWs plant must be further extended. The upgrades will entail the construction of additional facilities and infrastructure for the treatment of wastewater on the property.

The WWTW utilizes Conventional Activated Sludge treatment processes, with no primary settling (i.e. no primary sludge is generated, only secondary sludge). The present design capacity of the WWTW is about 30Ml/d (Ml/d = Mega litres per day) average dry weather flow. It is proposed to expand the hydraulic capacity of the WWTW by 50Ml/d to a final design capacity of 80Ml/d for the entire, upgraded WWTW. Installation of additional electrical infrastructure is also proposed as part of the refurbishment of the WWTW, to supply power to the site from the nearest Eskom substation.

The proposed new facilities at the WWTW will extend into undeveloped areas adjacent to the existing WWTW. Part of the proposed development area appears to have been utilized historically (>10 years ago) as oxidation ponds/sludge beds, but these are no longer in use and have largely re-vegetated, albeit in a degraded manner. The proposed development will also result in the discharge of additional treated wastewater to the Eerste River Estuary. The location and extent of the WWTW (which encompasses a Medium Voltage (MV) electricity cable and the WWTW itself (hereafter "WWTW Area of Influence") is illustrated in Figures 1 – 2.

A basic assessment is currently being undertaken to obtain environmental authorization for the project. According to best practice, the offset principles indicate that a biodiversity offset would most likely be required. Additionally, following botanical evaluations of the area to be impacted, Dr Boucher (of C Boucher Ecological Surveys) recommended a 30: 1 offset ratio for the area (Boucher, 2023).

This report aims to present a detailed specialist report that includes: (1) the identification, selection, and screening of potential offset options within the relevant property and/or broader region, along with an evaluation of their suitability to meet offset requirements, (2) an overview

of the habitat characteristics associated with the WWTW and the identified Target Offset Site, (3) offset quantum analyses, which encompasses a Residual Impact Assessment and outlines the quantum of the Offset Target Ratios, an (4) a Rehabilitation and Management Plan that outlines the necessary steps required to manage the offset sites in perpetuity.

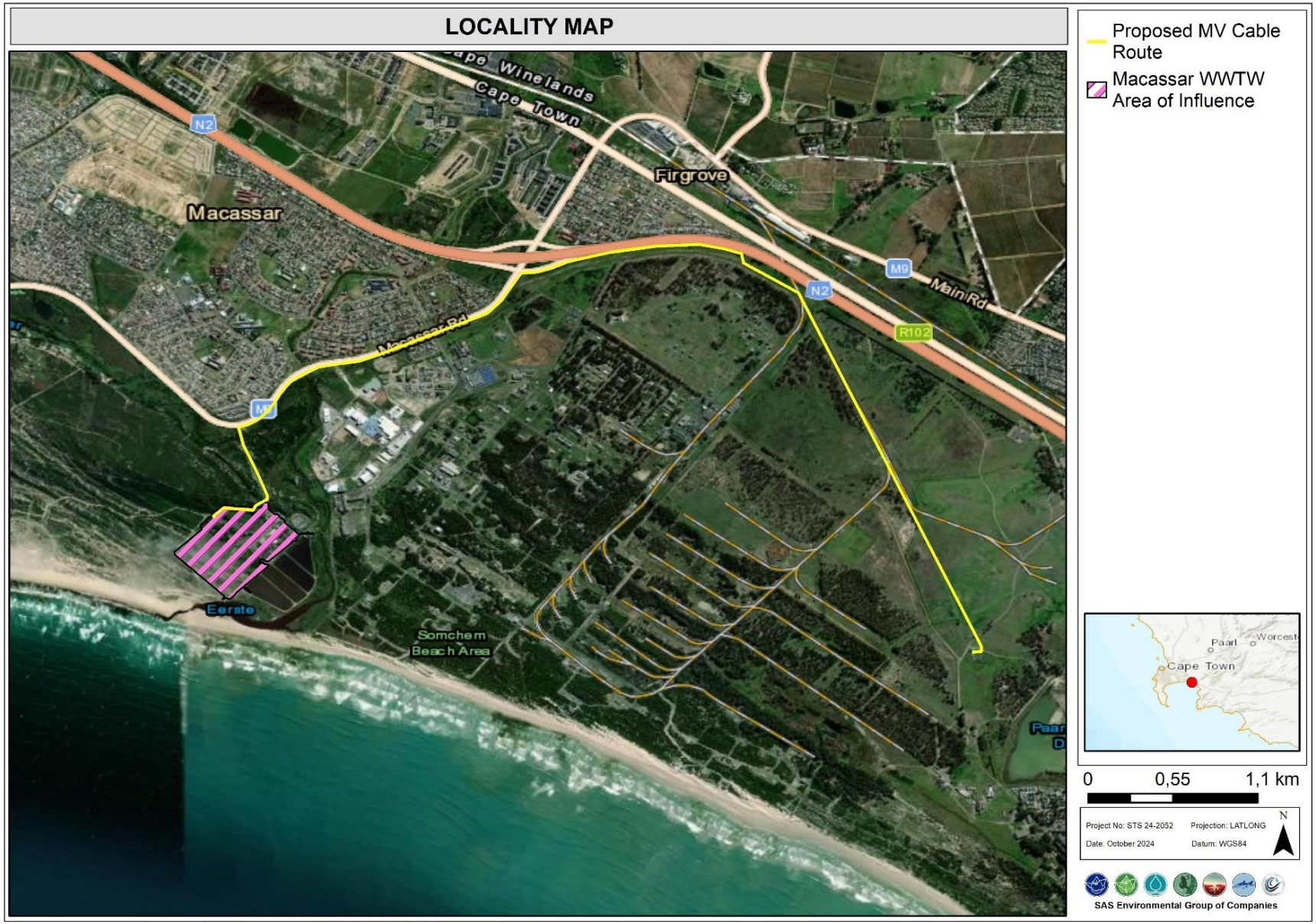

Figure 1: Digital satellite image illustrating the location of the Macassar WWTW.

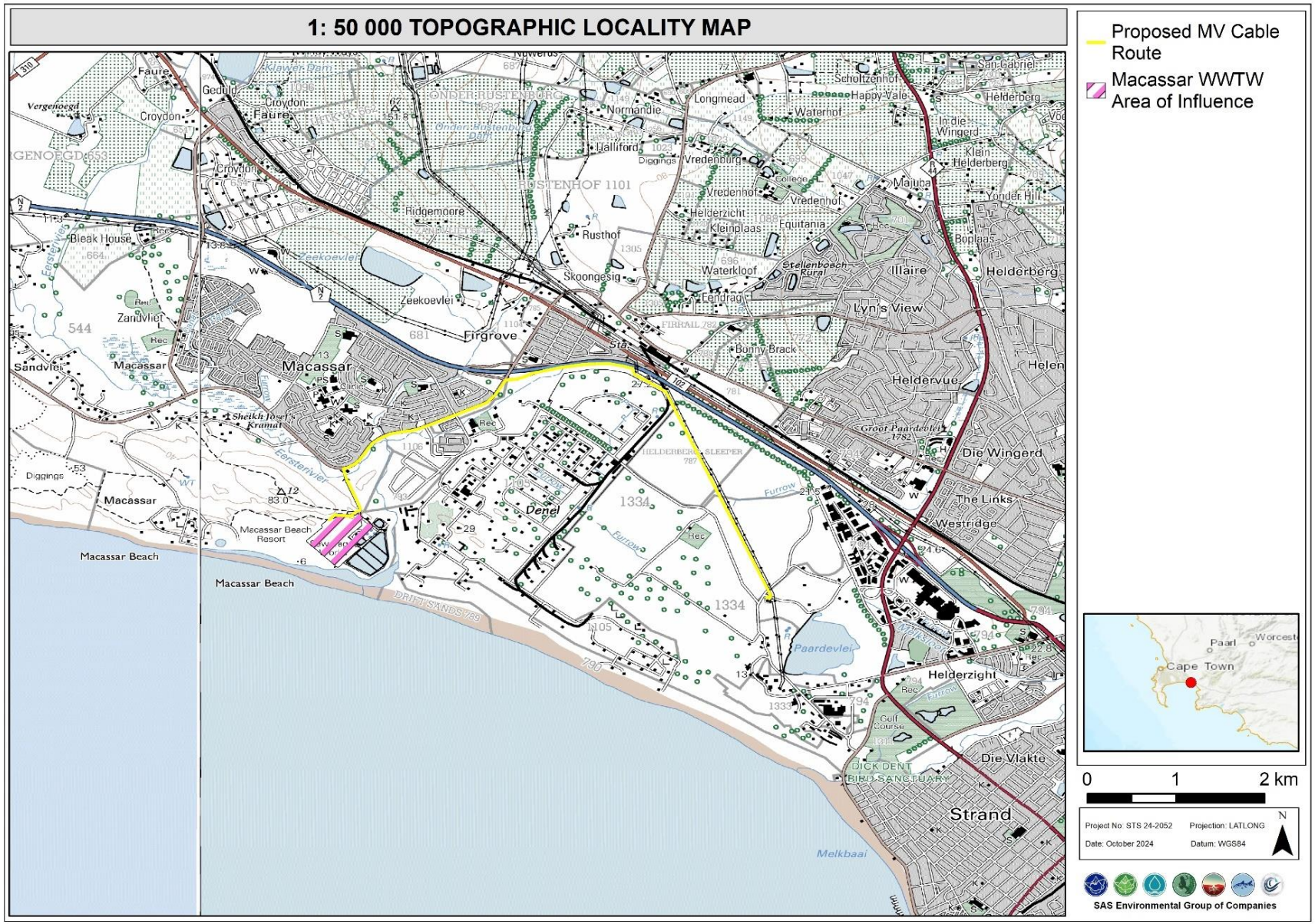

Figure 2: 1: 50 000 topographic map illustrating the location of the Macassar WWTW.

1.1 Scope of Work

The scope of work for this Offset Strategy includes the following key components:

- To gather all relevant spatial data pertaining to the terrestrial habitat associated with the WWTW Area of Influence and conduct a comprehensive review of the available ecological specialist assessment reports for the project area (BlueScience (2024) and Boucher (2023));
- To identify, select, and screen potential offset options within the applicable property and/or greater region. Evaluate these options to determine their suitability for meeting offset requirements;
- To quantify the residual biodiversity losses and determine the appropriate offset ratios necessary to achieve no net loss or a net gain of biodiversity;
- To develop a Rehabilitation and Management Plan that outlines the necessary actions required (where necessary) to rehabilitate and maintain ecological functions, addresses potential risks, and ensures compliance with biodiversity targets; and
- To prepare a comprehensive report documenting the findings and recommendations guiding the Offset Strategy. This report includes an evaluation of potential Offset sites, an indication of biodiversity loss and potential gains, the proposed measures for achieving the required offset targets, and a detailed Rehabilitation and Management Plan to ensure the long-term success and sustainability of the offset initiative.

1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this investigation:

- Available like-for-like offset options are limited due to the extensive development and urbanisation within the Cape Flats Dune Strandveld. Consequently, there is a scarcity of intact Cape Flats Dune Strandveld within the Cape region. This makes identifying suitable offset areas particularly challenging, especially when considering the need for large, contiguous sites and the difficulties associated with purchasing or establishing stewardship agreements with existing landowners. As such, trading up offsets were considered where necessary (refer to Section 2.3 for further details);
- The exact area at Paardevlei (Option 7) is still to be confirmed and it is currently unclear what may be available to contribute to the offset. What is unavailable at Paardevlei, including if nothing at all is available will be added to the area allocated from the Burgherspost offset bank (Option 8) which does have sufficient area to cater for the required offset quantum;
- The Rehabilitation and Management Plan provided in this report is intended to provide a general direction for which the proponent can achieve the desired ecological state of the acquired Offset Areas in the future. The strategy thus provides high-level context

and principles to which implemented actions must adhere. In-depth rehabilitation (including alien and invasive plant (AIP) control, erosion plans, etc (as required)) will need to be developed (at the appropriate time) under the guide of suitably trained specialists;

- Site-specific information is based on three high-level site assessments; the Macassar WWTW Area of Influence and Offset Option 1 were assessed on 1 October 2024, whereas the site investigations for Offset Options 7 and 8 were conducted on 5 November 2024. Safety concerns within the site limited the duration of the assessments and should be considered for future assessments;
- Site investigations were conducted at a high-level; should this offset obtain approval, comprehensive site visits to the Target Offset Areas should be conducted to gain a deeper understanding of the ecological systems within the area. Following this visit, the Rehabilitation and Management Plan should be further updated to provide more detailed guidance on management activities for these areas;
- The rehabilitation activities provided in this report pertain to those envisioned for the various offset areas (including Options 1, 7 and 8). Given the varied ecological condition of each Offset Option, different / more / less intensive rehabilitation activities may be required for each Option. However, for the purposes of this report, a single, consolidated Rehabilitation and Management Plan has been developed. Specific measures and actions tailored to the different Offset Options (Options 1, 7 and 8) will be discussed where necessary to address the unique requirements of each area and its specific rehabilitation needs. It must however be noted that refinement of this concept plan will be required at the implementation phase and adaptive management principles must be applied; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. It is, however, expected that the study area has been accurately assessed and considered, based on the field observations and the consideration of available specialist studies.

1.3 Applicable Legal Framework & Definitions

The following legislative documents were considered:

- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) (as amended);
- The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);

- Government Notice (GN) number 2747 (Gazette Number 47526): The revised National list of Ecosystems that are Threatened and in need of Protection, dated 18 November 2022, as it relates to the NEMBA;
- GN number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated September 2020 as it relates to the NEMBA;
- GN number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the NEMBA;
- GN 3009: Regulations Pertaining to Threatened or Protected Terrestrial Species and Freshwater Species in Government Gazette 47984 dated 3 February 2023, as it relates to the NEMBA;
- GN 3569: National Biodiversity Offset Guideline, in government Gazette 48841 dated 23 June 2023, as it relates to the NEMBA; and
- GN 3012: List of Terrestrial and Freshwater Species that are Threatened or Protected, Restricted Activities that are Prohibited, and Restricted Activities that are Exempted, in Government Gazette 47984 dated 3 February 2023, as it relates to the NEMBA.

The 2016 best-practice wetland offset guidelines (SANBI & DWS, 2016) were also consulted during the development of this Offset Strategy report. Please refer to **Appendix B** for additional legislative requirements.

2. OVERVIEW: OFFSETS & ECOLOGICAL COMPENSATION

2.1 The Mitigation Hierarchy

Offsets are implemented as part of the mitigation hierarchy and are specifically intended to mitigate or compensate for the residual environmental impacts of development/mining (often referred to as "compensatory mitigation") after all viable measures have been taken to first avoid or prevent, minimize or reduce, and remediate or rehabilitate those impacts (SANBI & DWS, 2016; Figure 3). The 2023 Biodiversity Offset Guidelines emphasize that offsets are essential for achieving no net loss or a net gain in biodiversity, particularly where significant residual impacts on ecosystems remain despite the application of other mitigation measures. Following the mitigation hierarchy, the following principles apply to offsetting:

- **Avoidance:** the proposed development/mining should first attempt to avoid or prevent negative impacts on biodiversity and ecosystem services by exploring alternative development types, locations, scales, layouts, and the siting of development/mining components;

- **Minimization and rehabilitation:** when avoidance is not possible, efforts must be made to minimize negative impacts and to rehabilitate or remediate affected areas to reduce residual impacts; and
- **Offsetting:** residual impacts that remain after minimization and rehabilitation must be compensated for through biodiversity offsets. Offsets are designed to counterbalance these residual impacts by providing measurable conservation outcomes that ensure the overall biodiversity value is maintained or enhanced.

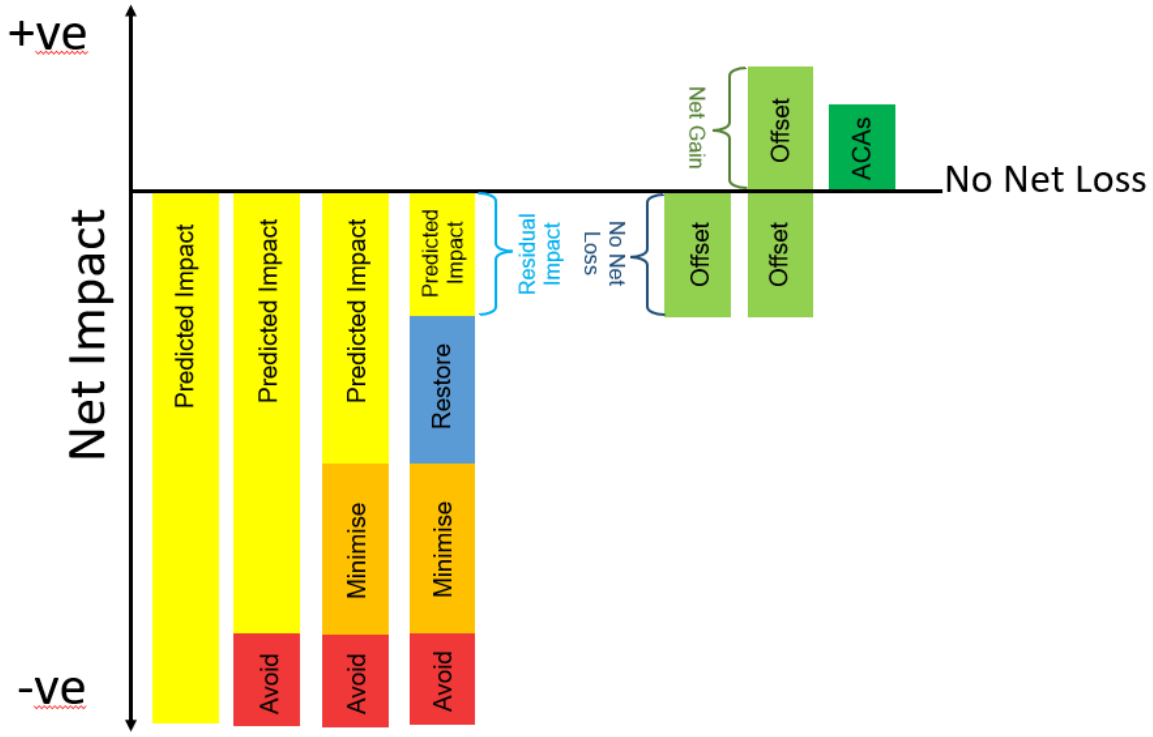

Figure 3: Depiction of the mitigation hierarchy and where offsets and additional conservation actions (ACAs) fit into the overall goal of achieving NPI. Image adapted from Temple et al., (2012).

Environmental offsetting provides a means by which to slow – and possibly even reverse – "ecological deficit" by counterbalancing the degradation, destruction, and depletion of natural resources through protection, rehabilitation, restoration and replenishment. Offsets are not only a means of compensating for lost habitat but also a critical tool for maintaining the ecological integrity and long-term security of priority biodiversity and ecosystem areas. According to the 2023 Biodiversity Offset Guidelines, offsets for both terrestrial and freshwater ecosystems, including wetlands, are vital for sustaining biodiversity and the ecosystem services that these habitats provide.

2.2 Biodiversity Offsetting

Biodiversity offset calculations are essential in ensuring that the ecological impact of development activities is effectively mitigated. According to the 2023 guidelines, these calculations take into account several key principles, including like-for-like conditions, which emphasize that the offset should replace the same type of ecosystem or habitat that was impacted. This principle ensures that the biodiversity value, including species composition, ecosystem functions, and ecological processes, is maintained as closely as possible to its original state. In addition, the guidelines prioritize spatial and temporal equivalence, ensuring that offsets are located near the impacted area and are implemented promptly. The overarching goal is to achieve No Net Loss, or preferably a Net Gain, of biodiversity. Moreover, offsets must adhere to the principle of additionality, ensuring that the benefits provided go beyond existing conservation efforts. Lastly, ongoing monitoring and adaptive management are vital to ensuring the success and efficacy of biodiversity offsets over time.

2.3 Trading-up

The trading-up principle in biodiversity offsetting and compensation refers to a strategy where a loss of biodiversity in one area is compensated by conserving or enhancing biodiversity in another area with higher ecological value. The principle prioritises not just replacing the quantity of biodiversity lost but improving the quality of biodiversity in a way that contributes to overall conservation goals. In practice, trading-up involves focusing on habitats or species of higher conservation priority. For instance, if a development project causes damage to a common habitat, the offset might involve protecting a more threatened habitat or species elsewhere, thereby providing greater ecological benefits. This approach aims to contribute to net positive biodiversity outcomes by directing resources towards areas where conservation efforts can have the most significant impact. The trading-up principle is often applied in situations where it is challenging to achieve like-for-like compensation due to the rarity or irreplaceability of certain habitats or species. It helps to ensure that biodiversity offsetting leads to long-term conservation gains rather than just mitigating losses. In the case of the WWTW, a special type of trading-up offsets was explored because limited options are available for direct like-for-like offsets within the required vegetation type, which is fragmented and limited in extent given its location within urban areas (refer to Section 5.2.1 for further details).

2.4 Offset Ratios

In addition to like-for-like, offset ratios are determined based on the conservation status of the ecosystem, the irreplaceability of the habitat, and the condition of the impacted area. For

ecosystems that are more threatened or have higher conservation importance, higher offset ratios are required. This approach not only aims to maintain biodiversity value but also seeks to enhance it by contributing to the preservation and restoration of threatened, rare, or keystone species and ecosystems. By adhering to these principles, biodiversity offsets ensure that the ecological integrity of the affected area is upheld, and in some cases, improved, thereby supporting broader conservation goals and ecological resilience. Please refer to Sections 7 - 8 and Appendix C for specific explanations of the applicable offset ratios as defined in the 2023 Biodiversity Offset Guidelines.

2.5 Ecological Compensation

In contrast with offsets, ecological compensation may be employed when achieving a strict like-for-like offset is not feasible. Ecological compensation allows for broader and sometimes more flexible conservation actions that do not necessarily match the exact type of biodiversity or ecosystem services lost. While it still seeks to balance the negative impacts of development/mining, compensation can involve different types of habitats, species, or even broader ecological goals, such as enhancing connectivity or restoring degraded landscapes that may not directly replace the impacted area. Compensation might also focus on providing other ecosystem services or addressing conservation priorities that are indirectly related to the impacts. While ecological compensation may not always aim for a strict like-for-like net gain, it can still contribute to net gain outcomes by addressing broader conservation needs. For example, ecological compensation might involve actions such as the restoration of a degraded ecosystem that is of greater conservation priority than the impacted area, thereby adding value to the overall biodiversity landscape. Through these broader conservation actions, ecological compensation can contribute to a net gain in biodiversity, even if the exact species or habitats lost are not directly replaced.

Both offsetting and ecological compensation provide measurable and lasting benefits, supporting the overall goal of no net loss or a net gain of biodiversity. The careful planning and implementation thereof are essential to ensuring that development and/or mining activities do not result in irreparable harm to the natural environment and that critical ecosystem services are preserved for future generations.

3. NEED AND DESIRABILITY OF THE PROJECT

The Macassar WWTW expansion project provides necessary infrastructure development that is required to meet the increasing demand for wastewater treatment from surrounding communities, including Khayelitsha, Somerset West, and Gordon’s Bay. The existing

Macassar WWTW utilises Conventional Activated Sludge technology and has an estimated hydraulic capacity of 48Ml/day Average Dry Weather Flow. However, the effective treatment capacity of the works is currently limited to 30Ml/day due to suboptimal performance of the works, because of insufficient aeration at the existing reactors. Treated effluent from the plant is discharged into the Eerste River and a small portion is also recycled for both off-site and on-site use. However, due to rapid urbanisation and a sustained population growth in the False Bay region, a shortfall in treatment capacity is experienced at the Macassar WWTW. The shortfall in treatment capacity, together with current operational constraints has led to the Macassar WWTW not being able to treat wastewater adequately, subsequently resulting in a poor effluent quality being discharged into the Eerste River. These challenges have prompted the City of Cape Town (CoCT) to prioritise the upgrade of the Macassar WWTW. Specifically, the expansion project is essential to safeguard not only human health, but environmental health and water resource management.

Without this necessary upgrade, the WWTW will soon reach its capacity, leading to potentially severe socio-economic and ecological consequences. Overflows and untreated sewage leakage could degrade nearby ecosystems, including the Eerste River and its estuary, which in turn would affect the Helderberg Marine Protected Area (MPA). The potential for pollution would not only compromise water quality but could also result in significant harm to marine life, including species reliant on the estuarine ecosystem for part of their lifecycle (Roux et al. 2023 and Whitfield 1998). Specifically, estuarine ecosystems, like the Eerste River estuary, are crucial habitats for many species. Fish species such as white steenbras (*Lithognathus lithognathus*, endangered (EN)) and southern mullet (*Liza richardsonii*) rely on the estuary as a nursery, whereas stuarine round herring (*Gilchristella aestuaria* often act as prey for larger fish and birds. Additionally, the Eerste River estuary support threatened and/or migratory birds, including species such as African black oystercatchers (*Haematopus moquini*, vulnerable (VU)), Greater flamingo (*Phoenicopterus roseus*, near threatened (NT)) and lesser flamingo (*Phoenicopterus minor* (NT)) as well as invertebrates like mudprawns (*Upogebia africana*) and Estuarine crabs (*Varuna litterata*) which play a role in nutrient cycling and are prey for many species. Pollution from untreated sewage could degrade water quality, impacting these species by disrupting food webs and breeding grounds.

Furthermore, the expansion of the WWTW is essential to protect local water resources, ensuring that the Eerste River, which flows into the Helderberg MPA, maintains its ecological function. The MPA is a marine biodiversity hotspot that plays an essential role in sustaining local fisheries, maintaining water quality, and conserving marine biodiversity (DEA, 2019). Without the expanded WWTW, untreated wastewater would threaten not only freshwater

systems but also marine ecosystems, further emphasizing the project's broader environmental significance.

From a socio-cultural perspective, the health and wellbeing of local communities are directly linked to the proper functioning of the WWTW. Untreated or inadequately treated wastewater would pose significant risks to human health, especially in densely populated areas, where access to safe sanitation is vital. The risk of waterborne diseases increases with untreated sewage spills and contaminated water supplies, which could disproportionately affect vulnerable groups in these rapidly growing urban areas. Ensuring that the Macassar WWTW operates efficiently is therefore key to preventing these potential health concerns and supporting sustainable urban growth.

Although the WWTW expansion will impact threatened vegetation types, its role in addressing the socio-economic needs of the area and protecting water resources cannot be understated. Proper wastewater treatment is important to prevent landscape degradation and ecosystem collapse that would occur without such infrastructure. The expansion will aid in the prevention of overflows, seepage, and contamination that could otherwise lead to both human health issues and the degradation of surrounding terrestrial and aquatic ecosystems.

Given these considerations, the need for a biodiversity offset strategy remains a necessary requirement to mitigate the unavoidable impacts on the impacted vegetation types that is overwhelmingly to benefit of community health and wellbeing as well as water resource management. By balancing development with conservation through well-planned offsets, the project supports the dual goals of addressing urgent socio-economic needs human health protection and ensuring environmental protection.

4. APPLICATION OF THE MITIGATION HIERARCHY

The Macassar WWTW holds the responsibility of mitigating negative impacts on biodiversity while enhancing opportunities to achieve long-term positive outcomes for ecological health and biodiversity, in line with regulatory and environmental commitments. Following the mitigation hierarchy, in the case of the Macassar WWTW, avoidance of impacts is not possible. Given the location of the existing WWTW and the pressing socio-economic need for the WWTW upgrades, impacts associated with the proposed development cannot be avoided. If environmental authorisation (EA) is received, the proponent will be required to implement mitigation measures. However, even with the implementation of strict mitigation measures lower in the mitigation hierarchy i.e. avoidance and minimisation, the construction and operation of the WWTW itself will still result in significant residual impacts to the receiving environment, e.g., loss of threatened vegetation type(s), loss of habitat connectivity, etc. To

address this, rehabilitation measures will need to be implemented to rehabilitate any temporarily disturbed areas, ensuring that as much of the natural habitat as possible is rehabilitated post-construction. However, given the irreversibility of certain losses, particularly in threatened vegetation types, the final option in the mitigation hierarchy, i.e., offsetting, is deemed necessary.

To address these residual impacts, an Offset Strategy is being developed to compensate for the loss of biodiversity and habitat, especially following the recommendation for an offset by Boucher (2023). This strategy will ensure compliance with best practice and the principles of ecological sustainability.

In contrast to the WWTW construction, the MV cable installation will not result in significant residual impacts. By following the mitigation hierarchy, minimisation and rehabilitation measures within habitat impacted by the instillation of the MV cable can be implemented during and after construction. As a result, the surrounding habitat will not experience significant residual impacts, as mitigation efforts should effectively address and rehabilitate any environmental disturbances. For this reason, only proposed activities that will result in significant residual impacts, i.e., the construction of the WWTW itself which will result in the direct loss of a threatened vegetation type (EN Cape Flats Dune Strandveld), will be considered applicable for offsetting purposes.

5. OFFSET ALTERNATIVE ANALYSIS & SITE SELECTION

Achieving an effective offset requires enhancing the conservation status and protection of both the targeted species of conservation concern (SCC) and their habitats to ensure no net loss of ecosystems, including both terrestrial and freshwater systems. Typically, *candidate offset sites* are identified, followed by an alternatives analysis. This involves an iterative process to evaluate various options, ensuring that the most suitable site is selected for further planning and development of the offset strategy.

The 2023 Biodiversity Offset Guidelines provide key guidance for selecting candidate biodiversity offset sites, and emphasizes the following principles:

1. **Location in biodiversity priority areas**: candidate offset sites should ideally be situated in biodiversity priority areas, such as Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Freshwater Ecosystem Priority Areas (FEPAs), and/or within priority focus areas as per the National Protected Area Expansion Strategy (NPAES) as identified in spatial biodiversity plans;
2. **Ecological equivalence and trading-up**: sites should follow the "like-for-like" principle, ensuring ecological equivalence with the impacted area. Alternatively,

"trading-up" is acceptable when it allows for the selection of sites with higher or more urgent conservation priorities;

3. **Guidance from existing plans**: site selection should be guided by existing biodiversity frameworks and priority areas, including the CBA and ESA networks, protected area expansion strategies, and/or strategic water source area;
4. **Connectivity and landscape context**: offsets should secure the best examples of the impacted biodiversity features and aim to improve ecological connectivity between protected and priority areas; and
5. **Other considerations**: practical factors, such as ease of management, conflicts in land use, land ownership, and potential threats to conservation, should be cautiously considered, ensuring that the overriding biodiversity outcomes are met.

Final offset site selection must ensure that suitable compensation for the loss of freshwater and terrestrial habitat due to mining activities is achievable, while addressing the suitability of a site in terms of meeting (1) water resource and ecosystem service requirements, (2) biodiversity conservation targets, (3) long-term ecological sustainability, and (4) socio-economic and land-use compatibility. Additionally, the site must align with relevant regulatory frameworks and be capable of supporting the necessary management interventions to ensure the successful restoration and preservation of ecosystem function (as per criteria listed in Table D1 (Appendix D).

5.1 Alternatives Analysis

Several options were evaluated on a desktop basis as potential offset sites. Eight (8) options were identified as potential candidate sites (given their location within specific vegetation types, associations with the National Protected Area Expansion Strategy (NPAES), proximity to protected area (as per the South African Protected Area Database (SAPAD), etc). The identified candidate offset sites include (Figure 5):

1. An off-site offset option, encompassing approximately 25.0 ha, which is located within the same property as the proposed WWTW (i.e., Portion (Ptn) 0 of Erven 1205). This site is owned by the proponent;
2. An off-site offset option, encompassing 72.3 ha, which is located immediacy west of the WWTW (i.e., Ptn 0 of Erven 702 and Ptn 0 of Erven 703);
3. An off-site offset option, encompassing approximately 335.5 ha, which is located west of the WWTW, namely the properties associated with the informal ‘Macassar Dunes

Conservation Area'[2] (i.e., Ptn 2 of Farm Drift Sands 544 and a section of Ptn 0 of Farm Drift Sands 544);

4. An off-site offset option, encompassing approximately 509.83 ha, which is located approximately 10.5 km northwest of the WWTW. This land is owned by Airports Company South Africa SOC Ltd (ACSA) (i.e., Ptn 0 of Erven 75850);
5. An off-site offset option, encompassing approximately 110.6 ha, which is located approximately 12.7 km northwest of the WWTW. This site is located within a section of the deproclaimed Driftsands Nature Reserve (Ptn 1 of Farm drift Sands 544);
6. An off-site offset option, encompassing approximately 110.6 ha. This site is located immediately east of the existing WWTW (including a section of Ptn 0 of Erven 635). This land is owned by Denel SOC Ltd;
7. An off-site offset option, encompassing approximately 53.53 ha, which is located approximately 3.7 km east of the WWTW[3]. This land is city owned. The farm portions are as follows: ST791-4RE, ST791-5 (owned by Water and Sanitation), and a portion of STE794-0RE; and
8. An off-site offset option, encompassing 824 ha, which forms part of the CoCT's Burgherspost offset land bank and is located approximately 65 km northwest of the WWTW. This land is currently under procurement by the city to be used as a land bank (refer to Appendix G). Note: only the necessary hectarage would be offset using this option.

Initially, only Option 1 through 5 where proposed as candidate offset sites; however, following discussions with the CoCT, the commenting authorities (CapeNature) and the competent authorities (Department of Environmental Affairs and Development Planning (DEA&DP)), Options 7 and 8 were added for consideration. These options were specifically included in the offset analysis as it was established that land acquisition (land claims etc.) would likely be a serious factor limiting the feasibility of Options 2 through 5. As CoCT manages/owns/is in the process of acquiring the properties associated with Options 7 and 8, their inclusion was considered a beneficial decision.

The candidate offset sites (Figure 5) were then screened for suitability following the criteria listed in Table D1 (Appendix D), with the findings presented in Table 1. Within the Table, a numerical score is given to each category that aligns to the criterion level investigated, i.e., a score out of three or four is assigned to the categories depending on the criterion level available for selection (i.e., ideal (4), acceptable (3), potentially acceptable (2), and generally

[2] Not a formally protected area under the NEMPAA.
[3] The exact area at Paardevlei (Option 7) is still to be confirmed and it is currently unclear what may be available to contribute to the offset. What is unavailable at Paardevlei, including if nothing at all is available will be added to the area allocated from the Burgherspost offset bank (Option 8) which does have sufficient area to cater for the required offset quantum.

unacceptable (1) *vs*. ideal (3), acceptable (2), and unacceptable (1)). Refer to Appendix D for further information.

Table 1: Alternatives analyses for offset and compensation for the Macassar WWTW. Refer to Appendix C for further details.

Criterion	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Like-for-like (Figures 6 - 9)	Ideal (4)	Ideal (4)	Ideal (4)	Ideal (4)	Ideal (4)	Ideal (4)	Ideal (4)	Acceptable (3)
Conservation Planning (Figures 10 – 13)	Ideal (3)	Ideal (3)	Ideal (3)	Potentially acceptable but generally undesirable (1)	Acceptable (2)	Acceptable (2)	Acceptable (2)	Ideal (4)
Habitat Condition	Acceptable (2)	Acceptable (2)	Acceptable (2)	Generally Unacceptable (1)	Acceptable (2)	Generally Unacceptable (1)	Acceptable (2)	Acceptable (2)
Local Biodiversity Value	Acceptable (2)	Acceptable (2)	Acceptable (2)	Acceptable (2)	Acceptable (2)	Acceptable (2)	Acceptable (2)	Ideal (3)
Long-term Ecological Viability (Figures 14 - 18)	Acceptable (3)	Acceptable (3)	Acceptable (3)	Generally unacceptable (1)	Generally unacceptable (1)	Acceptable (3)	Acceptable (3)	Ideal (4)
Land-legal Viability	Ideal (4)	Generally Unacceptable (1)	Generally Unacceptable (1)	Generally Unacceptable (1)	Generally Unacceptable (1)	Generally Unacceptable (1)	Ideal (4)	Ideal (4)
Rehabilitation Opportunities/Potential	Ideal (3)	Ideal (3)	Ideal (3)	Acceptable (2)	Acceptable (2)	Ideal (4)	Ideal (4)	Ideal (4)
Total score	**21**	**18**	**18**	**12**	**14**	**17**	**21**	**24**

5.2 Offset Selection Rationale

Available like-for-like offset options are limited due to the extensive development and urbanisation within the Cape Flats Dune Strandveld. Consequently, there is a scarcity of intact Cape Flats Dune Strandveld within the Cape region. This makes identifying suitable offset areas particularly challenging, especially when considering the need for large, contiguous sites and the difficulties associated with purchasing or establishing stewardship agreements with existing landowners. As such, trading up offsets were considered where necessary (refer to Section 2.3 for further details). A total of eight (8) potential offset options were considered, and the feasibility and suitability of the various offset options is presented below.

5.2.1 Suitable Offset Options

Offset Options 1, 7 and 8 were identified as the most suitable candidates for offset purposes. These options received the highest total scores of 21, 21 and 24, respectively in the alternatives analysis, indicating their strong alignment with the required offset criteria. These three options are also considered especially favourable as they are located within key biodiversity areas, such as CBA habitat and part of CoCTs Protected Area Implementation Plan (information supplied by CoCTs Biodiversity Management Branch (BMB)).

Option 1 is located within the WWTW property thus negating the need for additional purchasing of property. Options 7 and 8 are both state-owned, making them ideal for long-term stewardship agreements. State-owned land presents fewer challenges compared to privately owned land, where high asking prices and reluctance to enter into stewardship agreements often hinder progress.

Options 1 and 7 are located within the EN Cape Flats Dune Strandveld, thus satisfying the ‘like-for-like’ criteria pertaining to vegetation type. Although Option 8 is not located within the same vegetation type as that of the WWTW (i.e., EN Atlantis Sand Fynbos and EN Swartland Granite Renosterveld *vs*. EN Cape Flats Dune Strandveld), the use of Option 8 as an offset is still considered acceptable as it involves an even trade of EN vegetation for EN vegetation. Moreover, the use of the EN Swartland Granite Renosterveld is considered acceptable for offset purposes as it can be seen a specific type of “trading-up” offset. Although the associated trade-up would not entail trading up of a vegetation type of increased threat status, the use of the EN Swartland Granite Renosterveld would entail trading-up of a vegetation type with a significantly lower Remaining Ecosystem Extent percentage (REE %). That is, the REE % for the EN Cape Flats Dune Strandveld of 56% whereas, the REE % associated with the EN Swartland Granite Renosterveld is 20% (2023 Biodiversity Offset Guidelines).

Although the Swartland Granite Renosterveld is considered EN, it is under a higher degree of threat than that of the EN Cape Flats Dune Strandveld. Specifically, this vegetation type has the following threat trigger criteria as per the 2022 Red Listed Ecosystem (RLE; SANBI, 2022):

- Decline in extent between 1990 – 2040;
- Historical decline in extent (national and regional data); and
- Restricted distribution and a high rate of loss with the presence of threatening processes.

As with the Swartland Granite Renosterveld, the Atlantis Sand Fynbos offers a unique trading up scenario. This vegetation type has a REE % of 52 % (2023 Biodiversity Offset Guidelines). As with the EN Cape Flats Dune Strandveld, the Atlantis Sand Fynbos has the following threat trigger criteria (as per the 2022 RLE (SANBI, 2022)):

- Restricted distribution and a high rate of loss with the presence of threatening processes.

Furthermore, Option 8 provides important habitat for a significant number of SCC, including 89 floral SCC (eight (8) critically endangered (CR) species, 28 EN species, 28 vulnerable (VU) species, and one (1) near threatened (NT) species), 6 bird species (four (4) EN species, one (1) VU species, and one (1) NT species), one (1) mammal species, as well as a newly identified population of Silvers-spotted Copper (*Trimenia wallengrenii wallengrenii* (Critically Endangered, Possibly Extinct; CR-PE)). Given this, the use of Option 8 as an offset is considered feasible and a special case involving a 'trade-up' for a vegetation type that is under greater threat of loss.

The CoCT, as the proponent and intended managing agent (see Section 12 for further details), has expressed their willingness and agreement to use Option 7 and Option 8 as offset areas, provided that land use zoning within Option 7 is appropriate and that there are no plans for future settlements on parts of the associated farm portions.

Options 1, 7 and 8 were identified as the best options for offset purposes. By selecting these options, habitat within the EN Cape Flats Dune Strandveld, EN Swartland Granite Renosterveld and EN Atlantis Sand Fynbos can be safeguarded.

Note: The exact extent available for offset within Option 7 needs to be confirmed as it is currently unclear what may be available to contribute to the offset (given internal CoCT departmental ownership of the land). What is unavailable at Option 7 will need to be added to the area allocated from Option 8 (i.e., the Burgherspost offset bank).

5.2.2 Unsuitable Offset Options

Options 2 and 3 obtained a score of 18, sharing many of the same benefits as Option 1. Like Option 1, these features scored highly in several key categories, particularly in terms of like-for-like, conservation planning, habitat condition, and long-term ecological viability. However, these properties are currently associated with land claims and/or open to potential future settlement development. Options 2 and 3 are also associated with conservation areas and/or protected areas and thus do not satisfy the 'additionality' principle of the Offset Guidelines. Thus, these options were not considered feasible for use as offsets.

Offset Options 4 and 5, while providing some potential, were ultimately deemed less suitable. Option 4 scored 12 points, indicating its limitations in key categories such as habitat condition and long-term ecological viability. Although it offers ideal opportunities for rehabilitation, its overall suitability is compromised by its generally unacceptable ecological viability (i.e., the site is significantly fragmented and cut off from surrounding areas of intact vegetation communities). Similarly, Option 5, with a score of 14, performed poorly in areas such as conservation planning and land-legal viability, making it a less favourable choice. Its smaller size and less desirable land-legal status make meeting the target offset ratio unfeasible. Furthermore, the neighbouring Drifts Sands Nature Reserve is to be de-proclaimed, making Option 5 an unsuitable choice for offsetting.

Although the use of Option 6 in conjunction with Option 1 would allow for a linear, connective corridor to be established within the landscape, this Option was not considered favourable the very degraded nature thereof as well as procurement issues; this property is owned and leased by Denel and does not provide good options for stewardship agreements.

5.2.3 Additional Conservation Actions (ACAs)

As an Additional Conservation Action (ACA), rehabilitation efforts that focus on the Eerste River, located immediately east of the WWTW (Figure 4) could take place. This area is degraded, as evidenced by the presence of invasive species such as *Cenchrus clandestinus* (formerly *Pennisetum clandestinum*) and *Acacia cyclops*, as well as areas of erosion. Targeted rehabilitation activities in this area would significantly benefit the ecosystem, particularly as the river flows into the estuary. **Note**: even though this area is not necessarily within the WWTW footprint area, funding could be provided to the landowner to implement the ACA.

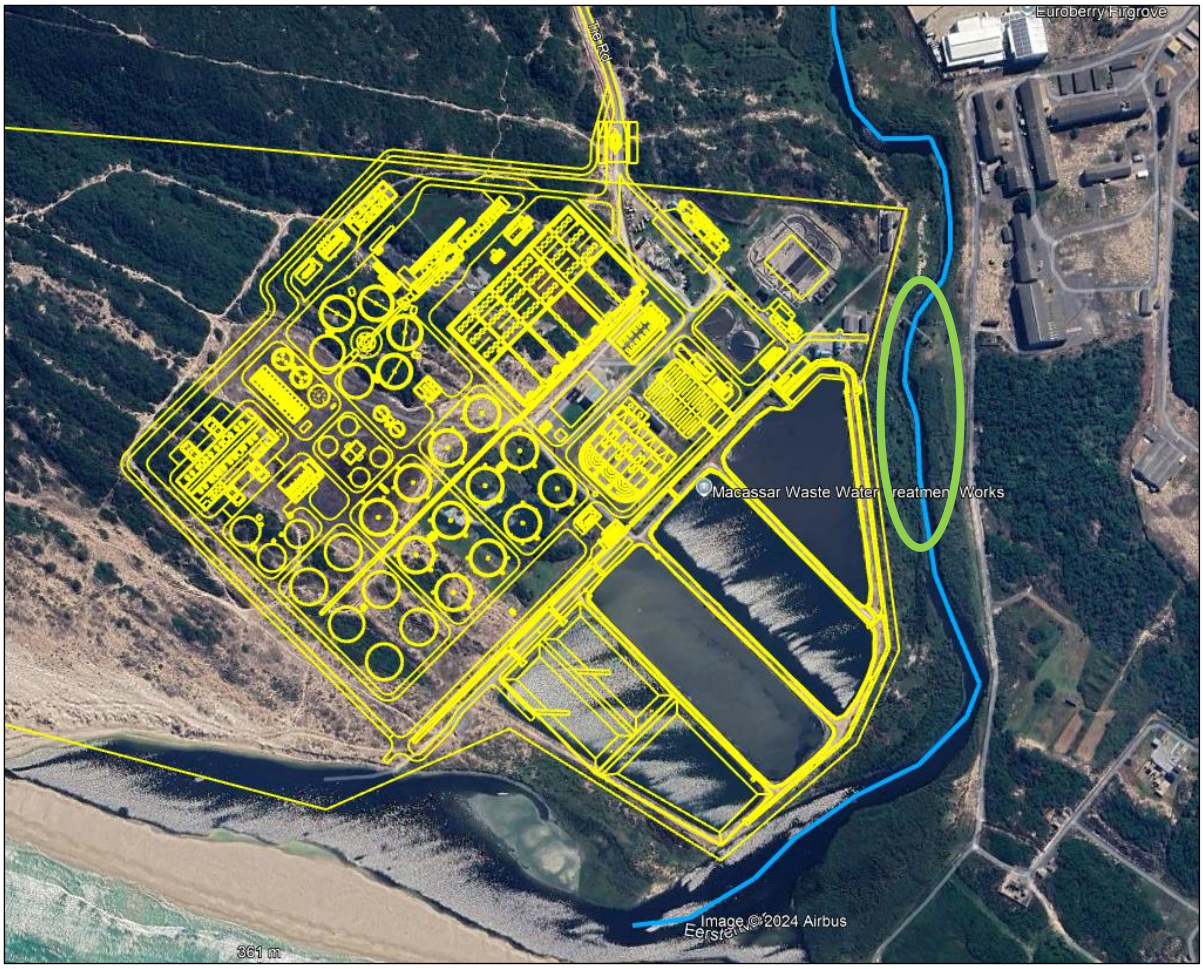

Figure 4: Digital satellite imagery illustrating the general area targeted for ACA actions (indicated by the green circle) along the Eerste River (included by the blue line).

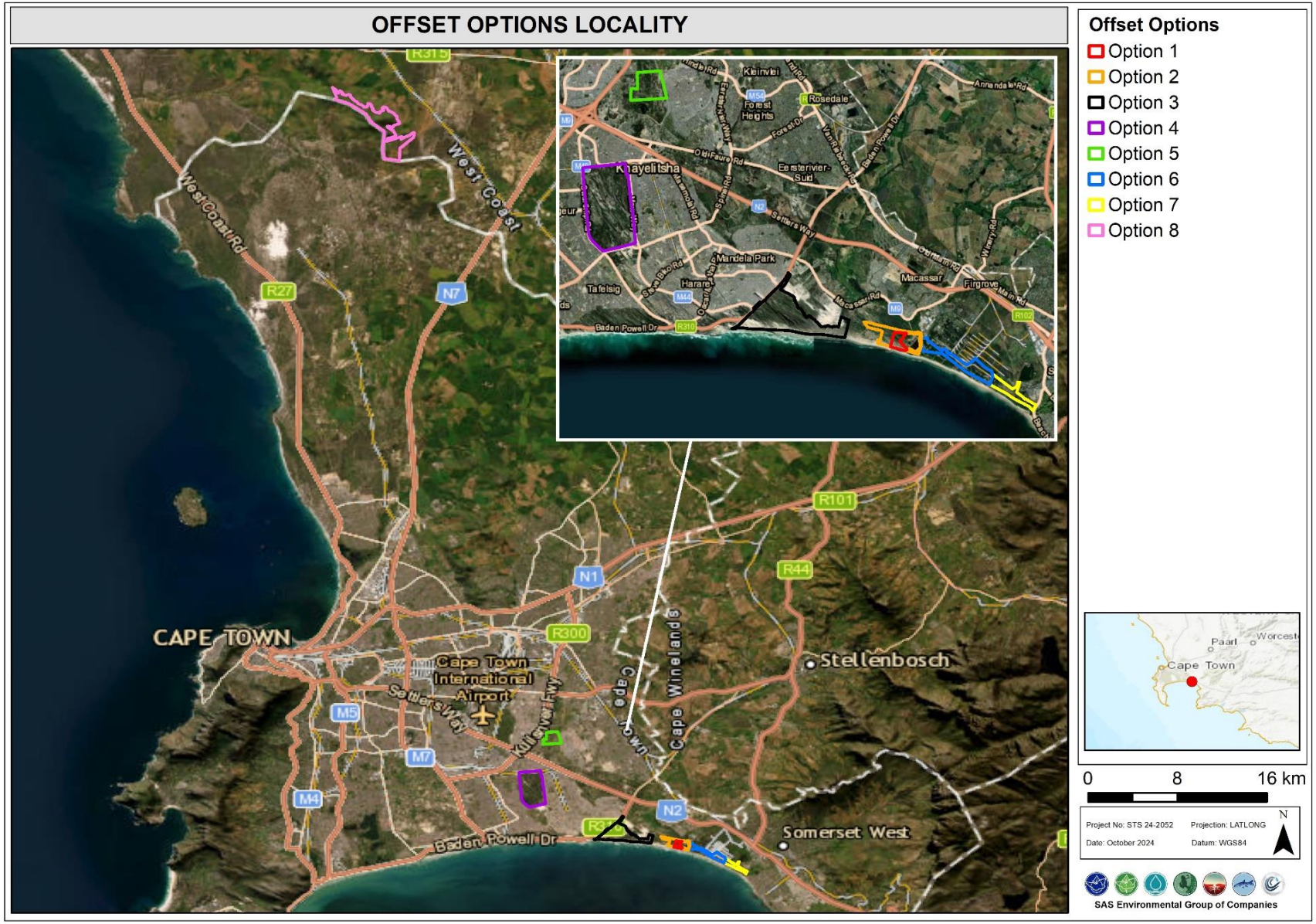

Figure 5: Map illustrating the candidate offset sites investigated for potential use as an offset.

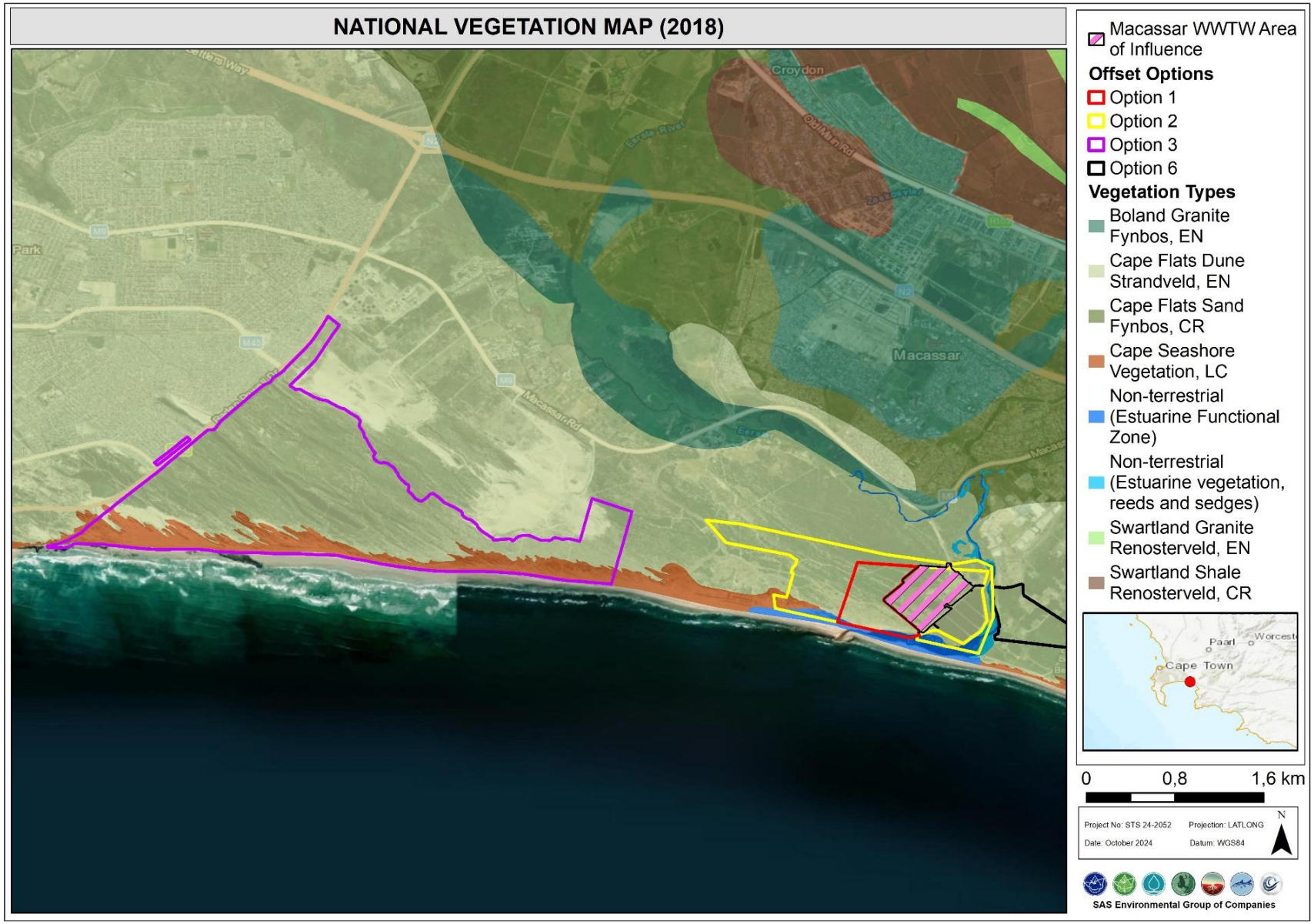

Figure 6: Map illustrating the vegetation types associated with the candidate offset site options 1, 2, 3 and 6.

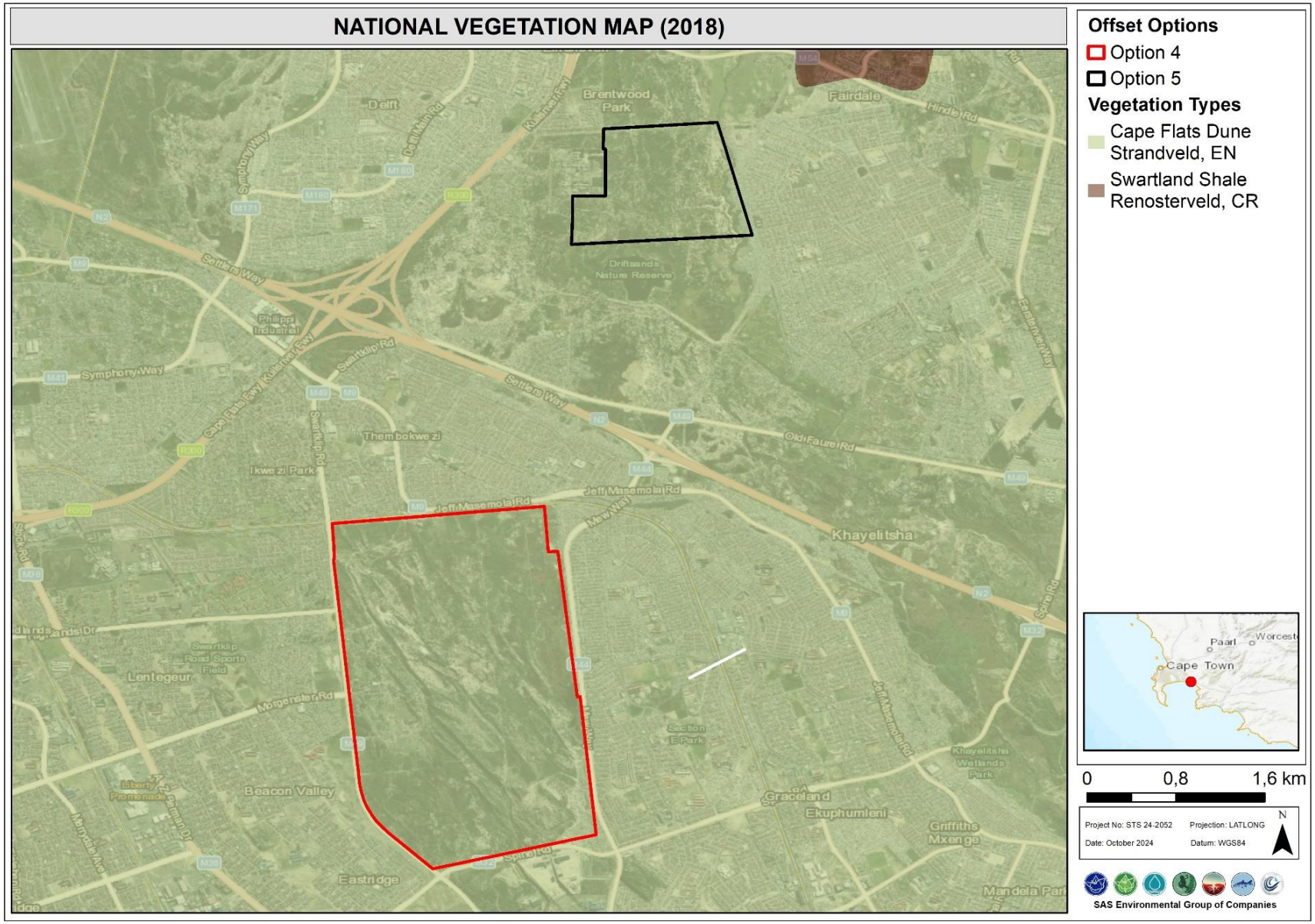

Figure 7: Map illustrating the vegetation types associated with the candidate offset site options 4 and 5.

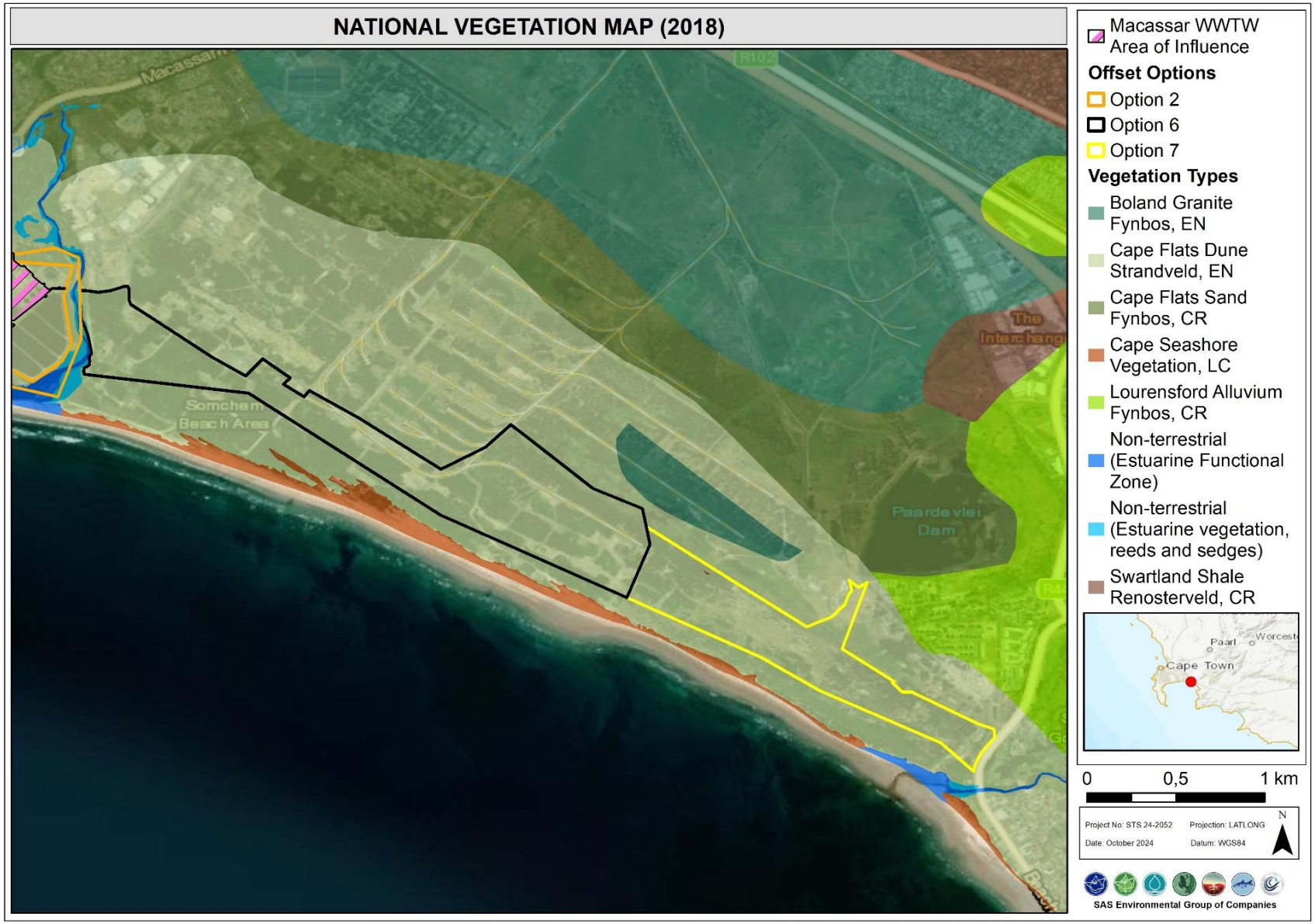

Figure 8: Map illustrating the vegetation types associated with the candidate offset site options 2, 6 and 7.

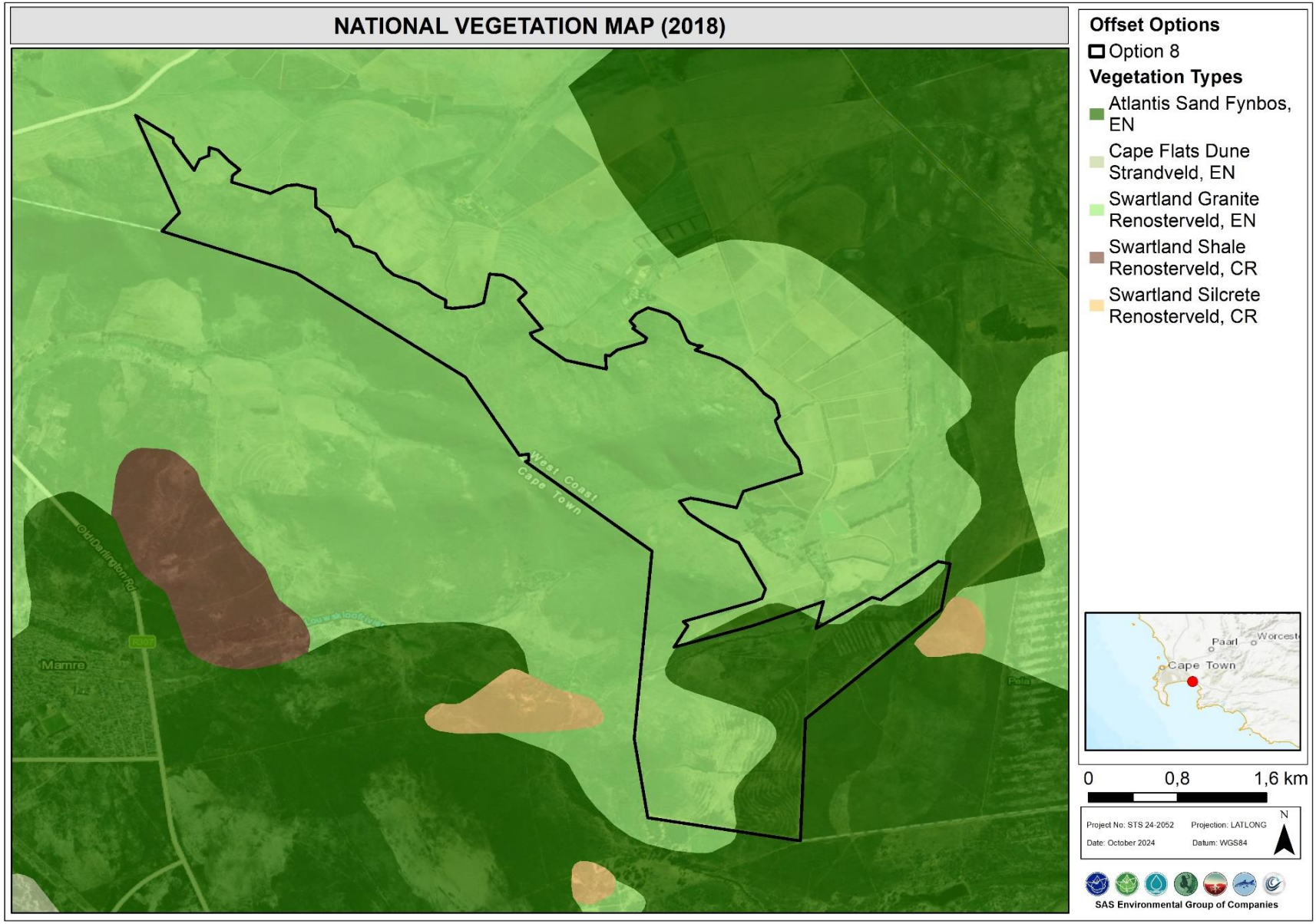

Figure 9: Map illustrating the vegetation types associated with the candidate offset site option 8.

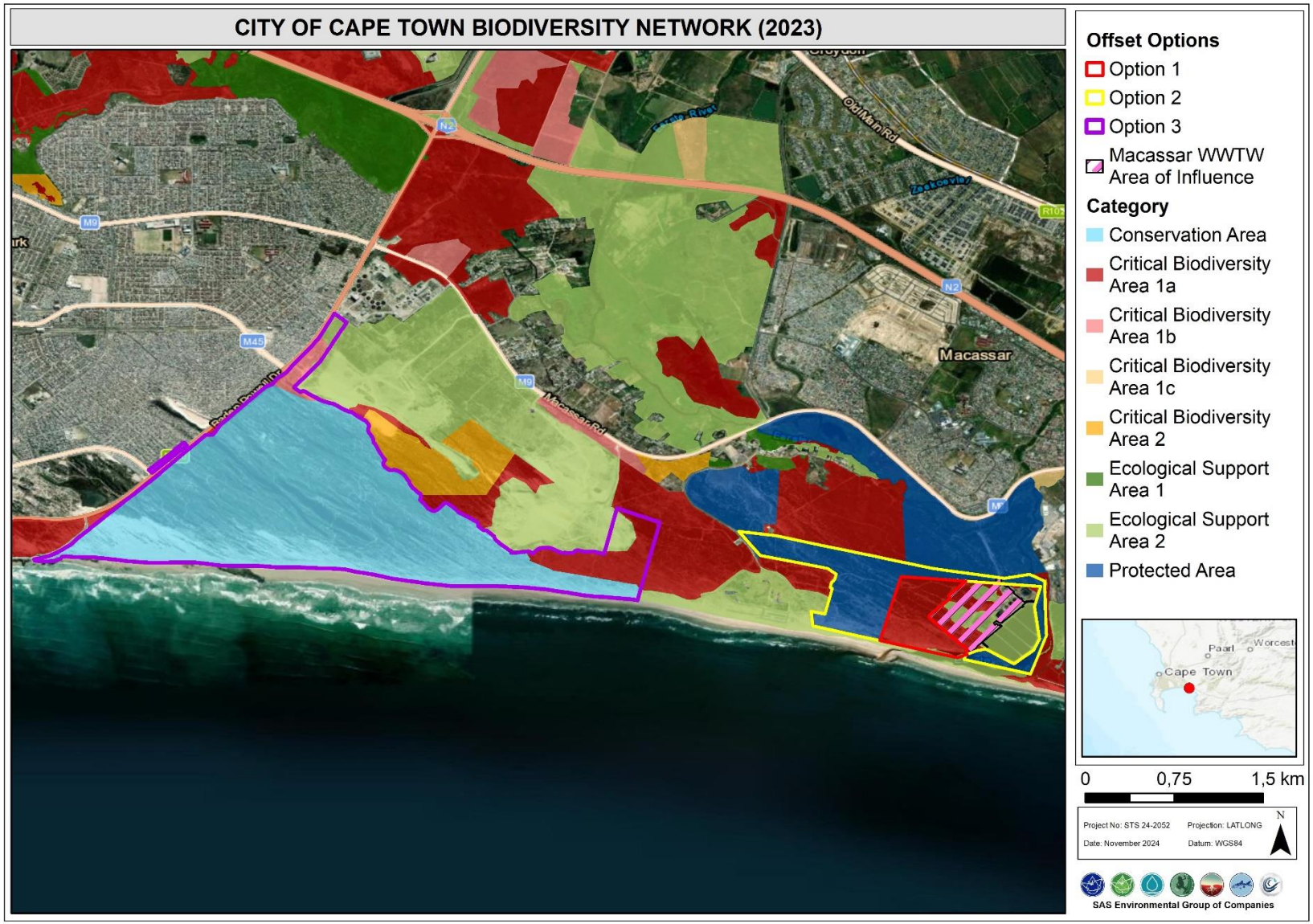

Figure 10: Map illustrating the municipal conservation features associated with the candidate offset site options 1, 2, and 3.

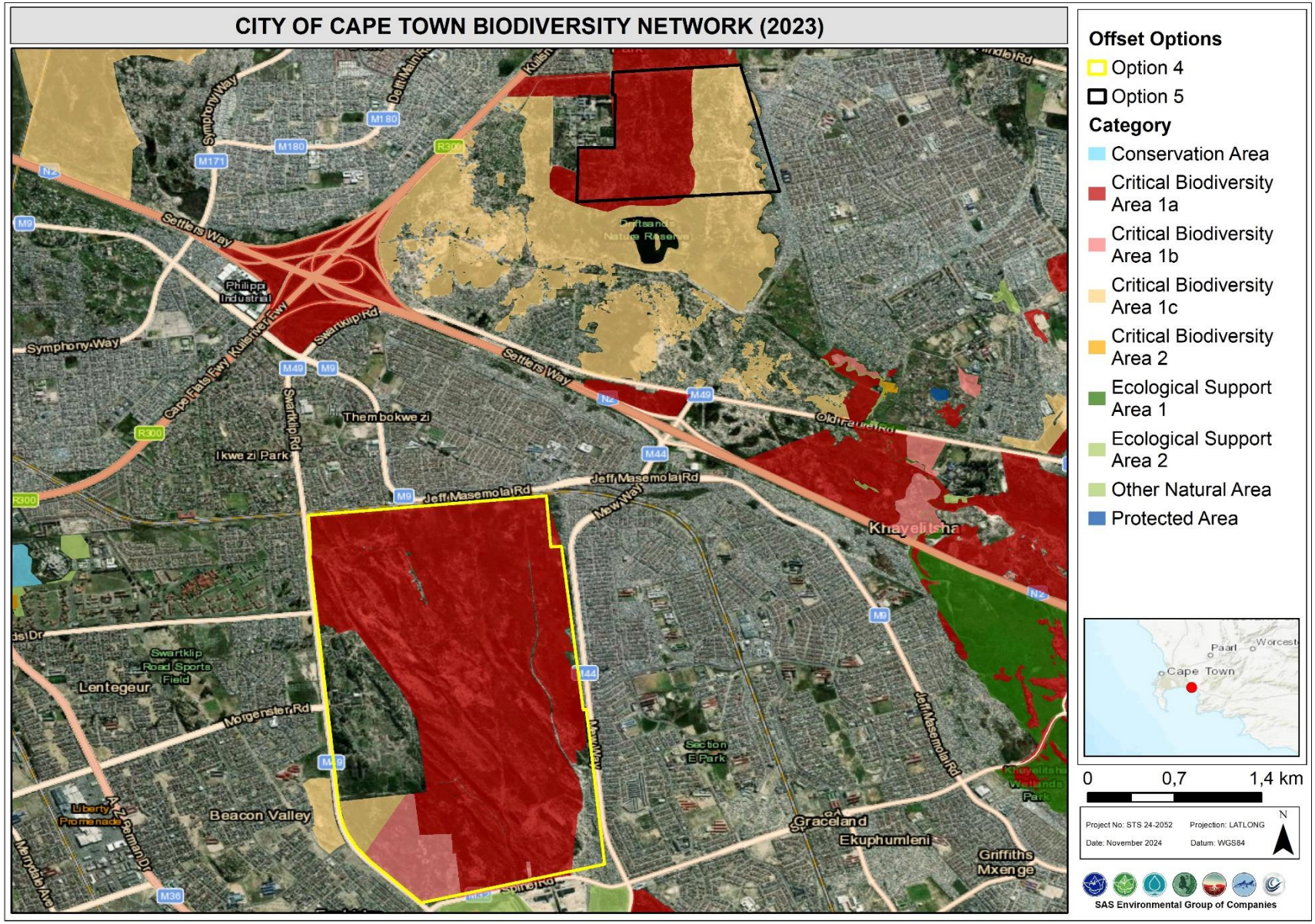

Figure 11: Map illustrating the municipal conservation features associated with the candidate offset site options 4 and 5.

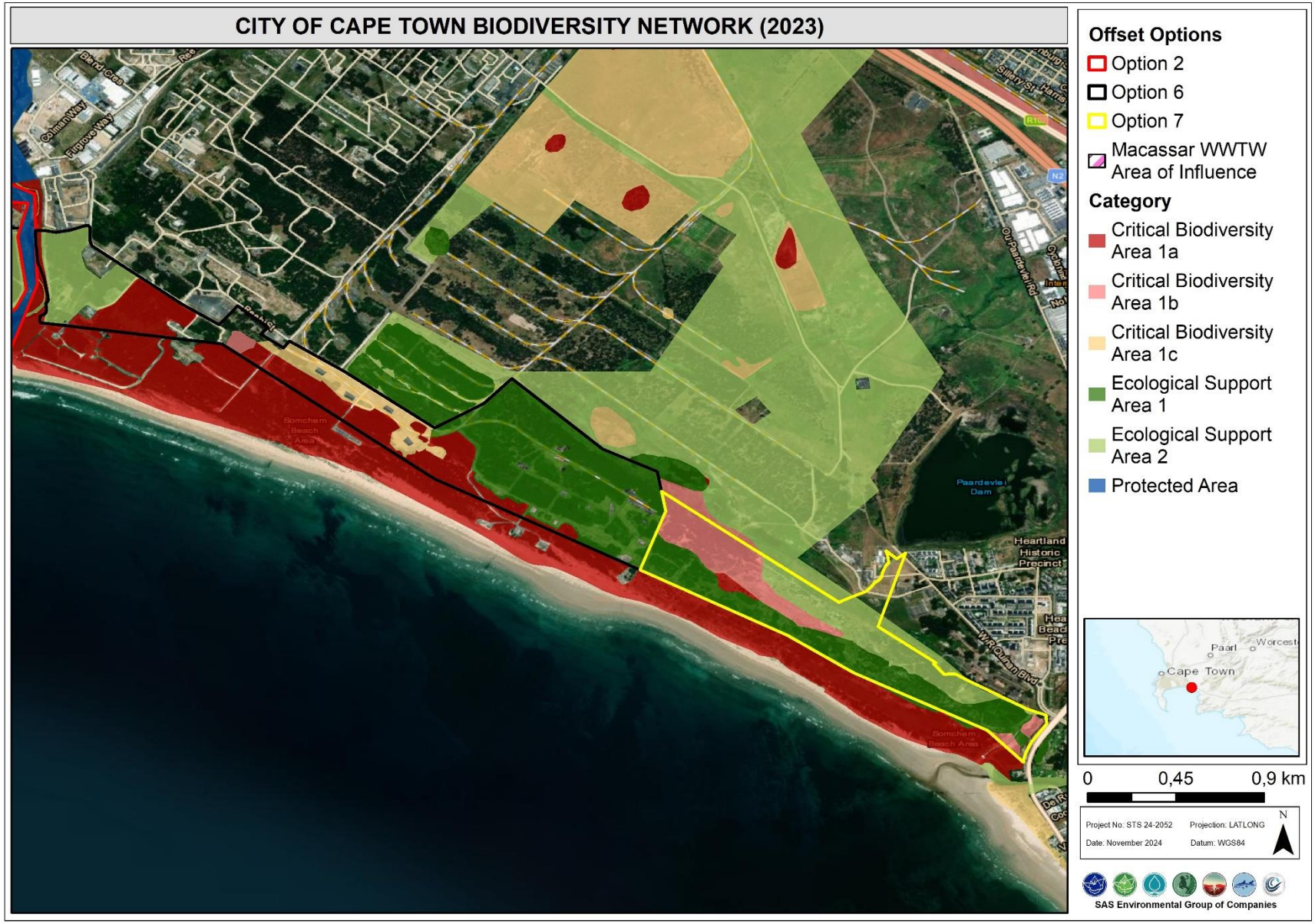

Figure 12: Map illustrating the municipal conservation features associated with the candidate offset site options 2, 6 and 7.

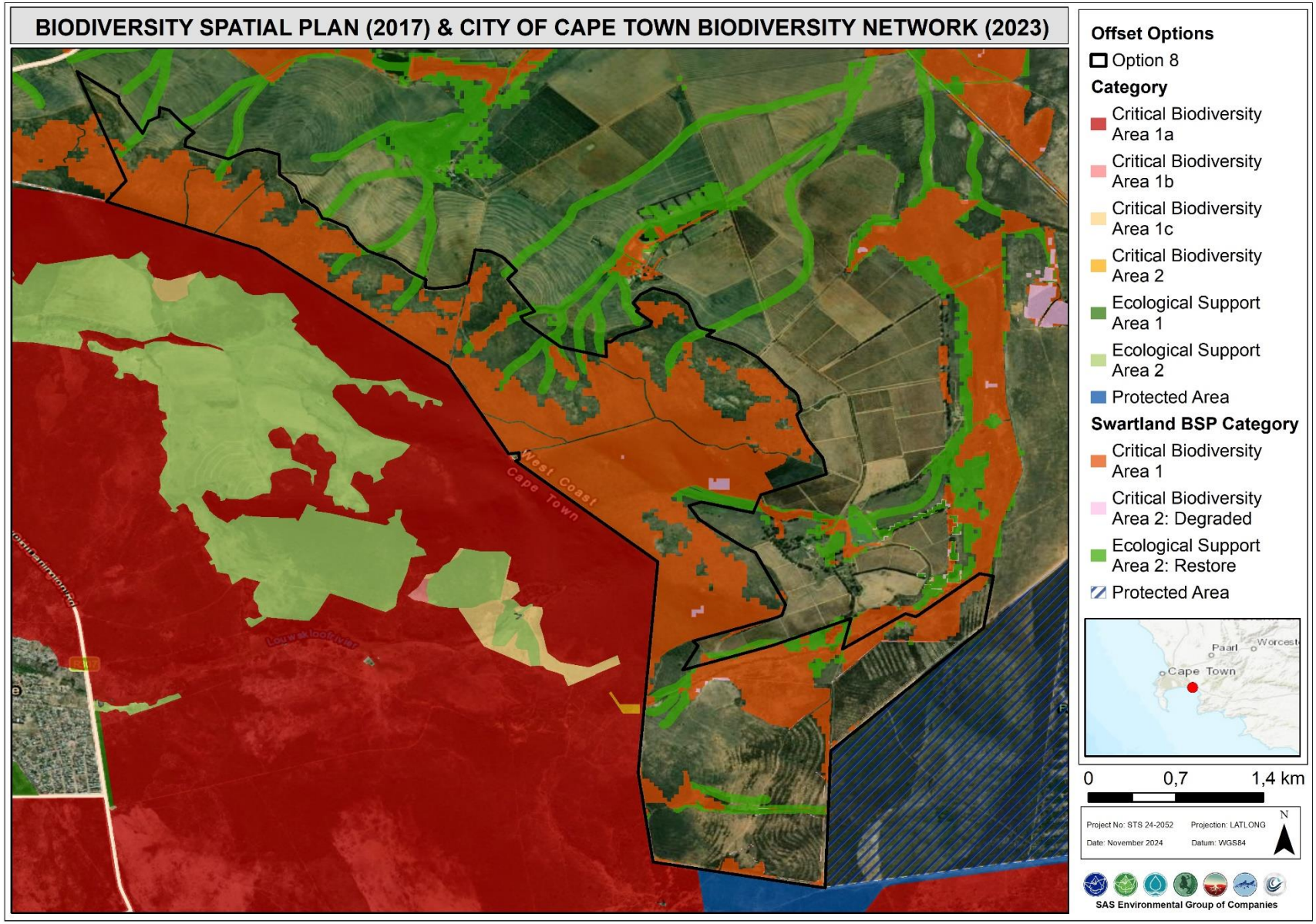

Figure 13: Map illustrating the municipal conservation features associated with the candidate offset site option 8.

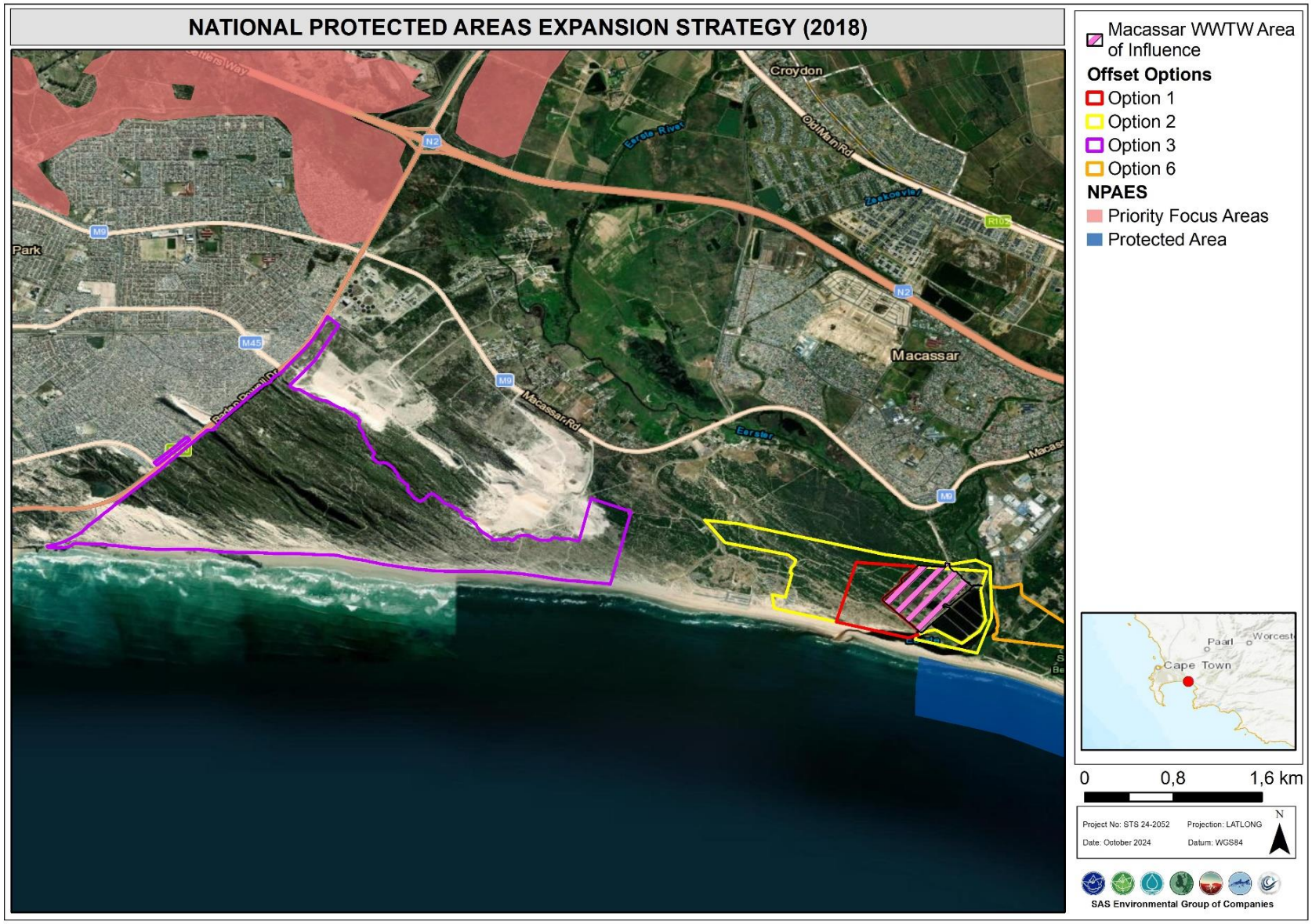

Figure 14: Map illustrating the candidate offset site options 1, 2, 3 and 6 in relation to categories of the 2018 NPAES database.

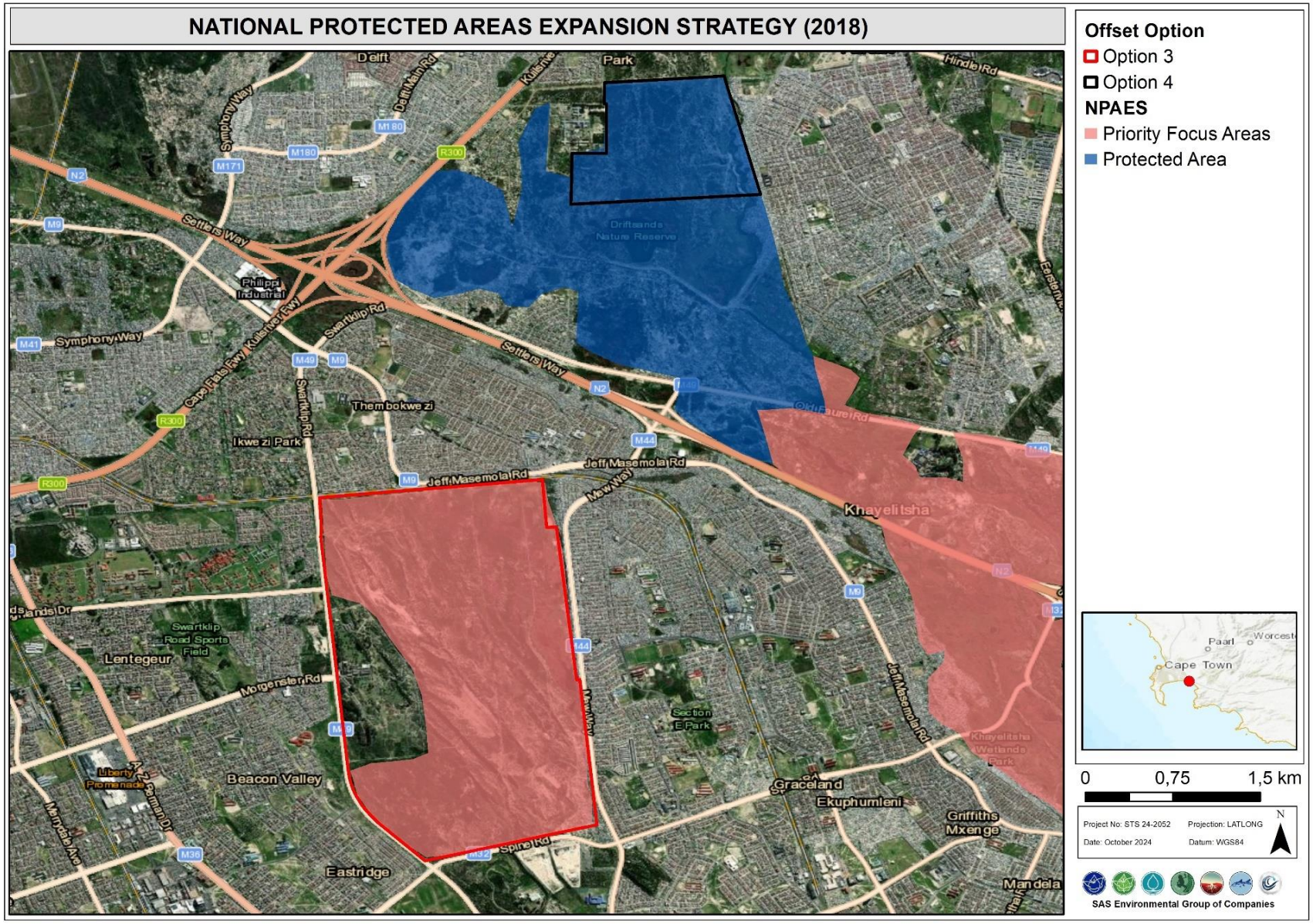

Figure 15: Map illustrating the candidate offset site options 3 and 4 in relation to categories of the 2018 NPAES database.

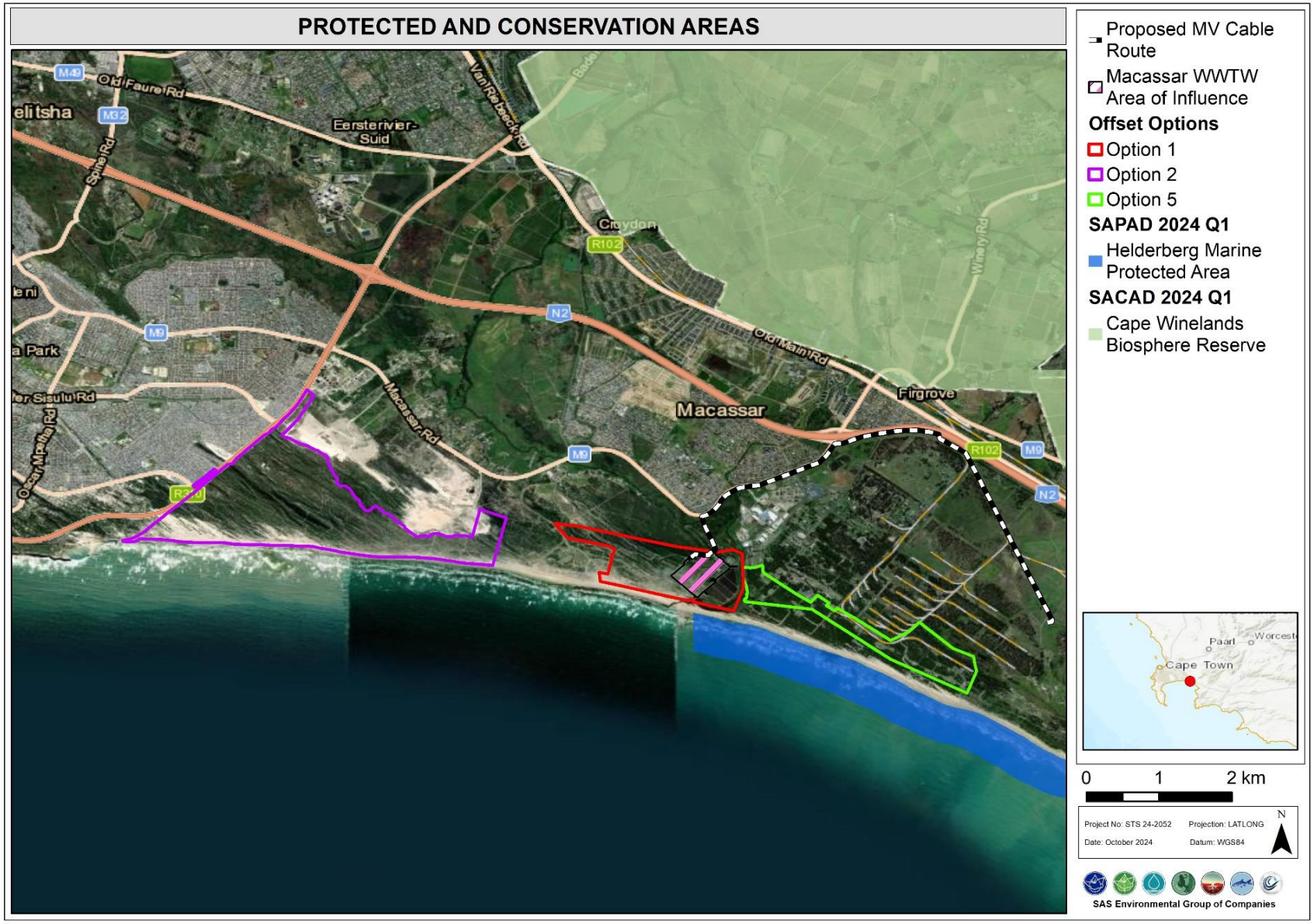

Figure 16: Map illustrating the candidate offset site options 1, 2 and 5 in relation to formally protected and conservation areas.

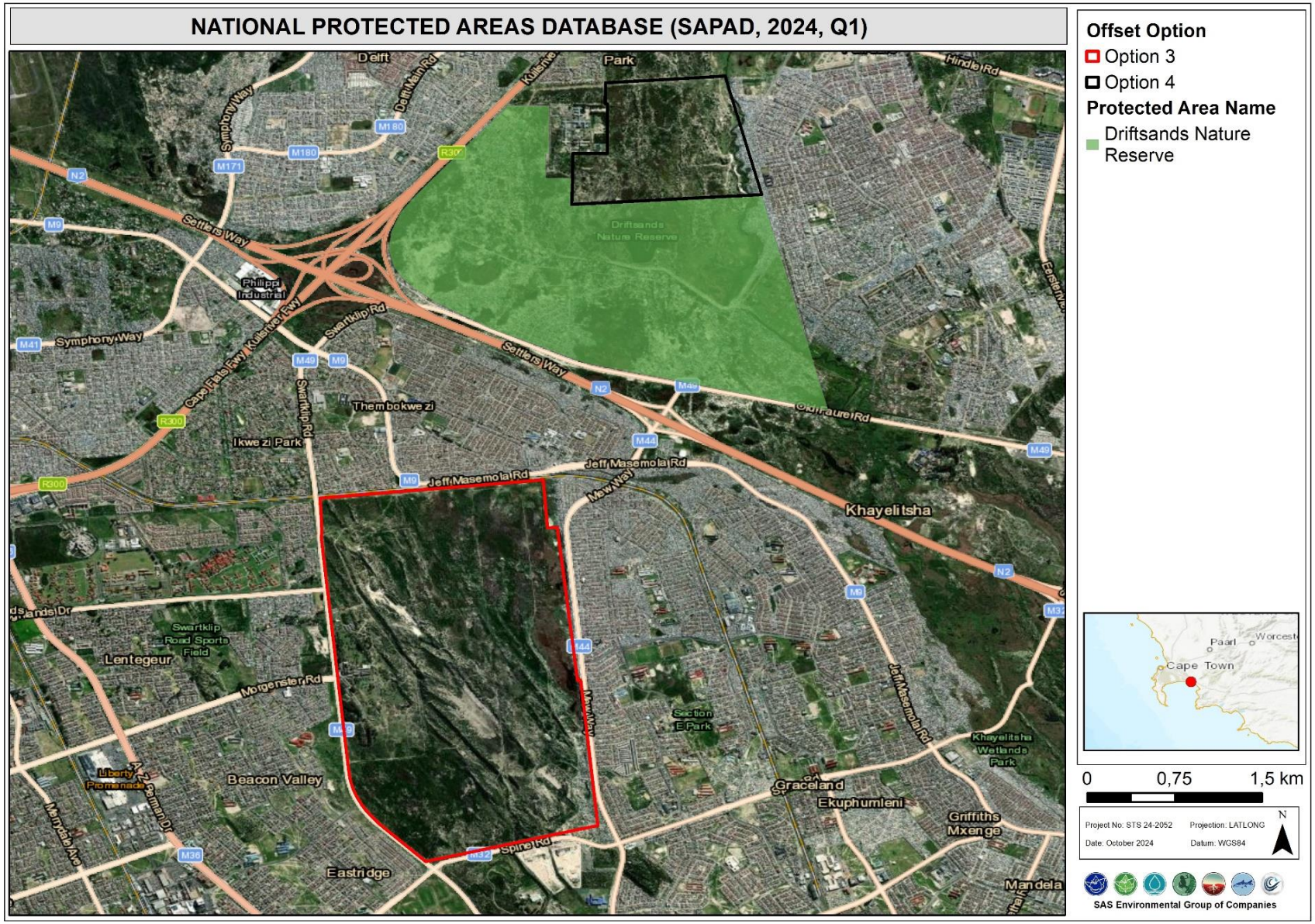

Figure 17: Map illustrating the candidate offset site options 3 and 4 in relation to formally protected and conservation areas.

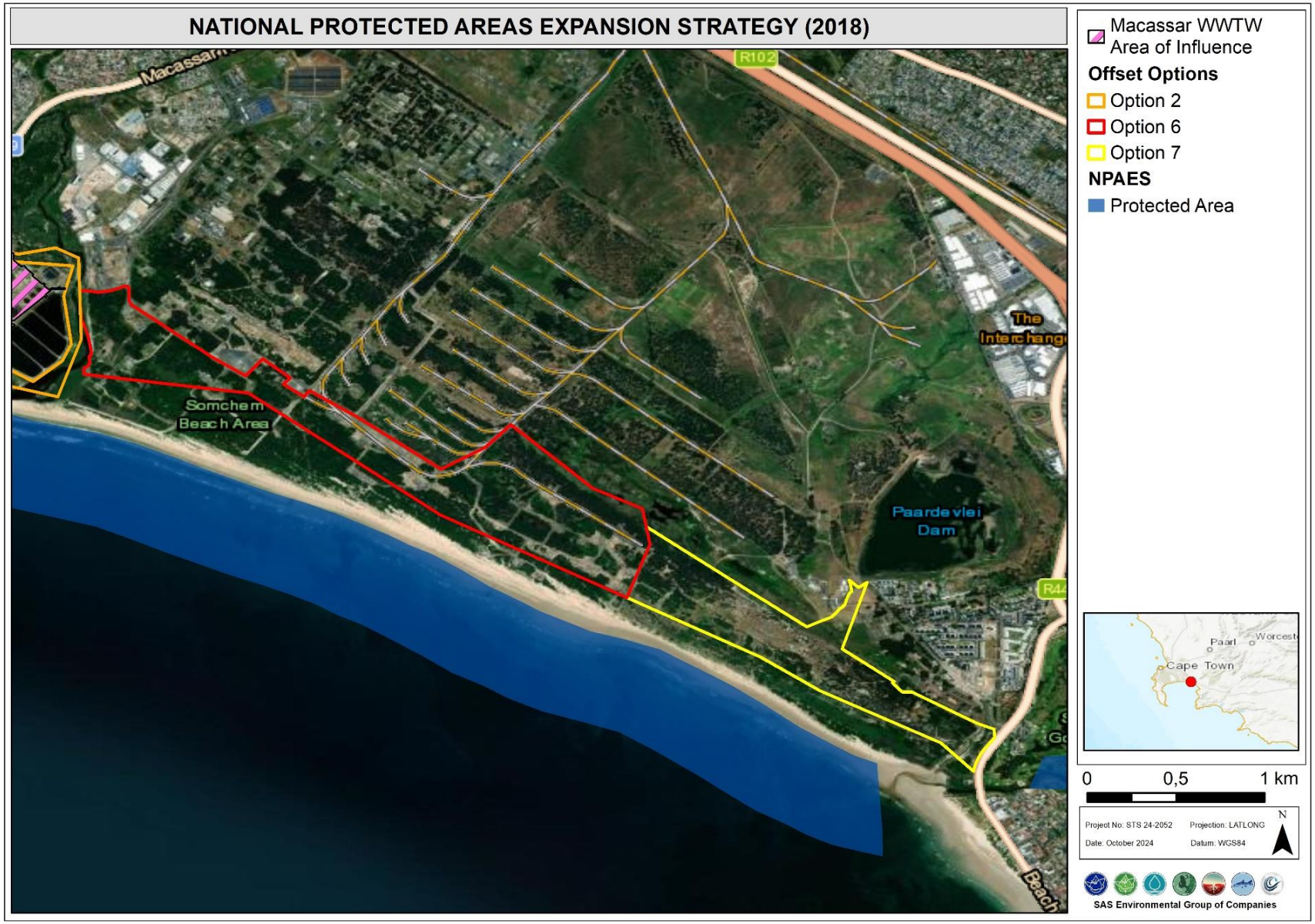

Figure 18: Map illustrating the candidate offset site options 2, 6 and 7 in relation to formally protected and conservation areas.

6. CHARACTERISATION OF THE MACASSAR WWTW AREA OF INFLUENCE AND THE TARGET OFFSET SITE

To effectively apply the various assessment methods and offset calculators, it is crucial to have a comprehensive understanding of the biodiversity characteristics of both the impacted area to be offset (i.e., the Macassar WWTW Area of Influence) and the area designated for offsetting (i.e., the Candidate Offset Sites). The section below provides an overview of the Macassar WWTW Area of Influence, where development and water treatment activities have occurred, in terms biodiversity features and characteristics. Additionally, a section is included to examine the ecological attributes of the Candidate Offset Site Options which are essential for the successful implementation of the Offset Strategy.

This section outlines the characteristics of the Macassar WWTW Area of Influence (i.e., where proposed activities will occur) and 2) the Target Offset Site (i.e., Candidate Offset Site Options 1, 7 and 8) from a biodiversity perspective.

Note: Habitat characteristics pertaining to the MV cable are not included in the discussions below as this habitat is not considered for offset purposes (refer to Section 7 for further information).

6.1 Biodiversity Characterisation: WWTW Area of Influence

This section outlines the characteristics of the WWTW Area of Influence from a biodiversity perspective.

6.1.1 Broadscale Habitat Characteristics

The Macassar WWTW Area of Influence (excluding the MV Cable) is located within the Fynbos Biome (and the associated West Strandveld Bioregion). The reference vegetation type includes the **Cape Flats Dune Strandveld**. The Cape Flats Dune Strandveld is classified as EN according to Mucina and Rutherford (2006), the updated 2018 Vegetation Map of South Africa, Swaziland, and Lesotho (SANBI, 2018a), as well as the latest 2022 RLE database (Figure 6 and Table 2). The Cape Flats Dune Strandveld is moderately protected.

Table 2: Vegetation type descriptions and photographs as per Mucina & Rutherford (2006).

Vegetation Type	Description
Cape Flats Dune Strandveld (EN)	Flat to slightly undulating (dune fields) landscape covered by tall, evergreen, hard-leaved shrubland with abundant grasses and annual herbs in gaps. 

From a desktop review perspective, the following information is applicable to the Macassar WWTW Area of Influence:

- The Macassar WWTW Area of Influence is associated with three (2) categories according to the 2023 City of Cape Town Biodiversity Network, including CBA 1a and Ecological Support Area (Category 2; ESA2) (Figure 10);
- In terms of protected and conservation area dynamics, the NPAES (2018 dataset) indicates that the Area of Influence is not within an **Area Under Negotiation, Priority Focus Areas or a Protected Area.** Furthermore, as per the (1) SACAD (2024 Q1) dataset[4] and (2) SAPAD (2024 Q1) dataset[5], the Area of Influence does not occur within a protected or conservation area (Figure 14); and
- In terms of Animals Species sensitivity, as per the DFFE screening tool outcomes, northern and northeastern sections of the Area of Influence fall within high sensitivity areas, with majority of the Area of Influence categorized as medium sensitivity. Triggering

[4] **SACAD (2024):** The types of conservation areas that are currently included in the database are the following: 1. Biosphere reserves, 2. Ramsar sites, 3. Stewardship agreements (other than nature reserves and protected environments), 4. Botanical gardens, 5. Transfrontier conservation areas, 6. Transfrontier parks, 7. Military conservation areas and 8. Conservancies.

[5] **SAPAD (2024):** The definition of protected areas follows the definition of a protected area as defined in the National Environmental Management: Protected Areas Act, (Act No. 57 of 2003). Chapter 2 of the National Environmental Management: Protected Areas Act, 2003 sets out the "System of Protected Areas", which consists of the following kinds of protected areas - 1. Special nature reserves; 2. National parks; 3. Nature reserves; 4. Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003); 5. World heritage sites declared in terms of the World Heritage Convention Act; 6. Marine protected areas declared in terms of the Marine Living Resources Act; 7. Specially protected forest areas, forest nature reserves, and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998); and 8. Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970).

species include (1) birds such as *Circus ranivorus* (African Marsh Harrier, EN), *Circus maurus* (Black Harrier, EN), *Sterna caspia* (Caspian Tern, vulnerable (VU)), *Pelecanus onocrotalus* (Great White Pelican, VU), and *Afrotis afra* (Southern Black Korhaan, VU), and (2) invertebrates such as *Frankenbergerius opacus* (DD), and *Aneuryphymus montanus* (Yellow-winged Agile Grasshopper, VU). For the Plant Species Theme, the Area of Influence is located in areas of medium sensitivity. Triggering floral species include: 53 EN, nine (9) CR, 47 VU and 34 Sensitive species[6]. A very high sensitivity was indicated for the Terrestrial Biodiversity Theme, with triggering features including the presence of key conservation features such as CBA 1: Terrestrial, ESA 2: restore from plantation or high-density AIPs, and the EN Cape Flats Dune Strandveld.

6.1.2 Fine Scale Habitat Characteristics

A previous assessment conducted by Helme (2024), distinguished three (3) communities for the WWTW Area of Influence. The three (3) categories are sensitivity and are considered the product of plant species diversity, plant community composition, rarity of habitat, degree of habitat degradation, rarity of species, ecological viability and connectivity, restorability of habitat, vulnerability to impacts, and reversibility of threats. The three identified categories associated with the WWTW Area of Influence include (Figure 19):

- **High sensitivity areas**: areas of high sensitivity supported largely natural vegetation of the EN Cape Flats Dune Strandveld, with at least two plant SCC having been identified in these areas. These areas were also associated with CBA1b habitat;
- **Medium sensitivity areas**: areas of medium sensitivity included those areas that support more recently colonised dunes, with structurally much simpler vegetation (not trees or large shrubs), and a lower species diversity (including fauna and flora). Most of these areas were also mapped as CBA1b, but did not support any floral SCC; and
- **Low sensitivity areas**: areas of low sensitivity include areas that have been heavily disturbed, support little or no natural vegetation, and in which no floral SCC occurred.

[6] As per the best practice guidelines as stipulated by the South African National Biodiversity Institute protocol (SANBI), the name of sensitive species may not appear in the public domain as a means to protect the identity and potential location of such species.

Figure 19: Map illustrating the sensitivity classes associated with the WWTW Area of Influence as identified by Helme (2024).

6.2 Biodiversity Characterisation: Target Offset Site

This section outlines the characteristics of the Target Offset Site (i.e., Candidate Offset Site Options 1, 7 and 8) from a biodiversity perspective.

6.2.1 Broadscale Habitat Characteristics

The Target Offset Sites share many conservation characteristics with the Macassar WWTW Area of Influence (Section 9.1). Two Options of the Target Offset Site (i.e., Options 1 and 6) are situated in the same vegetation type as the Macassar WWTW Area of Influence, i.e., the Cape Flats Dune Strandveld. However, Option 8 is located within the EN Swartland Granite Renosterveld and the EN Atlantis Sand Fynbos (Figures 6 and 9; Table 3). These vegetation types are classified as CR and VU respectively according to Mucina and Rutherford (2006). However, according to the updated 2018 Vegetation Map of South Africa, Swaziland, and Lesotho (SANBI, 2018a), as well as the latest 2022 RLE database these vegetation types are classified as EN.

Table 3: Vegetation type descriptions and photographs as per Mucina & Rutherford (2006).

Vegetation Type	Description
Swartland Granite Renosterveld (EN)	Moderate foot slopes and undulating plains supporting a mosaic of grasslands/herblands and medium dense, microphylls'[7] shrublands dominated by renosterbos. Groups of small trees and tall shrubs are associated with heuweltjies and rock outcrops. The boundary with Boland Granite Fynbos is diffuse and patchy. 
Atlantis Sand Fynbos (EN)	Moderately undulating to flat sand plains with a dense, moderately tall, ericoid shrubland dotted with emergent, tall sclerophyllous shrubs and an open, short restioid stratum. Restioid and proteoid fynbos are dominant, with asteraceous fynbos and patches of ericaceous fynbos in seepages. 

Additional habitat characteristics associated with the Offset Alternatives include:

[7] "Microphylls" are defined as plants with leaves that are small in size, specifically measuring less than 20 mm in length (Musina & Rutherford (2006)).

- Large portions of the Target Offset Site are designated as CBAs, including Category 1a, 1b, 1c, 2 as well as ESAs, and a Conservation Area and/or Protected Area (Options 2 and 3). This indicates that these areas provide essential ecological and biological functions crucial for conservation efforts (Figures 10 and 13); and
- In terms of Animals Species sensitivity, as per the DFFE screening tool outcomes, sections of the Target Offset Site are located within high and medium sensitivity areas. Triggering faunal species include (1) birds such as *Circus ranivorus* (African Marsh Harrier, EN), *Circus maurus* (Black Harrier, EN), *Hydroprogne caspia* (Caspian Tern, VU), *Pelecanus onocrotalus* (Great White Pelican, VU), *Sagittarius serpentarius* (Secretarybird, VU) and *Afrotis afra* (Southern Black Korhaan, VU), (2) invertebrates such as *Conocephalus peringueyi* (VU), *Frankenbergerius opacus* (DD), *Pachysoma aesculapius* (VU) and *Aneuryphymus montanus* (Yellow-winged Agile Grasshopper, VU), and (3) arachnids such as *Spermophora gordimerae* (DD). For the Plant Species Theme, the Target Offset Site is located in areas of high and medium sensitivity. The status of the floral triggering species includes CR, EN, VU, and NT. A very high sensitivity was indicated for the Terrestrial Biodiversity Theme, with triggering features including the presence of key conservation features such as CBA 1: Terrestrial, CBA 2: Terrestrial, ESA 1, ESA 2: restore from plantation or high-density AIPs, the EN Cape Flats Dune Strandveld, the EN Atlantis Sand Fynbos, and the EN Swartveld Granite Rensosterveld.

6.2.2 Fine Scale Habitat Characteristics

Detailed field assessments will be required to provide fine-scale habitat characteristics of the Target Offset Site (specifically Options 7 and 8). Field assessments for these options were undertaken on 5 November 2024.

A high-level field assessment was conducted on 1 October 2024, focusing on Offset Option 1 and aimed at evaluating site conditions and identifying potential rehabilitation interventions for implementation. Site one is predominantly natural, featuring intact Cape Flats Dune Strandveld vegetation.

7. BIODIVERSITY OFFSET METHODOLOGY

This section outlines the methods involved in the development of the Biodiversity Offset Strategy component. Most of the outlined methodology is provided in **Appendix C**; where relevant, reference to this Appendix and the appropriate figures and/or tables is defined in the sub-sections below.

7.1 Residual Impact Assessment: Biodiversity

Residual impacts, which are the negative effects on biodiversity remaining after the implementation of a development, were calculated using key ratios defined by the DFFE. Offsets must be applied according to these ratios, which are determined based on the ecological importance, sensitivity, vulnerability, and conservation status of the ecosystem. The standard approach for determining these ratios focuses on Ecosystem Extent, Ecosystem Protection Level, and Ecosystem Threat Status. Additionally, it is important to consider the classification of the area within biodiversity priority areas, such as CBA2s, to ensure that biodiversity priorities are met even in areas not selected due to ecosystem threat levels. The methods for determining offset ratios are detailed in **Appendix C**, with a high-level summary of the biodiversity offset determination methodology provided below:

- Ecosystem-based offset ratio calculation: the size of a biodiversity offset is determined by calculating an ecosystem-based offset ratio, which is the area required to offset the residual negative impact relative to the area affected. This ratio is influenced by the following factors:
  - Ecosystem Extent: if less than 30% of the ecosystem remains, a high offset ratio (e.g., 30:1) is applied. For ecosystems with 30-70% remaining, ratios vary based on the extent and protection level; and
  - Ecosystem Protection Level and Threat Status: the offset ratio increases for ecosystems that are CR, EN, or VU.
- Standard offset ratios: the following key ratios were defined by the DFFE (2023) which are then refined based on threat status and protection levels. Other aspects such as size, habitat intactness and species composition must also be considered:
  - A 30:1 ratio for CR ecosystems, where an offset would be appropriate only in exceptional circumstances;
  - A minimum ratio of 10:1 for EN ecosystems;
  - A 5:1 ratio for VU ecosystems; and
  - No offset for LC ecosystems.
- Urban development considerations: in urban settings, offset ratios may be adjusted downward due to the scarcity of space and natural areas;
- Like-for-like and trading-up: offsets should generally replace the same type of ecosystem ("like-for-like"). However, "trading-up" to protect higher-priority biodiversity may be justifiable if motivated by a lack of suitable areas for like-for-like offsets; and
- Adjustments for conservation priorities: if impacts occur in areas of lower conservation priority (e.g., CBA 2), the offset ratio may be adjusted upward by a factor of 1.5, up to a maximum of 30:1.

Appropriate offset ratios must align with the goal of achieving no net loss or a net gain in biodiversity. Ratios are typically higher for ecosystems with high conservation value or where the residual impact is significant.

8. BIODIVERSITY OFFSET RESULTS

The sections below provide the results pertaining to the Biodiversity Offset Strategy component. For the purposes of the offset determination SCC were assessed in this process and not the wetland offset determination to align to the National Biodiversity Offset Guidelines of 2023.

8.1 Residual Impact Assessment & Biodiversity Offset Target Ratios

Within the WWTW Area of Influence, the following extents are present within each sensitivity class:

- High Sensitivity areas (7.1[8] ha);
- Medium Sensitivity areas (2.2 ha); and
- Low Sensitivity areas (11.5 ha).

Areas of high sensitivity generally included sections with higher habitat integrity, while medium sensitivity areas were characterized by intermediate levels of ecological integrity. Low sensitivity areas encompassed historically altered sites (e.g., settling ponds) that have lower ecological integrity.

The focus of the offset calculations will encompass areas that have not previously been modified by the existing WWTW (i.e., areas of medium and high sensitivity – refer to Section 7.1 and Figure 19); significantly degraded and/or modified areas (e.g., Sediment and Settling Dam Overflow Ponds (of low sensitivity) – refer to Section 7.1 and Figure 19) will not be considered in the offset calculations as these areas are not deemed applicable for offset purposes[9].

8.2 Ratio Quantum Analyses

Table 4 provides pertinent information for calculating biodiversity offset ratios pertaining to the vegetation type associated with the Area of Influence.

8 One decimal place has been used in area calculations, as multiple decimals can create confusion and add negligible value in the context of larger-scale land assessments.

9 It is important to note that the extent of indigenous vegetation (as per the NEMA definition) to be cleared does not equate to the extent of habitat that requires offsetting. Only areas of **high** and **medium sensitivity** habitat are considered for offsetting, as **low sensitivity areas** and the MV cable area are not expected to experience significant residual impacts (refer to the report for further information). Therefore, the habitat requiring offsetting includes **high sensitivity and medium sensitivity areas.**

Table 4: Summary of broadscale vegetation characteristics as obtained from the 2023 Biodiversity Offset Guidelines.

Component	Aspect
Cape Flats Dune Strandveld	
Ecosystem Remaining Extent	56
Ecosystem Protection Level	Moderately protected
Ecosystem Threat Status	EN

Following the methods provided in **Appendix C**, the following **basic offset ratio(s)** were determined:

1. The Cape Flats Dune Strandveld (EN) is moderately protected and is estimated to have a remaining extent < 56 % (SANBI (2022) and 2023 National Biodoversity Offset Guidelines). Given this information, a **basic offset ratio of 2: 1** was calculated (see Table D1, Appendix D);
2. Following consideration of the threat status of the vegetation type (EN), a pre-determined **basic offset ratio of 10: 1** for EN ecosystems is recommended by the 2023 Biodiversity Offset Guidelines; and
3. Using the precautionary principle, the higher of the ratios would generally be used in further calculations. Thus, a **basic offset ratio of 10: 1** was determined.

Basic offset ratios can be **adjusted** based on the presence of CBAs and the condition and/or sensitivity of the habitat. Habitat sensitivity, often used as a proxy for ecological condition, helps determine the appropriate adjustments. In the Area of Influence, important biodiversity features have been identified, specifically CBA Category 1b habitat, which is classified as Irreplaceable and is in either good or fair condition. Ground-truthing field assessments confirmed that, with the exception of the Settling Ponds, all habitats within the Area of Influence support functioning CBA habitat, albeit to varying extents. The functionality of these CBA habitats is closely tied to their sensitivity, with high sensitivity areas generally exhibiting higher ecological integrity. **Consequently, offset ratios were adjusted to account for the presence of CBA habitat, using habitat sensitivity as a proxy of overall habitat condition**.

Habitats confirmed as supporting functioning CBA habitat, require a higher offset ratio. Following the methods provided in **Appendix C**, the following **adjusted offset ratios** were determined:

- **Habitats within CBA habitat and within areas of high sensitivity**: the adjusted offset ratio for these habitats was adjusted at a factor of 2; and
- **Habitats within CBA habitat and within areas of medium sensitivity**: the adjusted offset ratio for these habitats was adjusted at a factor of 1.5.

Given the above determined offset ratios, the following was calculated in terms of the required

habitat offset extents (Table 5). **Note**: low sensitivity areas (which encompass the sediment and settling dam overflow ponds) are excluded from calculations as this is not considered for offset purposes given the already modified nature thereof.

Table 5: Biodiversity quantum offset analyses for the Macassar WWTW.

Fine scale Habitat Unit	Residual Loss (ha)	Basic Offset Ratio	Preliminary Offset Required	Adjusted Ratio	Final Habitat Required within Offset Target (ha)
Habitat that overlaps with CBA habitat					
High Sensitivity	7.1	10: 1	71.4	2: 1	**142.8**
Medium Sensitivity	2.2		22.3	1.5: 1	**33.5**
Total	**9.3**	**-**	**93.7**	**-**	**176.3**

Thus, it was established that **176.3 ha** of Cape Flats Dune Strandveld or an appropriate alternate of conservation significance habitat is needed to be compliant with the biodiversity offset guidelines of 2023. **An average offset of 18.8: 1 was thus achieved (176.3/ 9.3).**

8.3 Biodiversity Offset Gains

The selected Target Offset Area encompasses sufficient habitat to account for the 176.3 ha that require offsetting. Specifically, 25.0 ha is available in Option 1, approximately 25 ha is potentially available in Option 7, and the remaining extent, approximately 126.3 ha is available within Option 8. The suitability of the selected sites is reinforced by the use of a like-for-like vegetation type (Options 1 and 6), a special case of trade-up (Option 8), and the significant potential for ecological enhancement through targeted rehabilitation activities (all options). Several factors make the selected Target Offset Areas (encompassing Offset Options 1, 7 and 8) a highly suitable choice for achieving the long-term conservation goals associated with the project to offset the residual (Table 6).

Table 6: Summary of biodiversity offset gains.

Criteria	Target Offset Area	Aspect	Adequate qualification in meeting or exceeding the target
Like-for-like offset	Options 1 and 7	Cape Flats Dune Strandveld (EN)	✓
Trade-up	Option 8	Swartland Granite Renosterveld (EN) & Atlantis Sand Fynbos (EN)	✓
Proclamation of Nature Reserve	Option 8	Potential proclamation of a Nature Reserve	✓

The proposed offset is adequate to compensate for the 176.3 hectares of residual impact, which was calculated using a 10:1 ratio, adjusted by factors of 2:1 or 1.5:1 based on habitat sensitivity. This results in an average offset ratio of 18.8:1, effectively offsetting 176.3 hectares for the 9.3 hectares lost.

From a conservation perspective, the offset is expected to yield notable biodiversity gains, particularly by enhancing and securing landscape connectivity and supporting key landscape

features of the EN Cape Flats Dune Strandveld as well as the EN Swartland Granite Renosterveld and EN Atlantis Sand Fynbos.

To further bolster the effectiveness of the Offset Strategy, it is recommended, in accordance with the guidelines, that the Offset Areas be formally proclaimed under the NEMPAA. This proclamation would provide additional legal protection and management oversight, ensuring the long-term conservation of the threatened vegetation type(s) and enhancing the overall conservation network in the region.

8.4 Biodiversity Offset Contingency Plan

It is important to note that although Option 7 is state-owned, there is always a possibility that unforeseen circumstances may render certain sections unavailable for offset purposes (e.g., if land use zoning designates the land for other uses). In such cases, any lost offset hectarage in Option 7 would be compensated by a larger offset extent within Option 8. Discussions with the CoCT have confirmed their agreement with this approach, should the need arise.

9. GENERAL MANAGEMENT AND GUIDING PRINCIPLES

This section provides an indication of general management and guidelines for the successful implementation of the offset.

9.1 Institutional Arrangements

Implementation of the Offset Strategy needs to take place within a well-structured governance framework that clearly defines roles, responsibilities, targets and outcomes, as well as the source and use of finances and processes for decision making and reporting. This section aims to define the most appropriate processes and mechanisms to facilitate and support the various role-players in undertaking their responsibilities in a transparent and efficient manner. The CoCT Environmental Management Department ("EMD") Biodiversity Management Branch ("BMB") has the necessary in-house skills and capacity, and mandate, to implement and/or undertake the ‘day-to-day’ and practical management of the offset sites. The options discussed in this section therefore aim to utilise the most appropriate organizations in terms of their mandate, skills and capacity for undertaking specific aspects of offset implementation, building on existing initiatives and relationships, and are visually presented in Figure 20. The Environmental Advisory committee could consist of the following departments/ entities: BMB, Wastewater Treatment Branch ("WWTB"), DEA&DP and DFFE.

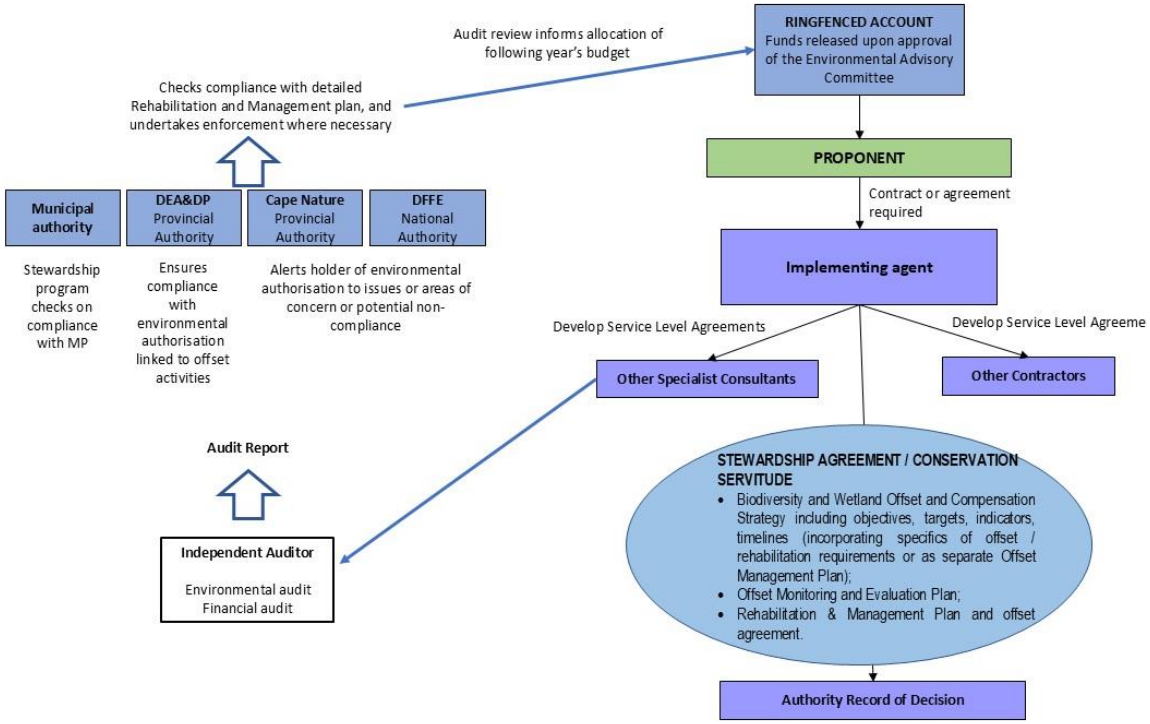

Figure 20: Flow diagram presenting proposed institutional arrangements and stakeholders.

9.2 Funding Model and Sources of Funding

Historically, the costs associated with significant residual impacts of large projects on the environment were not accounted for in the development costs and were effectively transferred to society as externalities, e.g., loss of ecosystem services. Offset strategies provide a mechanism for internalising these costs and thereby accounting for the 'full cost' of the project. To do so, however, requires that these costs are known and included in the capital budget of the project as well as defining the ongoing management costs of the Offset Strategy. As the applicant, the proponent will be legally responsible for satisfying its conditions regarding all rehabilitation activities and offset stipulations (i.e. securing and managing these offsets, with associated financial provision).

In the case of the WWTW, considering the 'polluter or environmental degrader pays principle' in NEMA, the offset costs must be included in both the capital budget and operational budget for the project.

The appointed implementing and managing agent for the proponent, has a contractual responsibility to meet the conditions of the offset which could become burdensome, and it is important that these costs are understood upfront.

A condition / requirement to the offset would be that the offset area must be proclaimed in perpetuity and that it be managed to the standard required as per a Nature Reserve under the NEMPAA.

9.3 Management and Implementation Structures

The proponent will be responsible for meeting the offset conditions. However, conservation is not the core function of the CoCT Directorate: Water and Sanitation Department ("WSD") Wastewater Treatment Branch ("WWTB") and there are other agencies (trained staff appointed by CoCT EMD BMB and/or other specialists) and programs which are better positioned for the implementation of rehabilitation and restoration programs as well as biodiversity offsets.

An Offset Agreement has been developed between the proponent and the implementing agent/s (Appendix G).

For successful operational management of the offset areas, necessary staff and resources will be required to ensure management and coordination of activities. The following key elements should be included for the proposed offset sites:

- **Offset Option 1**:
  - Operational staff are already in place for this area, reducing the immediate need for additional personnel. However, any expansion of activities or area coverage should include a review of resource requirements.
- **Offset Option 7** (if included in the offset):
  - Additional staff resources will be required to manage and monitor this area effectively, particularly if incorporated into the offset framework; and
  - Recommended staff and resource allocation should be evaluated based on the final inclusion and specific management needs of the site.
- **Offset Option 8** (Burgherspost):
  - The site will be managed as part of the Witzands Aquifer Nature Reserve, requiring dedicated personnel to oversee day-to-day operations and ensure the offset's objectives are achieved:
    - The recommended staff component includes a **Site Supervisor** (who would be responsible for coordinating all activities, managing field teams, and ensuring compliance with management plans), and **Field Rangers** (minimum of two to conduct regular patrols, monitor biodiversity, and support ecological management activities); and

- Additional resources required include a suitable **vehicle** for field operations and transport as well as equipment necessary for monitoring, invasive species control, and habitat management.

9.4 Roles and Responsibilities on the Ground

The following roles and responsibilities are applicable to this implementation plan and associated management actions (Figure 21):

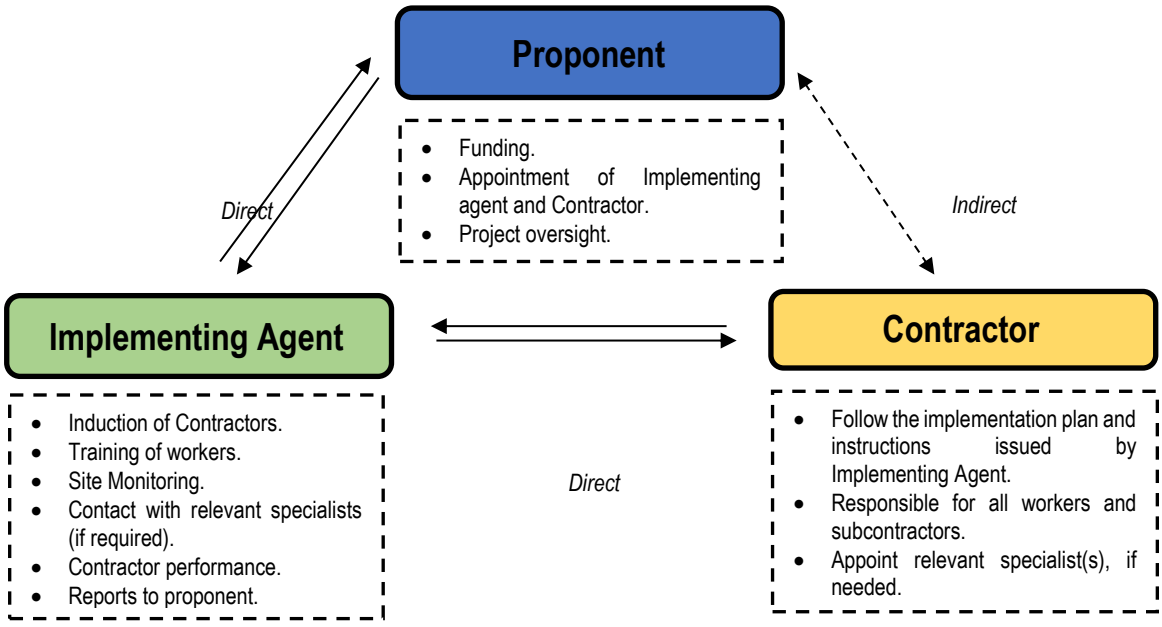

Figure 21: Diagram representing the roles and responsibilities that are applicable to the Rehabilitation and Management Plan.

9.5 Proponent

The proponent is responsible for the following:

- The proponent must ensure sufficient funding for the implementation and long-term maintenance of the mandated rehabilitation requirements as stipulated in this report;
- The Proponent will be responsible for entering into reactive Stewardship agreements and/or proclaiming the offset areas as nature reserves (under the NEMPAA (preferred option));
- The Proponent will be responsible for appointing an Implementing Agent tasked with managing the offset sites, overseeing daily operations, and ensuring the effective implementation of management activities. The Implementing Agent's responsibilities will include monitoring and auditing rehabilitation requirements, as well as supervising and evaluating contractor performance if contractors are appointed. This comprehensive role ensures the offset sites are effectively managed on the ground, addressing both operational and ecological requirements to achieve the offset

objectives; The Proponent will be responsible for ensuring all Contractors receive a copy of this document and understand its contents;

- The Proponent/ Implementing agent must ensure that that suitable penalties are in place for non-conformance of the conditions of the Water Use Licence as well as this Implementation Plan by the Contractor(s); and
- Should ownership of any property change, the role and responsibility for compliance with this Implementation Plan as well as long-term maintenance must also be transferred.

9.6 Implementing Agent

The Implementing agent is the entity or are the entities responsible for the implementation monitoring and auditing of the implementation plan both during rehabilitation and post-rehabilitation for phases of the offset. The Implementing agent is mandated to do the following:

- Ensure that all Contractor(s)/ Sub-contractor(s)/ employees are fully aware of their environmental responsibilities and the sensitivities of the site. This should take the form of an initial environmental awareness-training program in which requirements of this document will be explained;
- Monitor site activities on a regular basis to ensure that there is minimal unintended environmental impact to the surrounding areas as well as the areas to be rehabilitated;
- The Implementing agent should have all relevant contact details for the team responsible for implementation of this plan and any rapid response units, as needed, as well as details of the relevant specialists who developed the rehabilitation and implementation plans;
- Ensure that a ‘hotline’ exists for reporting incidents, specifically unplanned/uncontrolled fires breaking out and resolving any problems rapidly;
- the Proponent will be responsible for appointing an independent auditor to assess the Implementing Agent's compliance with the offset management and rehabilitation requirements;
- Supervising field teams (including rangers and other personnel) responsible for ecological maintenance, invasive species control, and habitat management;
- Establishing and enforcing conservation protocols for the long-term sustainability of the offset sites;
- Engaging with stakeholders, including local authorities and conservation officers, to ensure the offset sites are integrated into the broader ecological landscape;
- Proactively managing risks, such as fires or erosion, through rapid response mechanisms and preventative measures; and
- Compile all relevant technical and financial management reports and documentation.

Note: A mechanism for sourcing operational budget for options 7 and 8 must be defined by the implementing agent.

9.7 Training of Rehabilitation Workers

The Implementing agent is to facilitate an initial environmental induction to all Contractors and associated workers in environmental awareness, including minimisation of disturbance to areas of increased ecological sensitivity, as well as fauna and flora with a no poaching policy, management of waste and prevention of water pollution. Furthermore, the Implementing agent is to ensure that all operational workers have received basic training on fire management and prevention measures and be aware of any emergency protocols required.

9.8 Contractor Performance

The Implementing agent must ensure that the Contractor adheres to the conditions of this Implementation Plan. Should the Contractor require clarity on any aspect of this Implementation Plan, the Contractor must contact the Implementing agent directly, who, if needed can consult with the specialists involved in Phases one (1) through three (3) of the Biodiversity Offset Plan. Should the Implementing agent feel that the conditions of the environmental authorisation (for the proposed expansion project) or of this implementation plan are not being met by the Contractor(s), the Implementing agent has been given the authority by the Proponent to stop works if in his/her opinion there is/may be a serious threat to or impact on the surrounding environment and instruct the contractor(s) on suitable rectification and remediation actions that must be implemented immediately.

9.9 Contractors

The following is applicable to the contractors appointed for the programme:

- The Contractor(s) in this case refers to any Contractor(s) on site, including the sub-contractors associated with the rehabilitation of the identified areas only;
- The Contractor is to report directly to the Implementing agent; and
- It is the responsibility of the Contractor(s) to ensure that they adhere to this implementation plan as well as any mitigation measures instructed by the Implementing agent.

9.10 Audit

If the offset sites are proclaimed as nature reserves (as per the NEMPAA), then the annual audits conducted by CapeNature should be designed to fulfil the purpose of auditing the offset requirements.

It is common practice for audits to be conducted periodically to ensure ongoing accountability and the achievement of biodiversity offset objectives. The following should be noted:

1. **Frequency of Audits**: audits should be conducted annually during the initial phases of the offset implementation (e.g., during active rehabilitation and the early stages of offset management). Afterward, as the offset sites stabilize and biodiversity gains are established, the frequency may be reduced to every two to three years, depending on the findings and recommendations from earlier audits;
2. **Timing of the First Audit**: the first audit should occur within one year of the offset implementation commencement, ensuring early-stage activities are progressing as planned;
3. **Duration of Auditing Activities**: auditing should be a repeated activity throughout the lifespan of the offset program, continuing until biodiversity offset objectives are demonstrably achieved, which may span several years or even decades. This ensures sustained compliance and long-term biodiversity gains; and
4. **Justification for Periodic Audits**: regular audits are critical to adapting management strategies, addressing unforeseen challenges, and ensuring transparency in financial and biodiversity outcomes. The findings from these audits should guide continuous improvement in offset management.

10. REHABILITATION & MANAGEMENT PLAN

To identify and direct an optimal rehabilitation process, or to adopt the best possible/practicable rehabilitation and management approach, the desired outcomes of rehabilitation should be clear from the start. This concept rehabilitation plan is designed to enhance terrestrial ecosystems within the final designated Offset Areas.

Note: the rehabilitation activities provided in this report pertain to those envisioned for the various offset areas (including Options 1, 7 and 8). Given the varied ecological condition of each Offset Option, different / more / less intensive rehabilitation activities may be required for each Option. However, for the purposes of this report, a single, consolidated Rehabilitation and Management Plan has been developed. Specific measures and actions tailored to the different Offset Options (Options 1, 7 and 8) will be discussed where necessary to address the unique requirements of each area and its specific rehabilitation needs. **It must however be noted that refinement of this concept plan will be required at the implementation phase and adaptive management principles must be applied. If the offset obtains approval, separate, detailed management plans would be required to be developed by suitably trained individuals for each of the Offset Sites.**

Three key concepts are considered during rehabilitation strategies, e.g., “remediation”, “rehabilitation” and “restoration”, each with slightly different objectives and concepts. Below is a list of important terminology as adapted from McDonald *et al.* (2016) and Hattingh (2019):

- **Remediation:** is the environmental clean-up of land and water contaminated by organic, inorganic or biological substances; and
- **Rehabilitation:** is the transformation of land disturbed from its original condition to a new and beneficial condition that does not necessarily resemble the pre-disturbance condition. Practical rehabilitation should consist of the following phases in best practice:
    - Structural rehabilitation**:** Involves the physical rehabilitation of areas, by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long term sustainable ecological structure;
    - Functional rehabilitation ensures that the functionality of the ecosystem (associated with the affected areas) supports the intended post-closure land uses. This requires monitoring during and after the rehabilitation project;
    - Biodiversity reinstatement ensures that a reasonable level of biodiversity is re-instated to a level that supports the proposed post-closure land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community to become re-established or community suitable for supporting the intended land use; and
    - Species reinstatement which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural, ecosystem functioning and conservation reasons. Species reinstatement need only occur if deemed necessary.
- **Restoration** is defined as “the artificial acceleration of the processes of natural succession by putting back the original ecosystem’s function and form” (Hattingh, 2019). The aim of any ecological restoration activity is to achieve ecosystem recovery as far as possible, so that the repaired ecosystem resembles an appropriate local native model.

Rehabilitation and restoration are a hierarchical and iterative process. Efficient planning of a rehabilitation or ecological restoration project involves clearly defining what terminology will be used to describe desired outcomes. Additionally, it is useful to have a hierarchy of those terms to efficiently organise planning and create timeframes in which certain outcomes from project efforts are to be achieved. Figure 21 is a hypothetical example of a hierarchy of terms to define and guide the rehabilitation and restoration initiative (adapted from McDonald *et*

al., 2016) which defines the level of detail of planning at each point in the hierarchy. Please refer to **Appendix F** for additional information on the rehabilitation framework approach.

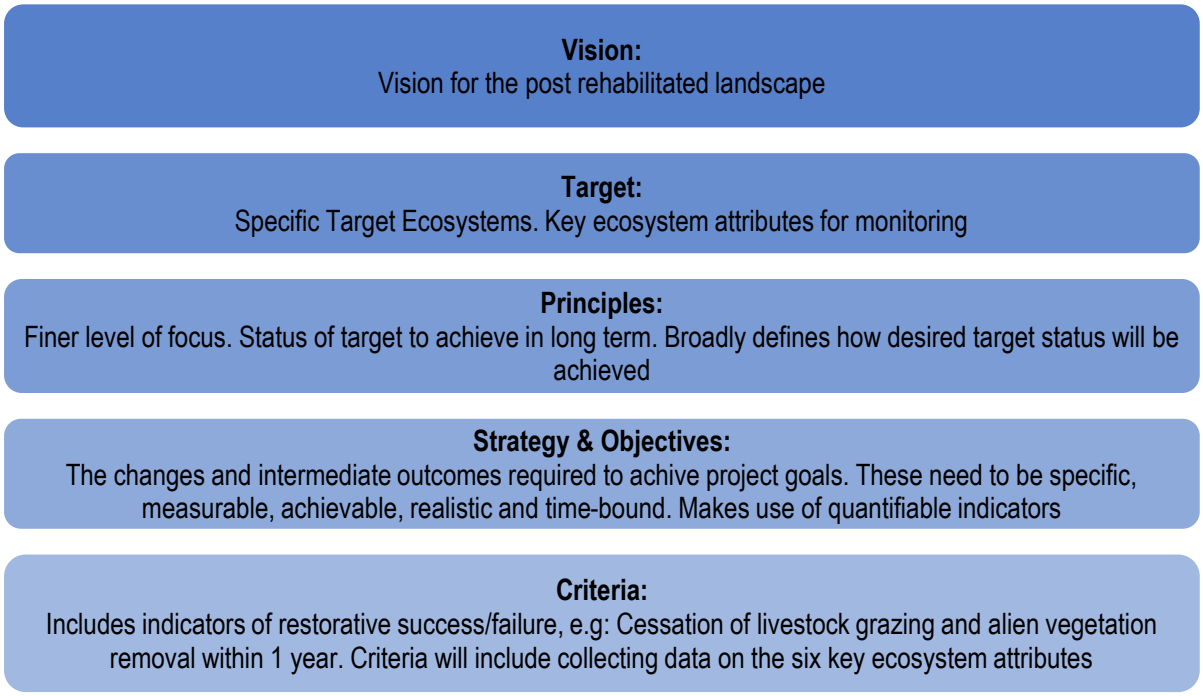

Figure 22: Example of the hierarchy of terms to assist in achieving long term and short-term rehabilitation goals.

10.1 Rehabilitation and Management Vision, Targets and Objectives

10.1.1 Vision

The vision for the ecosystems associated with the Macassar offset is presented in the Box 1.

BOX 1: REHABILITATION MANAGEMENT & VISION

To improve (where applicable) and maintain the terrestrial biodiversity within the Targeted Offset Areas, ensuring they have a structure and degree of functionality commensurate with (natural to largely natural) ecological communities such as that of the reference vegetation type in which levels of environmental and socio-cultural functionality are conserved and restored in perpetuity while transferring biodiversity management and restoration expertise and training to the benefit of present and future generations.

10.1.2 Targets

The overarching target for rehabilitation and management has been defined as a point in the rehabilitation continuum where the ecosystem function has been repaired to a point where interventions by the proponent can take place to initiate recovery to a self-sustaining, ecological intact biotic community (in strategic areas (i.e., CBAs) to contribute to conservation targets) that supports an array of indigenous species (fauna and flora) that will facilitate the

establishment of natural, good condition reference vegetation type[10] (over time), with the aid of additional human intervention and at a point the area becomes self-sustaining and self-perpetuating.

10.1.3 Objectives

The rehabilitation objectives for the Target Offset Areas (Options 1, 7 and 8) were determined to be:

- To comply with all relevant environmental regulations and license requirements;
- To create a stable and sustainable landscape that supports ecological rehabilitation and potential future uses in such a way as to minimize the residual impact on habitat and the associated vegetation and faunal species it supports;
- In areas where additional intervention is needed (e.g., degraded / modified areas), to ensure re-sloping activities and soil amelioration is conducted efficiently (e.g., in the case of rehabilitation of unused roads, old infrastructure areas, etc.);
- Maintenance of existing ecological processes (including herbivory and fire regimes) within the Offset Areas to ensure continued ecosystem service provision;
- Re-establishment of vegetation characteristics within the Offset Areas (where needed) to a functional state, allowing natural processes to take over and ultimately achieve conditions similar to those of the reference site[11], particularly in terms of vegetation structure and composition;
- Removal of physical barriers that hinder ecosystem connectivity or ecological functionality (i.e., removal of any dumped material, removal of internal fences, unused roads, etc.);
- Continued AIP species removal and control throughout the Offset Areas; and
- Ensure that freshwater habitats are appropriately managed to maintain their ecological integrity and functionality. This includes identifying and rehabilitating potential erosion areas, managing proliferation of AIPs and protecting biodiversity within these freshwater ecosystems.

To obtain the desired landscape within the Offset Areas, various rehabilitation activities may be required, depending on the current ecological condition of the respective areas. Specifically, areas that are largely natural and that have been subject to little anthropogenic

[10] Establishing the reference ecosystem model can be achieved by using existing reference sites that serve as analogues between the degraded site and its restoration target. In this case, the reference site is defined by Mucina & Rutherford (2006) which provides a synthesis of all the vegetation types found within South Africa. Within each vegetation synthesis, the general characteristics of the vegetation types is described together with an indication of dominant and./or important plant taxa within the vegetation type. These vegetation types form the basis on which the reference state is based.

[11] The reference site associated with the Offset and Compensation Area includes the Cape Flats Dune Strandveld, The Swartland Granite Renosterveld, and the Atlantis Sand Fynbos.

disturbance will require less intensive rehabilitation activities (e.g., large sections within Offset Option 8) *vs*. more intensive rehabilitation activities (e.g., degraded areas within Offset Options 1 and 7 in which historic unlawful dumping is apparent).

Across the Offset Areas, rehabilitation and management efforts will focus on enhancing the overall ecological condition and increasing the representation of floral species to reflect the reference vegetation type(s). In contrast, rehabilitation in degraded habitats will aim to restore the landscape to a minimum standard where pioneering vegetation is established within five years post-rehabilitation, supporting a stable ecosystem. With ongoing human-mediated intervention, these areas will gradually resemble the original system. The goal of this Rehabilitation and Management Plan is twofold: (1) to implement rehabilitation in degraded areas within the Offset Areas, and (2) to ensure the continued success of implemented management practices across the Offset Areas.

It is important to note that because the rehabilitation process and associated framework is iterative, these rehabilitation objectives may be updated as part of the adaptive management components of the framework.

Note: should this offset obtain approval, comprehensive site visits to the Target Offset Areas should be conducted to gain a deeper understanding of the ecological systems within the area. Following this visit, the Rehabilitation and Management Plan should be further updated to provide more detailed guidance on management activities for these areas. This will require the compilation of a more detailed offset implementation plan for each of the respective Offset Areas, as applicable.

10.2 Rehabilitation and Management Process Outline

The proposed rehabilitation framework is represented in the diagram below (Figure 23).

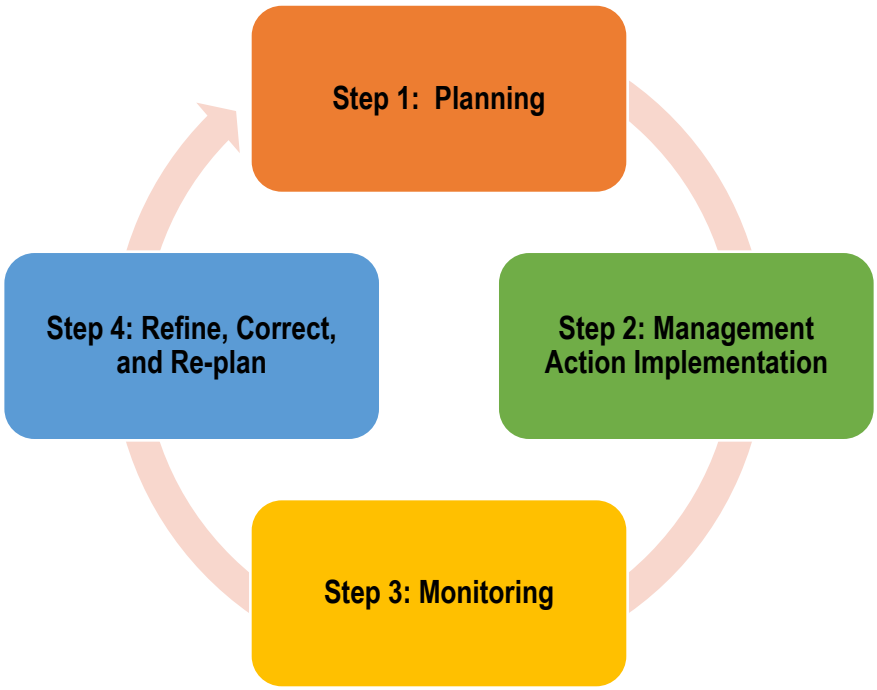

Figure 23: Rehabilitation Framework for the proposed offset associated with the Macassar WWTW Offset Strategy.

10.3 STEP 1 - Planning Phase

Step one sets out the necessary steps required for initial management practices. It focuses on planning and identifying the need for concurrent management activities as well as the requirements for long-term management planning.

The principles[12] associated with the proposed management framework for the Offset Strategy are discussed in their relative components in the Table 7. These principles will need to be enforced throughout the execution of the rehabilitation and restoration of the target areas.

Table 7: Key principles identified for the offset and rehabilitation framework to be implemented for the Offset Strategy.

Component	Principle/s
Financial provision	• Sufficient financial resources must be set aside for the rehabilitation and management actions, including capital expenditure for procurement of required equipment and workforce and for ongoing and adaptive maintenance and management, as well as for required monitoring.
Regulatory compliance	• Rehabilitation planning must be in accordance with legal compliance. • All proposed rehabilitation objectives and associated implementations will not conflict with local legislation. All rehabilitation objectives and associated activities must comply with all relevant legal bodies, and where possible, go beyond legal compliance and add additional ecological value.

[12] The principles of the planning phase are associated with the rules and principles that are set in place for successful rehabilitation to be achieved. A principle is a fundamental 'truth or law' that defines the direction or reasoning for a particular action. For rehabilitation planning, rehabilitation principles are used to define site-specific rehabilitation objectives and actions.

Component	Principle/s
	• Approvals for work in sensitive habitats such as the threatened vegetation types, CBAs, and ESAs (as is the case for the Offset Areas) must be obtained in terms of the NEMA.
Meeting expectations & statutory approvals	• Meet the requirements of relevant local and regional authorities such as the Department of Water and Sanitation (DWS). • All necessary permits for rescue and relocation of SCC will be required from the authorities. • Immediate neighbours or owners of infrastructure, within 100 m of a fire line, must be given written notice and in return give permission for the burn. • Participation in a Fire Protection Association will help to ensure correct procedures are followed. • The National Veld & Forest Fire Act, 1998 (Act No. 101 of 1998) and the Fire Brigade Services Act, 1987 (Act No. 99 of 1987) apply, as do Municipal By-laws, such as City Fire, City Environmental Health and sometimes Traffic. • Specifically, approvals for harvesting and propagation for provincially protected species and nationally protected species are required from the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) and DFFE. Permits from CapeNature are required to collect indigenous seed and other propagation material.
Contractor appointment	• Appointment of a suitably qualified Contractor(s) to undertake the required work: - Appointment of an implementing agent to audit and monitor the rehabilitation activities as well as to undertake the required post rehabilitation monitoring. - Should the Contractor not have the appropriate expertise for implementation of this plan then it is the responsibility of the Contractor to appoint a suitably qualified specialist ecologists to manage and oversee the implementation.
Ensure a meaningful contribution to biodiversity management and restoration	• Contribute towards meeting local and provincial conservation and associated SCC targets. • Manage the compensation activities to maintain and/or improve the ecological integrity of the identified recipient sites. • Ensure continued dominance of indigenous floral species within the identified Offset Areas.
Planning and resource provision	• After defining the site restoration goal(s), ensure sufficient resources by developing an appropriate restoration development, maintenance & management plan for Offset Areas with annual plan(s) of operation; assign human resources or draw up a detailed bill of quantities where work must be outsourced.
AIP clearing	• For the Offset Areas, AIP clearing can start as soon as the offset obtains approval from the relevant authorities.
Concurrent implementation	• A risk-based approach will be applied to ensure concurrent implementation of rehabilitation activities is carried out. This concurrent approach will ensure that the desired post-rehabilitation landscape and land use capability is aligned with end use targets.
Remove/ameliorate degradation factors	• Earth works where necessary. • Erosion control. • Control AIPs (by Fell & Burn, Fell & Remove Fuel, as appropriate). • Consider prescribed burn to volatilise excess nutrients in soil, litter layer & kill surface seed banks of alien annuals. • Plan for alien control follow-ups – most important where aliens recruit & after fires.
Erosion prevention and topsoil management	• Any area where active erosion is observed must be immediately rehabilitated in such a way as to ensure that the surface hydrology of the area is re-instated to conditions which are as natural as possible, and that preferential surface flow paths do not form. • Actions to be taken to prevent any further erosion from occurring within the rehabilitated areas are as follows: o Re-vegetating the disturbed and rehabilitated areas (Step 2 below); o Stabilise the soil through the use of geotextiles, especially effective with growing vegetation; and • Apply a layer of mulch to the rehabilitated areas to allow the soil to slowly soak up the water and reduce the impact of rain on bare soil. If mulch is the only option for erosion control, it should be chipped on site from indigenous plant material only, to avoid introducing further invasive species. This indigenous plant material could be obtained from firebreak maintenance brush-cut material. No foreign material should be brought into the offset sites.
Fire Management Plans	• Develop appropriate Fire plans for implementation within the Offset Areas. These plans can be implemented as soon as the offset receives approval from the relevant authorities.
Monitoring	• Monitoring will be initiated at the first implementation of any rehabilitation activity.

Component	Principle/s
	• Monitoring will be conducted progressively throughout the development's lifecycle and in conjunction with concurrent rehabilitation activities. • Data obtained from ongoing monitoring practices will be regularly assessed to identify trends that can demonstrate the success and/or failure of implemented rehabilitation activities. • The monitoring process will be linked to corrective, adaptive management practices.
Adaptive management	• An adaptive management protocol will be employed on-site, thus allowing for the implementation of alternative and improved rehabilitation activities and strategies so that corrective action can be implemented where required.

The following objectives, interventions and control measures must be implemented as part of the planning phase (Tables 8 - 9).

Table 8: Relevant Objectives and Control Measures to be implemented as part of the planning phase: Governance

Objectives or requirements	Execution Measures
GOVERNANCE	
Decision trees	• Once restoration goals and priorities have been clarified, a decision tree that highlights important options in implementing the various stages in ecological restoration may be created. This could help to simplify the restoration process. A decision tree should incorporate the latest research findings and that of site-specific specialists' input (i.e. assessments). One key decision is whether active or passive restoration is appropriate for the site. This depends on habitat condition. For example, passive recovery of veld is possible where invader plants have short residence times and diverse native remnants are present. But, achieving this depends on the invader, the target ecosystem and the quality of alien control.
Develop intervention scenarios	• It is necessary to define intervention scenarios. Each scenario will require differing levels of intervention and different approaches.

Table 9: Relevant Objectives and Control Measures to be implemented as part of the planning phase: On-site Execution

Objectives or requirements	Execution Measures
ON-SITE EXECUTION	
Erosion prevention and topsoil management	• Any area where active erosion is observed must be immediately rehabilitated in such a way as to ensure that the surface hydrology of the area is re-instated to conditions which are as natural as possible, and that preferential surface flow paths do not form. A suitably trained individual should advise on such concerns.
Threatened species management	• Several threatened species occur within Offset Option 8 and/or suitable habitat for such species is present within the Target Offset Areas**.** As such, minimisation of disturbance to these species must be prioritised. • Improved security measures will be required to reduce the risk of illegal access by poachers to the properties.
Physical landscape connectivity barriers	• An assessment of each of the Offset Areas must be conducted (physically and/or digitally using satellite imagery and then ground-truthed) to identify any physical barriers to landscape connectivity (e.g., dumped material, unused roads, etc.). • Once identified, suitable measures for the removal of such barriers should be designed for implementation in during implementation activities (Step 2).
Specialised habitat	• Identify specialised habitat within the Offset Areas that can be used to enhance biodiversity (over time). Specialised habitat can include any rocky areas, freshwater features, etc., within the Offset Areas. • Once identified, ensure appropriate management plans are developed so that these features are maintained in a good ecological condition and thus have the propensity to create habitat for additional species and, in time, act as source populations for the surrounding area.

Objectives or requirements	Execution Measures
AIP species	• **It is crucial that AIP control planning takes place prior to the commencement of other management activities, but also and in conjunction with other management activities.** This is important as AIP species can rapidly proliferate. It is thus vital to remove the source of any AIP propagules from targeted sites so to reduce the probability of AIPs establishing and enhancing the success of the establishment of indigenous species. AIP clearing must take place concurrently with the other management measures outlined in this report (i.e., throughout all phases of the management process). • Continued long-term AIP control measures must be implemented. • For areas where rehabilitation and management activities are targeted, a once-off detailed AIP survey must be performed within each rehabilitation area prior to the commencement of rehabilitation activities in which the following information must be recorded: o AIP species that are present during the survey and their specific growth form, e.g., herb, shrub and trees, including any coppice present; o The density of infestation must be recorded in an estimation of percentage (%) cover: ▪ 0-5%: Scattered infestation ▪ 5-25%: Sparse ▪ 25-50%: Medium ▪ 50-75%: Dense ▪ 75-100%: Very dense. • Should the Contractor and/or the implementing agent not have the expertise to identify and mark the AIPs, it is the responsibility of the Contractor to appoint a suitably qualified botanist to assist.
Stormwater management	• Where necessary, stormwater must be managed within the Offset Areas, e.g., Offset Option 1 will require stormwater management given its location immediately adjacent to the Macassar WWTW. Similarly, Option 8 which is mountainous will require appropriate management of stormwater to limit erosion. **Note**: Natural interventions should be considered as a first choice; human-made infrastructure and associated activities (e.g., reprofiling) should be considered as a last resort.
Rehabilitation plans	• None of the three identified Offset Areas (Options 1, 7, and 8) will require extensive rehabilitative replanting efforts. A passive management approach has been recommended, with an initial reseeding and phased replanting of easily sourced indigenous vegetation as necessary. • Where applicable, all rehabilitation work (Step 2 below) must be scheduled to commence during the onset of the rainy season (late autumn) to ensure species are planted at the beginning of the growing season (early winter) and thus enhancing their chances of establishment and survival. Timeframes must thus be properly planned.
Game management	• For Offset Areas that support game (i.e., Option 8), ensure that appropriate game management plans (in accordance with the requirements for nature reserves as stipulated by the NEMPAA) are developed. • Game management plans should focus on maintaining the correct stocking ratio for the surrounding vegetation type(s). • Regular game counts should be conducted to assess the stocking capacity of the veld. • Detailed veld condition assessments of the applicable Offset Areas should be conducted to assess the condition of the veld at least every five years, and monitoring of the veld will take place on an annual basis. Management interventions will be based on these assessments.
Unplanned fire management	• Unplanned fires can occur within the Offset Areas and surrounds. Thus, preventative measures should be implemented by the proponent to reduce the likelihood of fires. This includes restricted access to vulnerable areas and the placement of informative signage to promote vigilance and reporting of veldfires.
Fire management	• For all Offset Areas, ensure that appropriate fire management plans (in accordance with the requirements for nature reserves as stipulated by the NEMPAA) are developed; • Fire management plans (as developed by a suitably qualified specialist/ land manager) should be continuously implemented to ensure that the Offset Sites remains in good ecological condition;

Objectives or requirements	Execution Measures
	• Burning of wetland habitat within the Offset Areas would result in a deterioration of the wetland condition and functionality. An appropriate burning regime benefits not only the vegetation condition, but the wetland condition as well. These communities should only be burnt if enough dry mass is available.

10.4 STEP 2 – Management Action Implementation

This step involves the specific management activities (e.g., necessary rehabilitation, AIP control activities, etc) that are needed to reach the defined management targets.

10.4.1 Site-specific Rehabilitation

To identify and direct an optimal rehabilitation process, or to adopt the best possible/practicable rehabilitation approach, the desired outcomes of rehabilitation should be clear from the start. Therefore, a reference ecosystem was defined (Section 6) that will aid in the planning, monitoring and evaluation of the rehabilitation activities.

Rehabilitation techniques and designs form a key part of the proposed project and will be an important component in ensuring that present conditions are maintained and that, where feasible, an improvement in the ecological functioning of the receiving environment (project area of influence) will be sought. The Rehabilitation Plan further advocates the use of several environmental management tools and mitigatory measures that are appropriate for the long-term success of rehabilitation activities. The Rehabilitation Plan is a system that seeks to achieve a required end state.

Effective rehabilitation can be attained by adopting a three-phase approach (modified from the WWF Report, 2016):

1) Phase 1: Establishing a realistic rehabilitation goal (Section 10.1);
2) Phase 2: Compiling a practical rehabilitation and monitoring plan (current section); and
3) Phase 3: Engage adaptive management (Section 10.6.6).

Rehabilitation Principles

Table 10 outlines three key principles of rehabilitation and their achievability, relative importance of the principles, and the recommended and/or required specialist input.

Table 10: Rehabilitation principles, the importance and the recommended and/or required specialist input.

Principle[13] 1: Effectively utilising available scientific, traditional, and local knowledge, respectively.	Importance	Recommended and/or Required Specialist Input
This includes e.g.,	High	- Botanist - Ecologist/ applicable specialists

[13] Influences drawn from Gann, G.D., McDonald, T., Walder, B., Aronson, J., Nelson, C.R., Jonson, J., Hallett, J.G., Eisenberg, C., Guariguata, M.R., Liu, J. and Hua, F., 2019. International principles and standards for the practice of ecological restoration: Summary. Washington, DC: Society for Ecological Restoration. 11 p. Online: https://www. ser. org/page/SERStandards.

- Meeting the requirements of relevant local and regional authorities; - Making use of local experience regarding the establishment and maintenance of the species selected for rehabilitation; - Engaging with the relevant authorities for obtaining permit applications prior to the removal or relocation of floral SCC; and - Appointing qualified and trained personnel to undertake all aspects of the rehabilitation process. **Achievability:** Highly achievable.		- All appointed contractors - DFFE / DEA&DP - ECO
Principle 2: The use of reference models enhances the potential for native species and communities to recover and continue to reassemble, adapt, and evolve.	**Importance**	**Recommended and/or Required Specialist Input**
Rehabilitation earthworks should aim to reshape disturbed areas to **blend in with the surrounding landscape** and importantly, stabilise the soils to allow for more successful rooting of plants and erosion / stormwater management. **Achievability:** High.	Medium	- Botanist - Rehabilitation specialists
Re-vegetate disturbed sites with appropriate floral species (refer **Section 10.4.3** of this report). A good vegetation layer will support ecological functions in the area. **Achievability:** Achievable, but success will depend on: - Selection of species for rehabilitation must be based on practical considerations. The conditions of the soils should be taken into consideration to be able to determine which species will be most practical to plant, e.g., getting a vegetation cover should be the first goal so that soils can be stabilised.	High	- Floral Ecologist - Botanist
Ensure that optimal growing conditions are present for plants to successfully establish. **Achievability:** Achievable. Success will be dependent on: - Appropriate methods should be used for vegetation establishment. This will be determined by the type of species to be planted but should also consider the use of tools and methods that will limit soil disturbance or compaction; - Topsoil management; - AIP management; and - Also refer to **Section 10.4.3** of this report.	High	- Floral Ecologist - Botanist
Principle 3: Use of measurable indicators to assess progress toward restoration objectives.	**Importance**	**Recommended and/or Required Specialist Input**
Maintenance and Monitoring Monitoring is needed to document management actions such as rehabilitation practices. The causes of any problems detected in subsequent monitoring can then be determined, and adaptive management procedures developed and implemented. **Achievability:** Achievable and easy to implement.	High	- ECO

Summary of Rehabilitation Goals

The goal of rehabilitation is to undertake the rehabilitation measures in a way that rehabilitates habitat to a more natural condition to compensate for the residual impact of the WWTW expansion.

The desired outcome should be an undisturbed landscape that reflects and blends in with the vegetation type of the area, i.e., reflecting, to an extent, the reference vegetation communities in with the Offset Areas are located.

Rehabilitation Recommendations

None of the three identified Offset Areas (Options 1, 7, and 8) will require extensive rehabilitative replanting efforts. A **passive management approach** has been recommended, with an initial reseeding and phased replanting of easily sourced indigenous vegetation as necessary. Recommended rehabilitation activities and the necessary measures to implement during rehabilitation activities are presented in Table 11.

Table 11: Rehabilitation activities and recommended rehabilitation measures to implement.

Rehabilitation Activity	Rehabilitation Measures to Implement
Site demarcation and protection	• Clearly mark the boundaries of the offset area to prevent disturbance beyond the designated offset footprint. • Identify and mark areas of high ecological sensitivity (e.g., critical habitat, important species) as no-go zones to protect them during rehabilitation activities. • Restrict access to the offset site to authorised personnel only to minimise soil disturbance and the spread of AIP propagules.
Removal of non-natural structures and waste	• Remove any non-natural structures (e.g., disused infrastructure, temporary barriers) to restore ecological integrity and allow for natural habitat recovery. • Conduct waste removal with careful planning to avoid further degradation, spills, or contamination. • Dispose of all waste responsibly at a registered facility, ensuring compliance with environmental regulations.
Control of AIP species.	• Implement a targeted invasive alien plant (AIP) control programme, beginning with a baseline assessment of AIP coverage within the offset site. • Remove AIPs prior to re-vegetation efforts, using ecologically appropriate methods (e.g., manual removal, selective herbicide application). • Establish a follow-up programme to monitor and suppress AIP re-growth, as outlined in Section 10.4.2.
Ecological monitoring and adaptive management	• Develop a monitoring framework focused on ecological recovery indicators, such as vegetation cover, species richness, and habitat functionality. • Clarify the monitoring plan, including: Assigned responsibilities (e.g., biodiversity specialists, ecological monitors); Frequency of monitoring; • Indicators to be tracked (e.g., vegetation cover, species composition, ecological functionality); • Methods to be employed (e.g., transects, photographic documentation); Data storage and analysis protocols (e.g., geospatial mapping, biodiversity databases); • How the findings will inform adaptive management decisions. Ensure monitoring outcomes are integrated into periodic reviews to refine and enhance rehabilitation and offset management efforts; and • Additional monitoring requirements presented in Section 4.6 of this report.

Successful rehabilitation depends upon cogent conceptual planning, research, and design flexibility. All good housekeeping principles as stipulated in the developed rehabilitation plan must be applied throughout the implementation of rehabilitation activities.

10.4.2 Alien and Invasive Plant Species Clearing

To allow for coherent management interventions, an AIPCP for each Offset Area must be developed on approval of the Offset Strategy (if approved) and updated on a regular basis. Control of AIPs within the Offset Areas is important as infested areas can act as a source for AIPs to spread if left uncontrolled. The AIPCP will be most effective if it proceeds in phases. The three most important phases to consider during the implementation of the AIPCP include:

- Phase 1: Initial control.
  AIPs are removed from the entire project area (Target Offset Areas). Drastically reducing an existing alien plant population can be achieved by following the guidelines for invasive species listed in terms of Section 70 of the NEMBA and as required by section 76 of the NEMBA Act (DEA Biosecurity, 2015). For this AIPCP, the development of the Initial Control Phase followed the guidelines and important aspects recommended by the DEA Biosecurity (2015);
- Phase 2: Follow-up control.
  Control of seedlings, root suckers and coppice growth. Mechanical and chemical control of AIPs are effective short-term solutions. Rigorous follow-up control is needed to sustain an AIPCP over the medium-term. The aim is to deplete the seed bank and specific tactics for seed bank management can be employed. Follow-up control should be done on a minimum of once per growing season (i.e., annually); and
- Phase 3: Maintenance control.
  Sustain low alien plant numbers with biannual to annual control. Continuous monitoring and maintenance of all areas where AIPs have been removed should continue during the management activities of the Target Offset Area, with an additional five-year, annual control to be implemented to combat re-sprouting, and as an effort to deplete the existing alien species seedbank. It is very difficult and often expensive to completely eradicate alien species, which is why there is a need to maintain a control program over several years. Thereafter, the need for AIP control should be regularly assessed based on the need for control (adaptive management).

On-site AIP Control

On-site control should be implemented in line with the general principles and objectives set out in this report (Table 13) as well as any additional requirements as stipulated by the appointed ECO (refer to **Appendix F** for further information) or as mentioned in the existing AIPCP.

General recommendations for AIP control and management are described below. Table 12 indicates the recommended control measures to be implemented as part of management actions within the Offset Areas.

Table 12: Relevant Objectives and Control Measures to be implemented as part of the AIP species clearing.

Objectives or requirements	Control Measures
Initial Control	
General Good housekeeping	**Waste and Litter Problems** ➢ Suitable ablution facilities need to be provided for all personnel; ➢ Waste and litter should be cleared and be disposed of at a registered and approved disposal site; ➢ Suitable general waste receptacles must be provided; and ➢ Dumping of waste or litter must be prohibited within the offset sites and all watercourses. Any waste noted must be cleared immediately.
Chemical Control	➢ Dense seedling growth must be controlled with knapsack sprayers with a flat fan nozzle; ➢ If grass is present, the use of a registered selective herbicide must be used so as to prevent damage to the grass, and if grass is not present a registered non-selective or selective herbicide can be used; ➢ Suitable dye must be used to limit over- or under spray of areas; ➢ Chemical control will entail limited usage of registered herbicides for a specific species and one must adhere to the measurements on the product label; and ➢ **Care must be taken as to not use herbicides containing Glyphosate, Diquat and Paraquat within the identified watercourses associated with the rehabilitation area. These chemicals may only be used in the terrestrial zone of the rehabilitation areas.**
Follow-up Control	
Follow-up AIP treatment	➢ Follow-up control is essential to control alien saplings, seedlings and coppice regrowth to achieve and sustain the progress that was made in the initial phase. If the follow up control phase is neglected, the alien infestation will become worse and denser than before the eradication process started; ➢ Follow-ups must be done as stipulated by management plans which are likely to be based on local best practise; ➢ An annual assessment before mobilisation of the clearing crew should be undertaken to determine equipment and personnel requirements to secure the necessary funding; and ➢ After initial control operations dense regrowth may arise as new regrowth will sprout in the form of stump coppice, seedlings, and root suckers. The following should therefore be applied: • Plants that are less than 1m in height must be controlled by foliar application. • If grass is present, the use of a registered selective herbicide must be used to not harm the grass, and if grass is not present a registered non-selective or selective herbicide can be used. • Areas with dense seedlings should not be uprooted or hoed out, as these areas will result in soil disturbance and will in return promote flushes and germination of alien seedling growth.

A list of the dominant AIP species that were recorded within Offset Areas during the high-level field assessments has been provided (Table F6; Appendix F). Species-specific control measures for these species are also provided in Table F6 (Appendix F) and should be incorporated into the developed AIPCP's (which is to be updated on a regular basis by a suitably trained individual). The AIP lists provided in this report offer only a high-level overview of AIP species recorded within each Offset Area and do not comprehensively represent all AIP species present. As the assessments were conducted at a high-level, these lists may not fully capture the AIP diversity within the Offset Areas. Detailed field assessments at each Offset

Site will need to be conducted by qualified personnel involved in developing the developed AIPCPs.

10.4.3 Rehabilitation Approach

Note: None of the three identified Offset Areas (Options 1, 7, and 8) will require extensive rehabilitative efforts. A passive management approach has been recommended, with an initial reseeding and phased replanting of easily sourced indigenous vegetation as necessary.

Successful rehabilitation and amelioration of targeted areas within the offset sites will require a varied approach based on the condition of the targeted sites (i.e., required need for waste material / rubble removal, internal fence removal, etc). Table 13 serves as a summary of the various levels of intervention based on the integrity of each area (as delineated on a desktop level – ground truthing of these categories would be required on approval of the Offset Strategy). Please also refer to Figures 24 - 26.

Table 13: Veld disturbance categories.

Category	Correlated Ecological Condition	Definition
Natural areas	**Very High**	Structurally an intact ecosystem with no evidence of any past major unnatural disturbance; species composition 80-100% of expected.
Near-natural areas	**High**	Structurally a relatively intact ecosystem that may have suffered some negative impacts historically (e.g. altered fire regime, alien invasion, brush-cutting, resource extraction); species composition 50-80% of expected.
Degraded with some structural elements completely missing and some soil disturbance evident	**Medium-high**	Altered ecosystem with some structural elements (e.g. overstorey shrub layer) completely missing; low to moderate species richness; soil seed banks depauperate; alien plant cover is low to high; species composition 10-50% of expected. Area has suffered once-off, historical soil disturbance, such as ploughing or bulldozing.
Degraded with some structural elements completely missing with no soil disturbance evident	**Medium**	As above, but no obvious unnatural soil disturbance and/or soil disturbance that occurred sometime ago and vegetation recovery has proceeded well.
Highly degraded with some soil and disturbance	**Medium-low**	Vegetation structure is altered with many key elements missing (mainly weedy, herbaceous species remain owing to long term soil disturbance, frequent brush cutting, fires, ploughing or long-standing invasion); soil seed banks largely depleted (little evidence of geophytes); alien plant cover is low to dense; species composition 1-10% of expected.
Extremely degraded	**Low**	Land has been transformed by repeated ploughing (or other land-use activity e.g. quarries, excavations etc.) so that vegetation structure and soil-stored seed banks are destroyed and not restorable without significant intervention;

Category	Correlated Ecological Condition	Definition
		species composition 0-1% of expected (some weedy indigenous ephemerals may have colonised old fields).
Extremely Modified (Transformed)	**Very Low**	Hard infrastructure (buildings, hard surfacing) now replaces the historical ecosystem, and the site is considered permanently altered and non-restorable.

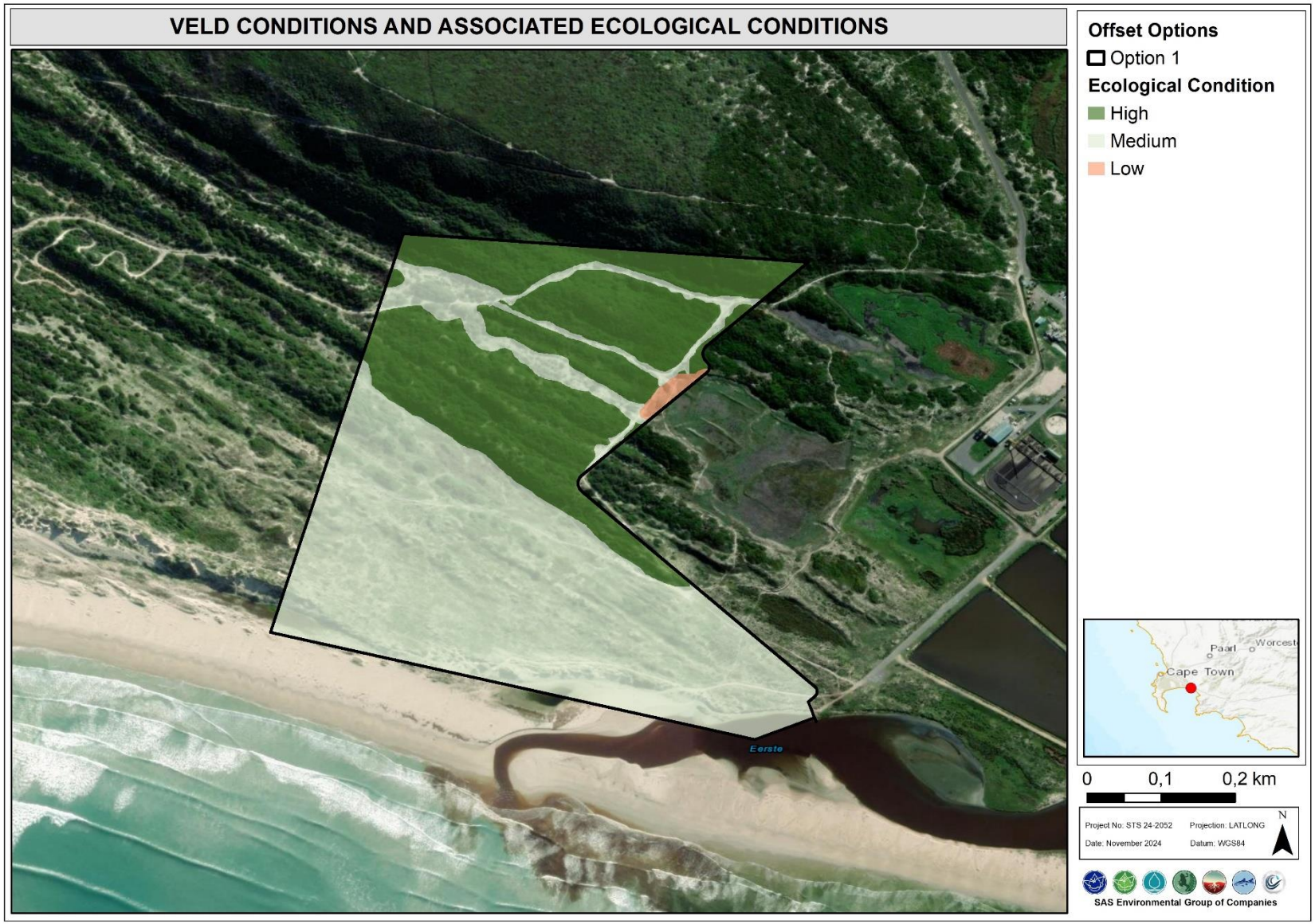

Figure 24: Veld disturbance categories associated with Option 1.

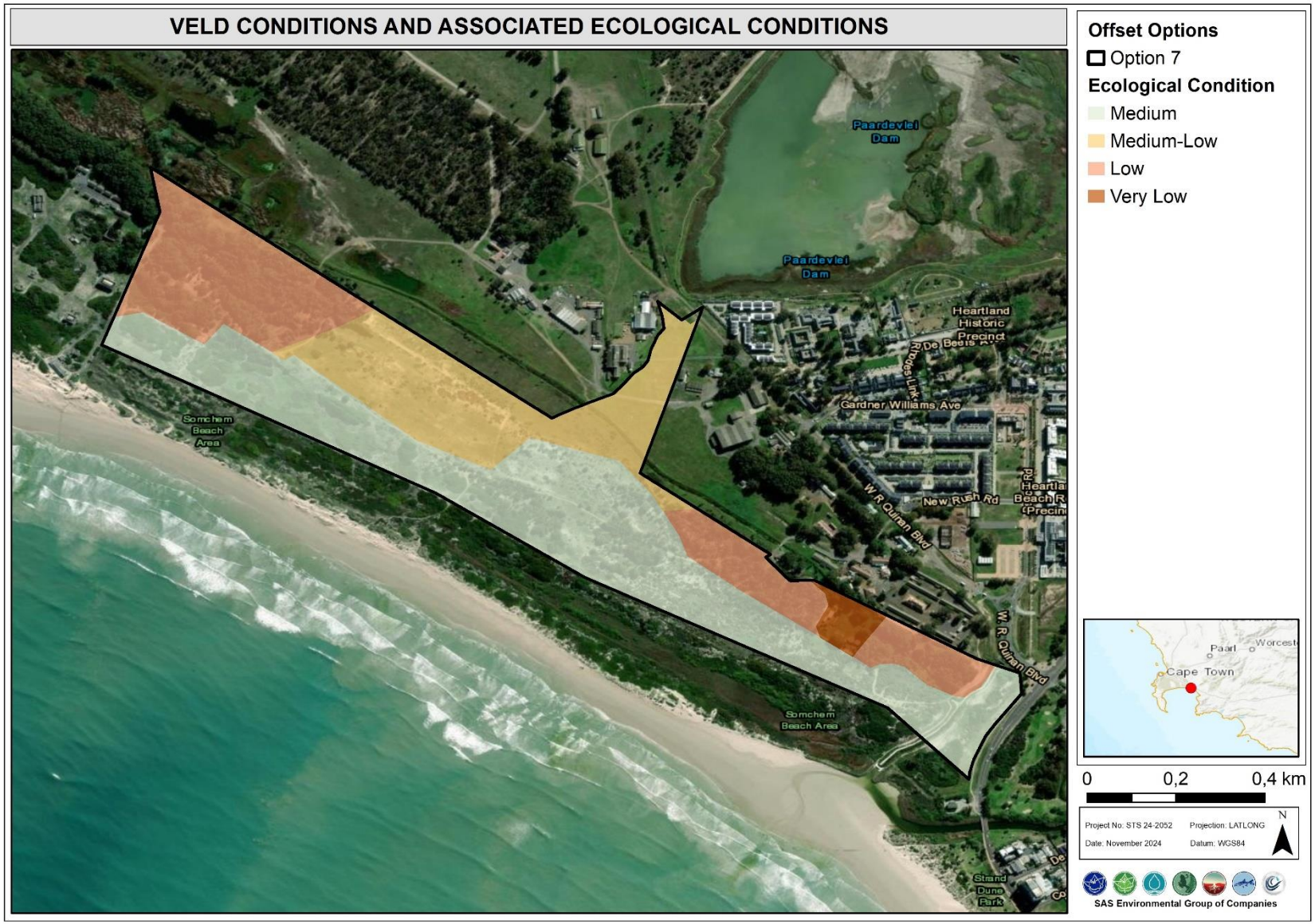

Figure 25: Veld disturbance categories associated with Option 7.

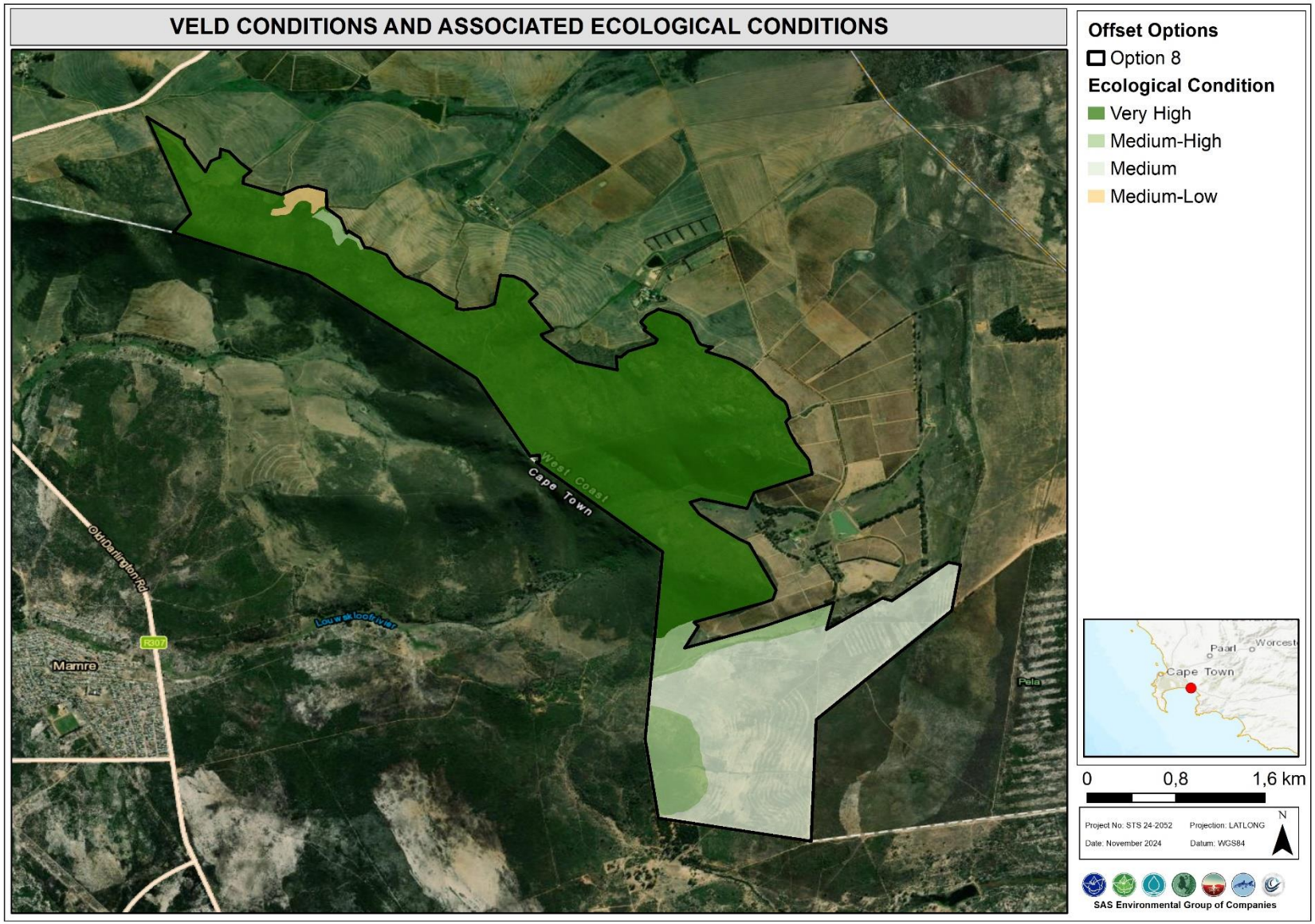

Figure 26: Veld disturbance categories associated with the Option 8.

10.4.4 Fire Management Plan

Fire management plans are essential in South Africa to protect biodiversity, preserve habitats, manage water resources, mitigate climate change, safeguard air quality and human health, and address socio-economic concerns. By implementing proactive measures to manage the frequency and intensity of fires, ecological integrity of landscapes can be maintained in a manner that promotes sustainable development. Specifically, fire management plans are important for several reasons, including habitat protection and biodiversity conservation, water resources management, carbon sequestration and climate change mitigation, and cultural and socio-economic impacts.

Fire management plans should incorporate specific objectives and control measures during their implementation (Table 14).

Table 14: Relevant objectives and control measures to be implemented as part of developed fire management plans.

Objectives or requirements	Execution Measures
Fire Management Practices	• A fire management plan for each offset Area should developed on approval of the offset (if approved). The fire management plans must be developed and routinely updated by a suitably trained individual. Ideally, management efforts should also be continuously implemented to ensure that the targeted areas remain in good ecological condition; • Due to the size of Option 8, perimeter firebreaks will be necessary to prevent uncontrolled and unnecessary fires. Internal firebreaks needed for ecological burning operations can be prepared ahead of the burn and need not be cut annually; • Additional conditions for consideration within the Fire Management Plan for fynbos vegetation types include: - Generally, fynbos should be burned every 10–15 years to allow for plant regeneration and prevent the dominance of mature shrubs, which can lead to a decline in species diversity; - Different types of fynbos vegetation may require slight adjustments to this interval. For instance, mountain fynbos may have a longer interval (up to 18 years), while coastal fynbos may benefit from a shorter interval; - Frequent burns (e.g., every 3–5 years) should be avoided, as they can prevent seed production in many fynbos plants, especially slower-growing proteas and ericas; - Most natural fires in fynbos historically occur in the hot, dry summer months (December to March). Burning in summer mimics this natural regime, which aligns with the seed release and germination cycles of many fynbos species; - Burning in early winter should be avoided as it does not provide the conditions needed for optimal seed germination and can negatively impact breeding species. Early winter burns may also result in poor regeneration of certain fire-adapted plants; - Implementing a rotational burning approach, where different areas are burned at staggered intervals, can help maintain biodiversity by providing refuges for wildlife and enabling species recolonization from unburnt patches; - Burns should be conducted when there is sufficient fuel (dry biomass) to carry the fire effectively but not to such an extent that the fire becomes overly intense. High-intensity fires can damage soil structure and seed banks, particularly for slower-growing species; - Avoid burning wetland areas and riparian zones, as these habitats are not typically fire-dependent and can be negatively impacted by fire. Only burn these areas if fuel load or invasive vegetation requires it, and ensure these burns are carefully monitored; and - Identify any sensitive or threatened species in the area that may be adversely impacted by fire. For example, certain birds (e.g., Cape Sugarbird) and small mammals rely on specific vegetation cover, so ensure unburnt refuges are available within the landscape.

10.4.5 Wildlife Management

Successful wildlife management requires careful consideration of factors such as stocking ratios, specific foraging behaviours, and the land's carrying capacity.

If deemed necessary (by appropriate specialists), wildlife management plans should incorporate specific objectives and control measures to ensure sustainable land management, particularly in areas undergoing rehabilitation / conservation-orientated activities (Table 15). For instance, within Option 8, game camps could be used to allow selective exclusion of eland and rhebok from newly rehabilitated areas, giving these areas the opportunity to establish without grazing pressures.

Table 15: Relevant objectives and control measures to be implemented as part of developed wildlife management plans.

Objectives or requirements	Execution Measures
Sustainable Practices	• For Offset Areas where wildlife (e.g., antelope, etc.) will be present, e.g., Option 8, a wildlife management plan should be developed and routinely updated by a trained ecologist or land manager. Management efforts should be continuously implemented to ensure the target areas remain in good ecological condition, supporting optimal fynbos health and biodiversity; • Developed wildlife management plans will need to align with stipulations as guided by the NEMPAA; • Additional conditions for consideration within the Grazing Management Plan include: - Stocking rates must be adjusted based on the carrying capacity of the veld, which can fluctuate seasonally and annually. Overgrazing must be avoided to prevent land degradation and loss of biodiversity; - Regular monitoring of vegetation cover, species composition, and soil health should be conducted to assess the impact of wildlife grazing and browsing. If degradation is detected, immediate adjustments to the grazing plan should be made; and - Implement an adaptive management approach, adjusting the grazing strategy in response to climatic conditions, vegetation recovery, and biodiversity conservation goals.
Game Camp Management	• Within Option 8, the use of game camps to control access to specific areas, allowing for selective avoidance of regions in need of rehabilitation or recovery could be considered. These camps will help prevent grazing and browsing pressures on newly rehabilitated areas, ensuring vegetation has time to establish and mature; and • Within Option 8, eland and rhebok could be kept in game camps during rehabilitation activities to protect these areas. Monitor game camps regularly to ensure they are effective in maintaining exclusion and adapt the boundaries as necessary based on vegetation regrowth.
Habitat Condition Assessment	• Assess the ecological health of habitats within Offset Areas (including game camps where appropriate) through periodic surveys. Monitor parameters such as plant species diversity, vegetation density, and soil stability to evaluate recovery progress in rehabilitated areas. Adjust game camp boundaries or release schedules in response to habitat improvements.

10.4.5.1 Erosion Control

Erosion is a natural process that occurs in many landscapes, including the fynbos biome. It develops when concentrated water runoff removes topsoil or carves deep channels into the ground, leading to the formation of erosion features and gullies. Although erosion is a natural process, it can be significantly intensified by various land-use practices and environmental stressors, leading to more severe erosion-related impacts. Within the Offset Areas, any

erosion concerns that are evident will require management to ensure such features do not worsen in the future.

To address the erosion concerns within the landscape, the following management actions can be considered (however, a specialist would be required to address specific erosion concerns and make suitable recommendations based on specific examples):

- **Brush packing:** brush packing involves placing cut branches or natural organic material (from indigenous species) over eroded areas. This helps slow down surface runoff, trap sediments, and facilitate seed retention. **Benefits**: Brush packing helps prevent further erosion by stabilising the soil and promoting natural revegetation. It also acts as a physical barrier against wind and water erosion;
- **Revegetation with indigenous species:** use indigenous, drought-resistant plants and grasses to revegetate the eroded areas. These plants should have strong root systems that will stabilize the soil and reduce surface runoff. **Benefits**: Vegetation helps to trap sediments, enhance soil structure, and restore biodiversity. The increased plant cover will also reduce the risk of erosion caused by wind and water (refer to Section 10.4.3);
- **Grazing management:** implement controlled grazing practices or a temporary grazing exclusion zone around vulnerable area(s) (e.g., grazing camps). Fencing off badly eroded areas can prevent further trampling and disturbance. **Benefits:** This will allow the vegetation to regenerate and strengthen, further stabilizing the soil. Rotational grazing systems can also prevent overgrazing and reduce soil compaction;
- **Erosion control structures:** install small check dams or gabions (wire mesh filled with rocks) in active erosion channels to trap sediment and slow down water flow. **Benefits:** These structures help reduce the erosive force of runoff water, allowing it to deposit sediment and gradually fill in the gully, reducing its depth;
- **Mulching:** apply mulch (such as straw or other organic matter) over bare patches to improve moisture retention and protect the soil from direct sun and wind exposure. If mulch is the only option for erosion control, it should be chipped on site from indigenous plant material only, to avoid introducing further invasive species. This indigenous plant material could be obtained from firebreak maintenance brush-cut material. No foreign material should be brought into the offset sites. **Benefits**: Mulch encourages seed germination, prevents crusting of the soil, and reduces further erosion by stabilizing the soil surface; and
- **Water harvesting:** install small-scale water harvesting structures (e.g., swales, bunds) to direct water to areas where it can infiltrate the soil instead of flowing through the erosion gullies. **Benefits:** Increased water infiltration will help promote vegetation growth and reduce runoff during rainfall events.

By implementing these management actions, erosion can be managed, and long-term rehabilitation of the landscape can be achieved.

10.5 Phase 3 - Monitoring Phase

Ongoing monitoring and auditing of corporate aspects of the Biodiversity Offset, such as financial aspects, legislative compliance, AIP control, and ecological integrity is considered a crucial aspect of the initiative. Aspects which should be monitored include:

- Finances - detailed budgets must be developed prior to the implementation of the offset programme, and all expenditures accounted for and audited annually;
- Compliance with all relevant legislation (as outlined in this report, and any additional Acts which may be relevant in terms of corporate governance) must be monitored and included as part of the auditors' Terms of Reference;
- All offset sites must be secured through appropriate legislative mechanisms to protect the biodiversity offsets and ensure the long-term success thereof; and
- The data gathered during the monitoring processes must be used as part of an adaptive management approach to evaluate the success or failure of the offset and to proactively change management approaches if necessary.

Continued prudent monitoring of the areas within the is of utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage the progress of the rehabilitation interventions and any arising issues (Table 16).

To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- Site walk-through surveys should be applied as the preferred method of monitoring (at specified frequencies) with the specific focus on:
  - Erosion monitoring (for the duration of the rainy season);
  - AIP species proliferation (as stipulated by the AIPCP);
  - Ecological condition of the terrestrial habitats;
- General habitat overviews (e.g., management units), as well as specific monitoring of terrestrial habitat integrity, drivers and functionality, should be undertaken;
- All data gathered should be measurable (qualitative and quantitative);
- Monitoring actions should be repeatable;
- Data should be auditable; and
- Reports should present and interpret the data obtained.

For monitoring purposes of ecological integrity, it is recommended that a fixed-point monitoring method is implemented to ensure repeatability of assessments for better comparison. Selection of the fixed monitoring points should aim to achieve a comprehensive coverage of the various Offset Areas.

Table 16: Monitoring actions for the Offset Areas following the implementation of rehabilitation.

Aspect	Monitoring Location	Frequency of sampling	Frequency of Reporting
AIP control	- In all areas in which clusters of AIPs have been removed. - For consistency, the same point should be used for each repeat sample. - Each AIP monitoring point consists of a 20 m radius area.	- AIP monitoring should occur on an annual basis. To ensure that temporal comparisons can be made, assessments should as far as possibly take place at the same time each year. - Within each observation area the species identification and significance, estimates of AIP abundance, estimates of AIP diversity, and quantification of AIP recruitment should be recorded. The data will then be analysed, and a degree of temporal similarity between each Monitoring Point can be determined. - Frequency of reporting and sampling can be defined by the applicable specialist(s) when designing the applicable management plans, etc.	Monitoring protocols should be specified and refined in the detailed design phase of the rehabilitation plan.
Ecological Integrity	- Selected fixed monitoring points that provide an indication of all habitat types associated with the Offset Areas. - Ensure that specialised habitats are included in monitoring points. - Specific faunal monitoring protocols to be followed	- The following should be considered during monitoring activities: all species recorded within the monitoring point, AIP proliferation within the point, estimates of cover (e.g., percentage rock, bare ground, grass, woody, and herbaceous cover), indication of veld condition (poor, moderate, good). The data will then be analysed, and a degree of temporal similarity between each Monitoring Point can be determined. - Faunal assemblages must be recorded and where possible changes in abundance noted. - Frequency of reporting and sampling can be defined by the applicable specialist(s) when designing the applicable management plans, etc.	
Erosion	- All rehabilitated areas. - Areas earmarked for erosion control (e.g., dongas).	- Frequency of reporting and sampling can be defined by the applicable specialist(s) when designing the applicable management plans, etc.	

***Note: This monitoring plan must be implemented by a competent person and submit the findings to the responsible authority for evaluation.**

10.6 Phase 4 - Refine, Correct and Replan Phase

This phase involves a “refine-correct-re-plan” approach that ensures that the rehabilitation plan is continuously being updated and improved so to effectively achieve the rehabilitation targets set out in the planning phase. Only once on-site rehabilitation has started will this phase become significant.

11. OFFSET STRATERGY BUDGET

The specialist has provided the proponent, the CoCT, with a comprehensive and detailed budget for the implementation, management, and long-term sustainability of the Biodiversity Offset Strategy (including management activities as highlighted in the Rehabilitation and Management Plan). The proponent has reviewed and acknowledged the budget, demonstrating a clear understanding and acceptance of the associated financial commitment. CoCT has committed to allocating the necessary resources to ensure the successful implementation of the offset strategy, thereby supporting its long-term ecological and conservation goals in alignment with the 2023 Biodiversity Offset Guidelines.

12. OFFSET CONDITIONS & CONSIDERATIONS

In accordance with the recommendations included in the Offset Technical Memorandum[14], the City, led by WWTB, commits to pursue the processes available to acquire the required operational budgets. Specifically, the city commits to ‘secure, and through the provision of the necessary resources, ensure the formal protection and effective ecological management of identified ‘Offset Sites’ to offset the required 176.3 ha of EN Cape Flats Dune Stranveld. The identified Offset Sites include 25.0 ha within the remaining Ptn of Erven 1205 (in which the existing WWTW is situated), as well as 25 ha[15] of designated land near the Paardevlei Wetland (encompassing Ptn 0 of Erven 702 and Ptn 0 of Erven 703) and a portion (126.25 ha) of the City of Cape Town’s Burgherspost Offset Landbank (including Ptn 0 of Farm 713, Ptn 0 of Farm 707, Ptn 0 of Farm 708, Ptn 0 of Farm 754, and/or Ptn 2 of Farm 754). The exact area at Paardevlei is still to be confirmed and it is currently unclear what may be available to contribute to the offset. What is unavailable at Paardevlei, including if nothing at all is available will be added to the area allocated from the Burgherspost offset bank’ which does have sufficient area to cater for the required offset quantum.

[14] Scientific Terrestrial Services (STS) Project no. 24-2052 (2024). Technical Memorandum: High-Level Alternatives Analysis for the Proposed Biodiversity Offset Initiative for the Macassar Wastewater Treatment Works (WWTW) Expansion Project, Macassar, Western Cape. Prepared for Zutari (Pty) Ltd.
[15] Still to be confirmed.

A letter of support outlining the BMB's support for the Offset Project has been provided – please see Appendix G. Further to this, an Offset Agreement illustrating the parties (WWTB and the BMB) agreement in terms of the Offset is provided included in Appendix G.

Additional considerations applicable to the offset include the following:

- The Offset Areas must be legally secured as conservation areas under appropriate legislative frameworks (e.g., the NEMPAA) to ensure their long-term protection and management; and
- Detailed offset implementation plans can be compiled for each offset site (on approval of the offset strategy, should it receive approval).

13. CONCLUSION

The Biodiversity Offset Strategy developed for the Macassar WWTW expansion aligns with the principles and requirements of the 2023 Biodiversity Offset Guidelines. This strategy addresses the residual impacts on the EN Cape Flats Dune Strandveld, a threatened vegetation type. Comprehensive offset ratio calculations, adjusted for habitat sensitivity and functionality (e.g., presence of functioning CBA habitat), determined that 176.3 ha habitat is required to achieve compliance with biodiversity offset standards and ensure the long-term viability of the affected ecosystems.

The selected Offset Areas (Options 1, 7 and 8) offer substantial opportunities for achieving conservation gains through targeted management actions, such as AIP control, erosion control, and the rehabilitation of degraded areas. These Offset Areas, especially Option 8, also provide suitable habitat to support various SCC and enhance ecological connectivity within the region, contributing to broader conservation priorities. Although Option 8 is not located within the same vegetation type as the WWTW (Cape Flats Dune Strandveld), its use as an offset is considered acceptable due to its alignment with "trading up" principles. While this does not involve trading up to a vegetation type with a higher threat status, it constitutes an improvement in terms of ecosystem conservation value due to the significantly lower REE % of the proposed vegetation.

The specialist has provided the proponent, the CoCT, with a comprehensive and detailed budget for the implementation, management, and long-term sustainability of the Biodiversity Offset Strategy (including management activities as highlighted in the Rehabilitation and Management Plan). The proponent has reviewed and acknowledged the budget, demonstrating a clear understanding and acceptance of the associated financial commitment. CoCT has committed to allocating the necessary resources to ensure the successful

implementation of the offset strategy, thereby supporting its long-term ecological and conservation goals in alignment with the 2023 Biodiversity Offset Guidelines.

A letter of support from the BMB outlining their endorsement of the Offset Project is included in Appendix G. Additionally, an Offset Agreement formalising the terms of agreement between the WWTW and the BMB is also provided in Appendix G. CapeNature has expressed its support for the proposed Offset strategy, noting that “considering that the site alternatives are not practical or feasible, and that the upgrade requirements should mitigate long-term environmental degradation” (Appendix G).

supported as per previous comments, considering that site alternatives are not practicable or feasible, and that the upgrade requirements should mitigate longer term environmental degradation.

In conclusion, the proposed offset initiative is expected to significantly contribute to the conservation and sustainable management of terrestrial fynbos habitats. This strategy aligns with national and local biodiversity offset guidelines and meets the requirements for no net loss of biodiversity. It is recommended that the Biodiversity Offset Strategy be considered for approval by the relevant authorities.

14. REFERENCES

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APPENDIX A: INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as the available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX B: LEGAL REQUIREMENTS

Table B1 tabulates each legislative document and the aspects that are relevant to the offset strategies.

Table B1: legislative document and the aspects that are relevant to the offset strategies.

The National Environmental Management Act, 1998 (Act No. 107 of 1998)	The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, refer specifically to biodiversity management in the following Clause: (4)(a) *Sustainable* development requires the consideration of all relevant factors including, (i) that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied. This Maintenance and Management Plan has been developed in fulfilment of the requirements as defined in the Environmental Impact Assessments EIA Regulations, 2014 (as amended) (No. R. 327) where a "maintenance management plan" is defined as a management plan maintenance purpose defined or adopted by the competent authority. The following EIA Regulation triggers the need for this MMP: Activity 19, Listing Notice 1: The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving- (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (N.B. Points (d) and (e) does not apply as these activities fall within the coastal zone).
The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)	The NEMPAA provides the legal framework for the declaration and management of protected areas, including national parks. It outlines the requirements for conservation, management, and development within a protected area, focusing on biodiversity, sustainable use, and community involvement. The Act also details the process for declaring protected areas and the responsibilities of the management authorities, such as SANParks. The main objectives of NEMPAA are: 1. **Establish a Protected Areas Network**: To provide for the declaration and management of a comprehensive system of protected areas in South Africa that conserves biodiversity and landscapes, and preserves cultural heritage. 2. **Conservation of Biodiversity**: To protect ecosystems, species, and genetic resources, ensuring their persistence and resilience over time, contributing to national and global biodiversity conservation efforts. 3. **Sustainable Use of Resources**: To promote sustainable use of natural resources within protected areas, ensuring that economic activities, such as eco-tourism and resource extraction, are balanced with conservation goals. 4. **Ecological Integrity and Ecosystem Services**: To ensure the maintenance of ecological integrity and the continued provision of ecosystem services, such as water regulation, climate stability, and flood control. 5. **Cultural and Natural Heritage Protection**: To protect areas of natural and cultural significance, including landscapes, sacred sites, and areas with unique historical or archaeological value. 6. **Public Participation and Benefit Sharing**: To ensure that the establishment and management of protected areas involve community participation and provide benefits to local communities, particularly those who have been historically marginalized. 7. **Alignment with International Conventions**: To align South Africa's protected areas framework with international commitments, such as the Convention on Biological Diversity (CBD) and the Ramsar Convention on Wetlands, promoting global conservation initiatives. 8. **Enhancing the National Protected Areas Estate**: To facilitate the expansion and effective management of protected areas, ensuring the protection of key biodiversity areas through cooperative governance across sectors and with various stakeholders.

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The objectives of this act are (within the framework of the National Environmental Management Act) to provide for: ➢ the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➢ the use of indigenous biological resources in a sustainable manner; ➢ the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources; ➢ to give effect to 'ratified international agreements' relating to biodiversity which are binding to the Republic; ➢ to provide for co-operative governance in biodiversity management and conservation; and ➢ to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act. This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources. Furthermore, a person may not carry out a restricted activity involving either: a) a specimen of a listed threatened or protected species; b) specimen of an alien species; or c) a specimen of a listed invasive species without a permit. Permits for the above may only be issued after an assessment of risks and potential impacts on biodiversity is carried out. Before issuing a permit, the issuing authority may in writing require the applicant to furnish it, at the applicant's expense, with such independent risk assessment or expert evidence as the issuing authority may determine. The Minister may also prohibit the carrying out of any activity, which may negatively impact on the survival of a listed threatened or protected species or prohibit the carrying out of such activity without a permit. Provision is made for appeals against the decision to issue/refuse/cancel a permit or conditions thereof. **National Environmental Management: Biodiversity Act (NEMBA) (Alien and Invasive Species Regulations, 2014):** NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aim to: ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) as: (a) a species that is not an indigenous species; or (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2014): ➢ **Category 1a**: Invasive species that require compulsory control. ➢ **Category 1b**: Invasive species that require control by means of an invasive species management programme. ➢ **Category 2**: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread. ➢ **Category 3**: Ornamentally used plants that may no longer be planted.
The Conservation of Agricultural	Amendments to regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) ensures that landowners are legally responsible for the control of invasive alien plants on their properties. The CARA legislation divides alien plants into weeds and invader

Resources Act, 1983 (Act No. 43 of 1983)	plants, with *weeds* regarded as alien plants with no known useful economic purpose, while *invader plants* may serve useful purposes as ornamentals, as sources of timber and may provide many other benefits, despite their aggressive nature.
The National Water Act, 1998 (Act No. 36 of 1998)	The purpose of the National Water Act, 1998 (Act 36 of 1998) (NWA) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled. The NWA, 1998 also provides for water use licenses which an operation will have to apply for, before commencing with any Section 21 water use activity. Various conditions may be attached to these licenses and a breach thereof will result in criminal and civil liability. The conditions attached to water use licenses will function alongside the additional protective measures, duty of care and statutory liability provisions provided by the NWA and other legislation to regulate a whole array of water issues. Accordingly, and in terms of the *Guide to the National Water Act*, "water use" refers to doing something that has an impact on the water resource, for example: ➢ The amount of water in the resource; ➢ The quality of water in the resource; and ➢ The environment surrounding the resource. Section 4 governs the entitlement to use water and states that water may only be used if it is a Schedule 1 use, a continuance of an existing lawful use (ELU), or authorised in terms of a general authorisation (GA) or license. A water use may therefore not be implemented unless it is properly authorised through one of these types of authorisations. The National Water Act, 1998 (Act No. 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i). A watercourse is defined as: a) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) A wetland, lake or dam into which, or from which water flows; and d) Any collection of water which the minister may, by notice in the Gazette, declare a watercourse.
Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the NWA (Act 36 of 1998) as amended	GN 4167 outlines the parameters and process of a General Authorisation (GA), which replaces the need to apply for a licence in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA. The notice **replaces GN 509 of 2016.** The GA sets out the need to determine the regulated area of a watercourse, as well as the degree of risk posed by an activity/ies related to a particular water use. In accordance with GN 4167 of December 2023, the regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: a) the outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake, or dam; b) in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or c) In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans. The GA only applies to the use of water in terms of Section 21(c) and (i) of the NWA where the risk class is **Low** as determined through the application of the Risk Matrix as prescribed in the Notice. The GA also does not apply where other Section 21 water uses are triggered, does not apply for most sewage infrastructure and pipelines carrying hazardous materials, water uses associated with hazardous materials, water uses associated with water and wastewater treatment works, and for most mining-related water uses. The GA may be exercised as follows:

	i) Section 21(c) or (i) water use activities that are determined to pose a LOW Risk as determined through the application of the Risk Matrix as prescribed in the Notice can be undertaken subject to the general conditions of the GA; ii) Section 21(c) or (i) water use activities set out in Appendix D1 of the Notice can be undertaken *without* being subject to the requirement of a risk assessment and subject to the general conditions of the GA. Such water use activities in Appendix D1 include *inter alia* emergency river crossings, fence erection, solar renewable infrastructure that has no direct impact on watercourses and mini-scale hydropower developments; iii) Prescribed water use activities undertaken by certain State Owned Entities as detailed in Appendix D2 of the Notice can be undertaken *without* being subject to the requirement of a risk assessment and subject to the general conditions of the GA; iv) Maintenance work associated an existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix can be undertaken; v) River and stormwater management activities including maintenance of infrastructure as contained in a river management plan or similar management plan, may be conducted subject to the approval of such a plan by the relevant DWS regional office or catchment management agency; vi) Rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix can be conducted; and vii) Emergency work arising from an emergency situation and or incident associated with the persons' existing lawful water use entitlement can be undertaken, provided that all work is executed and reported in the manner prescribed in the Emergency protocol contained in Appendix C of the GA. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.
Government Notice 704 as promulgated in Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)	These regulations, forming part of the National Water Act, were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the project complies with Government Notice 704 as promulgated in Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) which contains regulations on use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may:* *(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100-year floodline or within a horizontal distance of 100 metres (m) from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become waterlogged, undermined, unstable or cracked;* According to the above, the activity footprint must fall outside of the 1:100-year floodline of the drainage feature or 100m from the edge of the feature, whichever distance is the greatest, unless authorised by DWS.
Government Notice 3569: National Biodiversity Offset Guideline, in government Gazette 48841 dated 23 June 2023, as it relates to the NEMBA	The purpose of the National Biodiversity Offset Guidelines is to provide a framework for mitigating the impacts of development on biodiversity. These guidelines emphasize the principle of "like-for-like" offsetting, ensuring that any biodiversity loss from development activities is compensated by conserving or restoring an equivalent type and amount of biodiversity elsewhere. The guidelines aim to achieve no net loss, or ideally a net gain, in biodiversity, supporting ecological sustainability and resilience. They establish standards for identifying suitable offset sites, calculating offset ratios, and ensuring long-term management and monitoring of offset areas to maintain their ecological integrity.

APPENDIX C: BIODIVERSITY OFFSET DETERMINATION METHODOLOGY

The starting point for determining the size of a biodiversity offset is calculating an applicable ecosystem-based biodiversity offset ratio. A biodiversity offset ratio provides the area-based size of a biodiversity offset relative to the area of the residual negative biodiversity impact.

Given that the focus of this section is on ecosystems, the standard approach for determining ratios is based on Ecosystem Extent, Ecosystem Protection Level (EPL) and Ecosystem Threat Status. It is also recommended that it is taken into consideration which type of biodiversity priority area the relevant area is classified as. This is to ensure that biodiversity priorities can still be met in areas that are CBA2s but were not selected because of ecosystem threat level.

DETERMINING THE BASIC OFFSET RATIO

The standard approach to determining a basic biodiversity offset ratio is based on biodiversity targets. Those targets are, in turn, based on Ecosystem Extent, Ecosystem Protection Level and Ecosystem Threat Status of the various ecosystem types identified in the ecosystem assessment conducted as part of the determination of ecosystems that are threatened and in need of protection in terms of the National Environmental Management: Biodiversity Act, 2004.31 The proposed applicable ratios are listed in the look-up table, which is attached, marked Annexure A, of the offset guidelines (https://cer.org.za/virtual-library/policy/national-biodiversity-offset-guideline-23-june-2023). The look-up table also sets out the rationale for the standard approach in greater detail and will be reviewed periodically and updated, if and when necessary.

The standard approach is shortly as follows:

1. If the Ecosystem Extent is less than or equal to 30%, the precautionary principle demands that a 30:1 ratio must be applied; and
2. If the Ecosystem Extent is between 30 and 70%, the ratios provided for in the look-up table, which takes into consideration Ecosystem Extent and EPL, should be applied. The ratios in that range of Ecosystem Extent vary between 1:22 to 1:1 depending on the extent of the ecosystem remaining and how much of the relevant ecosystem type is protected. In the table below, ratios were assigned to 6 different “bands” based on remaining ecosystem extent and ecosystem protection level (Table C1 & Figure C1).

Table C1: Ratio look-up table based on remaining ecosystem extent and ecosystem protection level (as per the 2023 Biodiversity Offset Guidelines).

Remaining Ecosystem Extent (%)			Not Protected		Poorly Protected		Moderately Protected		Well protected	
Bands	Low	High	Low	High	Low	High	Low	High	Low	High
1	0	30	TPC Ratio Applied							
2A	30	40	12.0	22.0	8.0	15.0	4.0	8.0	2.0	4.0
2B	40	50	7.0	12.0	4.0	8.0	2.0	4.0	0.0	2.0
3A	50	60	3.0	7.0	2.0	4.0	0.0	2.0	0.0	0.0
3B	60	70	0.0	3.0	0.0	2.0	0.0	0.0	0.0	0.0
4	70	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

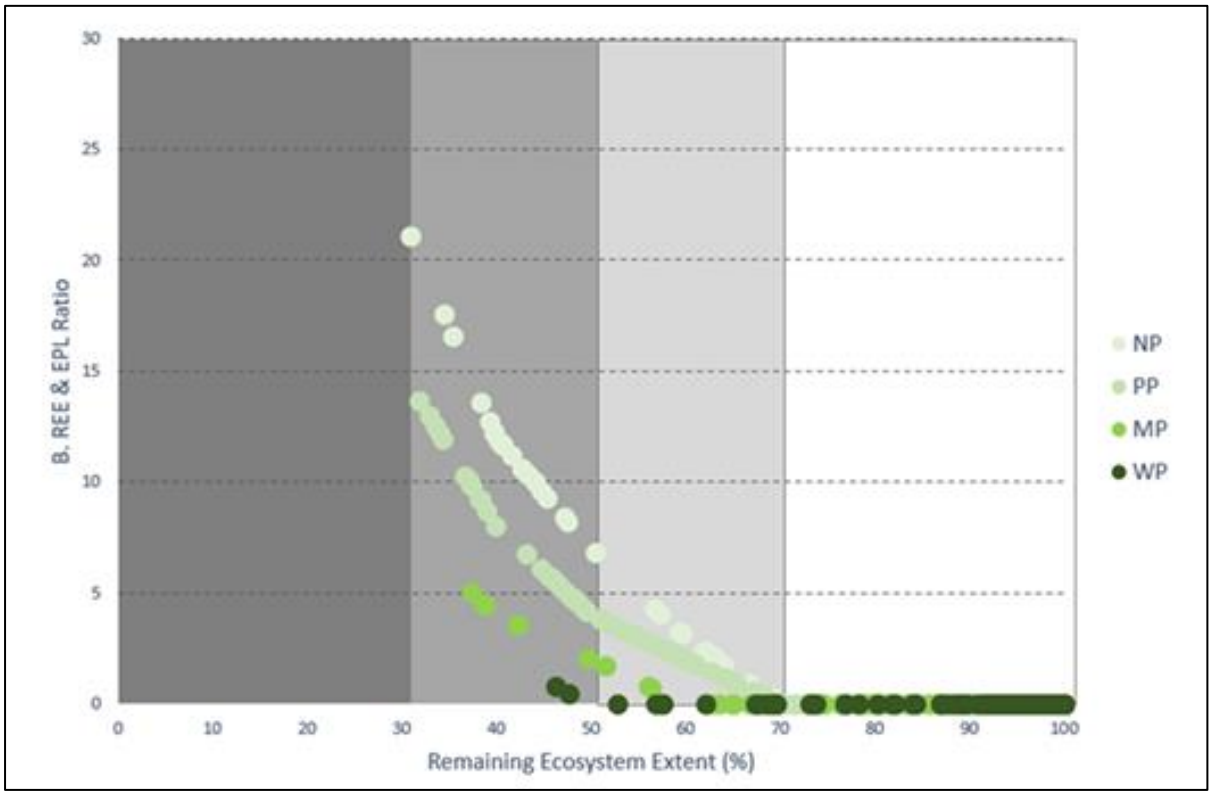


Figure C1: Starting Ratios based on Ecosystem Extent and EPL; NP = not protected, MP = moderately protected, WP = well protected, REE = remaining ecosystem extent, and EPL = ecosystem protection level (as per the 2023 Biodiversity Offset Guidelines).

3. Take into consideration the ecosystem threat status: it is recommended that the following ratios are applied for the different ecosystem threat statuses:
    - Critically Endangered: 30:1;
    - Endangered: 10:1; and
    - Vulnerable: 5:1.

Ecosystems are not only threatened by a reduction in range. They are also threatened for other reasons.

4. Following the precautionary approach, it is recommended that the highest of the two ratios described in 2 and 3 above is selected as the starting ratio.

It should be noted that a biodiversity offset could still be required for an activity, or activities, that are likely to have a significant residual negative impact on an ecosystem of LC with an Ecosystem Extent of greater than 70%. In those cases, the starting ratio would be based on the information before the decision-maker, such as the reasons why the biodiversity offset is required.

It is emphasised here that the standard approach is not binding, but a guide based on relevant scientific information on ecosystems. Competent authorities (CAs) must apply their minds to each case, which would involve considering additional factors, such as the size of the historical extent of the ecosystem measured against the extent of the residual negative impact (if a large percentage of the extent of the ecosystem would be impacted on, a higher ratio would be justified) and the cumulative residual negative impact of the activity, or activities, on biodiversity.

Some provincial conservation authorities or CAs have adopted, or may in future adopt, province specific approaches to determining biodiversity offset ratios, based on province-specific biodiversity targets. Those approaches take precedence over the standard approach provided for in this guideline provided that they are scientifically defensible. Consideration also needs to be given to how ratios are determined for development in the urban setting. It is likely that there would be good reasons for adjusting biodiversity offset ratios down for activities in the urban setting given the relative scarcity of space and natural areas

in those areas. In this regard, consideration should be given to approaches for determining biodiversity offset ratios for development in the urban environment.

'Like-for-better' biodiversity offsetting/ 'trading-up'

Wherever possible, a 'like-for-like' biodiversity offset should be required and provided to ensure that residual negative impacts on the affected biodiversity features are appropriately compensated. In exceptional cases, targeting biodiversity of greater conservation concern (for example, ecosystems that have higher threat status than the impacted ecosystem, or areas of higher biodiversity priority as indicated in applicable systematic biodiversity plans), may be justifiable. Where such an approach of 'trading up' is being considered, a strong motivation should be provided for this choice (for example, when it can be shown that there are no suitable areas of the same or proxy habitat available). Such motivation should also show the relationship between the biodiversity offset site's biodiversity and impacted biodiversity.

DETERMINING THE ADJUSTED BIODIVERSITY OFFSET RATIO

To ensure that biodiversity priorities are considered as part of the determination of the size requirement for a biodiversity offset, the relevant CBA Map must also be considered as part of that process. While any loss in a CBA 1 is generally considered irreplaceable, if it is found that the negative significant impact on biodiversity will take place in a CBA 2, it is recommended that the basic biodiversity offset ratio should be adjusted by increasing it by a factor of 1.5 up to a maximum of 30:1.

APPENDIX D: OFFSET SITE SELCETION CRITERIA

In the first phase of the offset study, several *offset candidate sites* are considered. Candidate sites may include both on-site and off-site offset options. A suite of site selection criteria has been identified by the National Wetland Offset Guidelines (DWS & SANBI, 2014) and adapted by STS to reflect both freshwater and biodiversity targets. The selected criteria are summarised in Table D1. Final offset site selection must ensure that suitable compensation for the loss of freshwater and biodiversity features due to the proposed development is achievable, while addressing the suitability of a site in terms of meeting Water Resource and Ecosystem Service requirements as well as biodiversity targets (as per criteria listed in Table D1).

Table D1. Offset site selection and screening tool to meet ecosystem conservation targets. Selection criteria adapted from the Wetland Offset Guidelines (DWS & SANBI, 2014).

Criteria	Site attributes	Acceptability Guideline
Like-for-like Habitat Type	**1. Vegetation type and/or HGM type – Habitats (vegetation types) and/or wetlands selected should ideally be of the same habitat type ('Like-for-like' principle).**	
	Terrestrial: same vegetation type; AND/OR **Freshwater**: same HGM type, same habitat type, and vegetation group.	Ideal
	Terrestrial: same vegetation type and/or different vegetation type of increased conservation significance (i.e., trading-up); AND/OR **Freshwater:** wetland is a different HGM type but the same vegetation type, within the same Wetland Vegetation Group	Acceptable
	Terrestrial: same vegetation type (Limpopo Ridge Bushveld and Musina Mopane Bushveld) but in a degraded state / vegetation communities illustrate a significant deviation from the reference vegetation type. AND/OR **Freshwater**: Wetland is a different HGM and habitat type, but within the same Wetland Vegetation Group. OR Wetland is the same habitat type, but within a different adjacent Wetland Vegetation Group with a critical need for protection.	Potentially acceptable but generally undesirable i.e. should only be considered if no viable offsets sites that are ideal / acceptable
	Terrestrial: not the same vegetation type and/or vegetation type of lower conservation significance. AND/OR **Freshwater**: wetland is in another Wetland Vegetation Group of a lower threat status (trading down).	Generally unacceptable
Conservation Planning	**2. Landscape/Conservation planning – offset site selection should be aligned with regional and national conservation plans where possible.**	
	Terrestrial habitat and/or freshwater features have been identified as being of high importance in national, provincial and municipal conservation plans e.g. Critical Biodiversity Areas (CBAs), focus and/or priority areas for protected area expansion (as per the 2018 National Protected Area Expansion Strategy (NPAES)), Freshwater Priority Areas (FEPAs), and/or within River FEPA catchments.	Ideal
	Terrestrial habitat and/or freshwater features have been identified as moderately important in national, provincial and municipal conservation plans e.g. Ecological Support Areas (ESAs), and/or NFEPA support areas.	Acceptable
	Terrestrial habitat and/or freshwater features have not been specifically identified as important in national, provincial and municipal conservation plans.	Potentially acceptable but generally undesirable
Habitat Condition	**3. Habitat condition – The habitat condition should ideally be in a moderately modified condition with good rehabilitation potential (Class C or D for freshwater features) and good/better than that of the impacted site prior to development.**	

Criteria	Site attributes	Acceptability Guideline
	Terrestrial Habitat: offset site is of good ecological condition[16]. **Freshwater Habitat:** offset site (post-rehabilitation) condition is Class B of higher.	Ideal
	Terrestrial Habitat: offset site is of fair ecological condition[17]. **Freshwater Habitat:** offset site (post-rehabilitation) condition is Class C.	Acceptable
	Terrestrial Habitat: offset site is of poor ecological condition[18]. **Freshwater Habitat:** offset site (post-rehabilitation) condition is Class D.	Generally unacceptable
Local Biodiversity Value	**4. Local biodiversity value – habitat that is unique or that is recognised as having high local biodiversity value should be prioritised for protection.**	
	The habitat (including terrestrial and freshwater) is characterised by habitat and/or species of high biodiversity value i.e. presence of unique and noteworthy biodiversity attributes like high species or habitat diversity, rare species or habitat, unique features etc.	Ideal
	The habitat (including terrestrial and freshwater) is characterised by habitat and/or species of moderate biodiversity value (i.e. some noteworthy features present).	Acceptable
	The habitat (including terrestrial and freshwater) is characterised by habitat and/ species of low biodiversity value.	Generally unacceptable
Long-term Ecological Viability	**5. Ecological viability of site – Ecological connectivity and consolidation with other intact ecosystems together with the potential linkage between protected areas is preferable. Also, catchment land use transformation (current and planned) should be low to moderate to reduce risk of indirect impacts.**	
	The offset provides an opportunity to consolidate / expand existing protected areas. Catchment threats and pressures are low.	Ideal
	The offset site is well connected to other intact natural areas and there are no obvious land use threats to its long-term persistence.	Acceptable
	The offset site is moderately connected to other intact natural areas and there are measurable land use threats to its long-term persistence that can be managed.	Potentially acceptable but generally undesirable
	The offset site is poorly connected with other intact ecosystems/ there are land use threats to its long-term persistence and/or catchment highly transformed / catchment land uses have intense hydrological and geomorphological impacts.	Generally unacceptable
Land-legal Viability	**6. Land-legal Issues – The rezoning of the site to a formal conservation use is legally and practically feasible and does not contradict / is in line with current land use planning.**	
	Offset site is located on privately or state-owned land with no conflicting current or future land use zoning and is located within a single cadastral unit / property.	Ideal
	Offset site is located on privately or state-owned land with no conflicting current or future land use zoning and is located across 2-4 properties.	Acceptable
	Offset site is located on privately or state-owned land with no conflicting current or future land use zoning and is located across 5-8 properties.	Potentially acceptable but generally undesirable
	Offset site is located on privately or state-owned land with conflicting current or future land use zoning or development applications / rights and/or is located across >8 properties and/or the wetland is located within tribal authority land.	Generally unacceptable
Demand for Regulating Services	**7. Downstream demand for regulating ecosystem services – a higher demand for regulating ecosystem services provides an indication of the opportunity for the realisation of the gains in ecosystem services as well as the importance of such.**	

[16] Good ecological areas are areas that are natural or near-natural, i.e., an ecological condition class in which composition, structure and function are still intact or largely intact.
[17] Fair ecological areas are areas that are moderately modified, semi-natural, i.e., an ecological condition class in which ecological function is maintained even though composition and structure have been compromised.
[18] Poor ecological areas are areas that are severely or irreversibly modified, i.e., an ecological condition class in which ecological function has been compromised in addition to structure and composition.

Criteria	Site attributes	Acceptability Guideline
	There is a high to very high demand for regulating ecosystem services by downstream users.	Ideal
	There is a moderate to moderately high demand for regulating ecosystem services by downstream users.	Acceptable
	There is a low demand for regulating ecosystem services by downstream users.	Generally unacceptable
Rehabilitation Opportunities / Potential	**8. Rehabilitation opportunities – sites with a lower cost to benefit ratio for achieving functional gains and with good rehabilitation potential are preferable over sites that require extensive and costly rehabilitation to achieve a PES C or higher (freshwater features) or representation of the reference vegetation type (terrestrial habitats).**	
	Habitat within offset site has good rehabilitation potential that can be achieved by relatively cost-efficient interventions.	Ideal
	Habitat within offset site has good rehabilitation potential that can be achieved by costly and extensive interventions.	Acceptable
	Habitat within offset site has poor rehabilitation potential. OR Habitat within offset site has moderate rehabilitation potential that can be achieved by costly and extensive interventions.	Generally unacceptable

APPENDIX E: REHABILITATION AND MANAGEMENT PLAN FRAMEWORK

Standard Practices for Planning, Implementing, and Monitoring Ecological Repair Projects

Important principles of rehabilitation or Ecological Repair project **implementation** include:

- No further or latent damage on natural resources is to be caused by the restoration/rehabilitation works;
- Planned interventions are interpreted and carried out responsibly, effectively and efficiently by suitably qualified, skilled and experienced people or under the supervision of a suitably qualified, skilled and experienced person;
- All interventions are undertaken in a manner that is responsive to natural processes and fosters and protects potential for natural and assisted recovery;
- Corrective changes of direction (to adapt to unexpected ecosystem responses) are facilitated in a timely manner and are ecologically informed and documented;
- All projects exercise full compliance with work, health, and safety legislation; and
- All project operatives communicate regularly with key stakeholders (or as required by funding bodies) to keep them abreast of progress.

The below figure (Figure E1) outlines standard practices used in Ecological Repair project planning where professional staff or contractors are engaged. They can be applied any rehabilitation or restoration project but the degree to which they are applied should be adapted to correspond to the size, complexity, degree of damage, regulatory status, and budgets of the particular project.

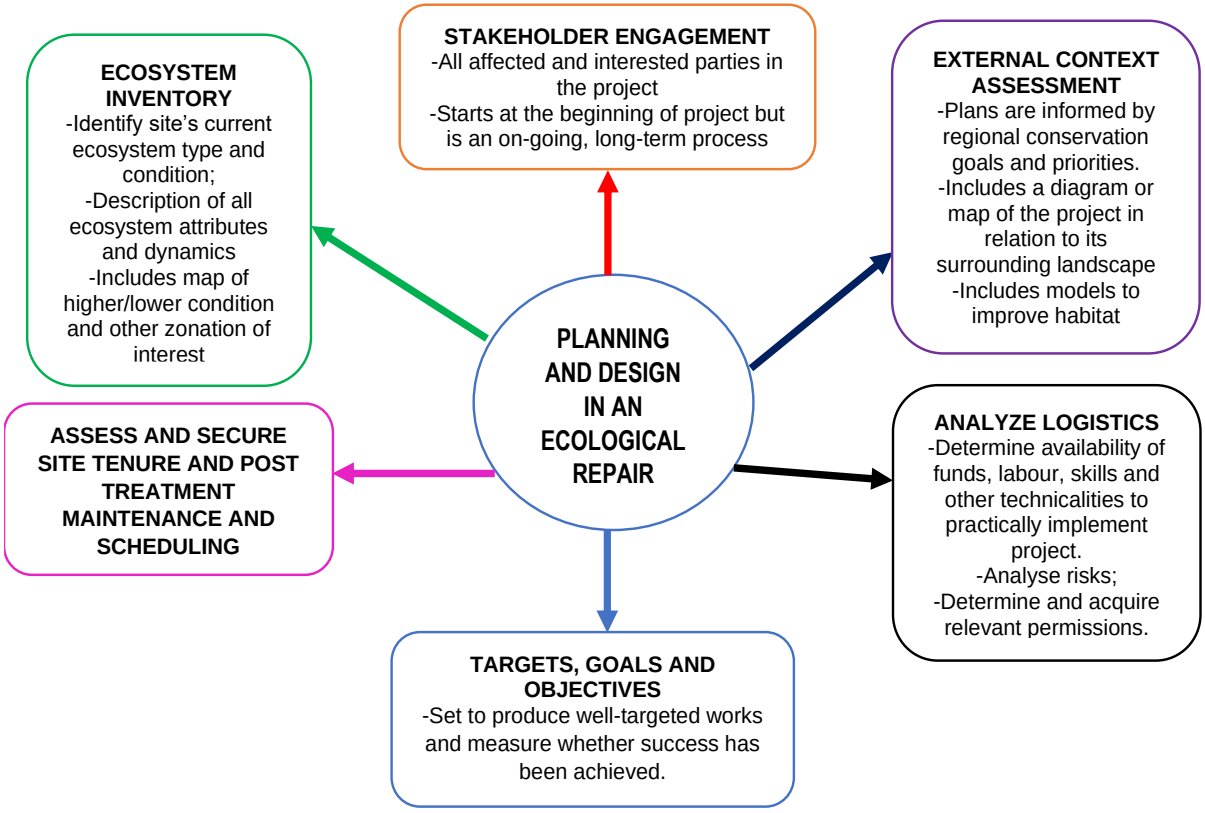


Figure E1: Planning and design process of rehabilitation and ecological restoration projects, according to McDonald *et al* (2016).

Key Actions in Rehabilitation and Restoration Projects

Rehabilitation activities should be undertaken on a continual basis, with each iteration improving on the previous plan, i.e., in a continuous, cyclic nature. It is crucial that the rehabilitation plan be an ongoing process, where the plan is continually refined and improved. To achieve this, a rehabilitation framework has been proposed. This cyclic framework is divided into four phases, namely a planning phase, an implementation phase, a monitoring phase, and an adaptive management phase (Figure E2). This framework is a modified version of that presented by Hatting *et al.,* (2019).

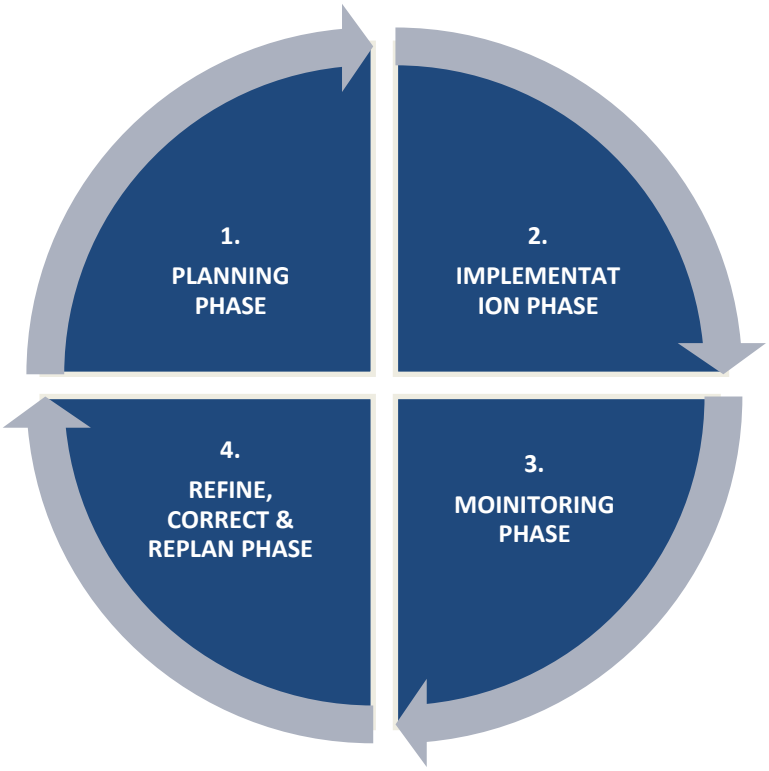


Figure E2: Schematic diagram illustrating the cyclic nature of the proposed rehabilitation framework. Each iteration (i.e., phase) is intended to identify strengths and weaknesses of the framework and implement improvements in the next round of rehabilitation.

The Phases can be summarised as follows (Hatting *et al.,* 2019):

1. Planning Phase: this phase outlines the rehabilitation targets and objectives that rehabilitation activities aim to achieve. It involves setting out a vision and objectives as well as a conceptual rehabilitation plan and design that can be implemented in conjunction with operational mining activities;
2. Implementation Phase: this phase involves the rehabilitation activities needed to reach rehabilitation targets. This phase involves the in-field rehabilitation context of the rehabilitation plan set out in the planning phase, i.e., the on-site implementation of rehabilitation activities (e.g., soil amelioration activities, vegetation trials etc.);
3. Monitoring Phase: this phase provides recommendations on monitoring methods required to successfully evaluate the implemented rehabilitation activities. During this phase the need for refinement of implementation activities is identified; and
4. Adaptive Management Phase: this phase involves a “refine-correct-re-plan” approach that ensures that the rehabilitation plan is continuously being updated and improved so to effectively achieve the rehabilitation targets set out in the planning phase.

Key Action 1: Planning: rehabilitation and restoration practice is based on knowledge of an appropriate local native reference ecosystem, taking environmental change into account.

Establishing the reference ecosystem model can be achieved by using existing reference sites that serve as analogues between the degraded site and its restoration target. When existing reference sites are unavailable, the reference model can be estimated, by collecting ecosystem information on local native plants, animals, other biota, and abiotic conditions from various sources. These sources include extant reference sites, field indicators, historical records, and predictive data. The reference model must account for ecosystem capacity to adapt to existing and anticipated environmental change. As such, the process of selecting a reference model should consider contemporary examples where they exist.

The second key concept underpinning successful Ecological Repair is clearly identifying what site-specific ecosystem attributes must be restored to facilitate ecosystem recovery. This involves dividing broad categories (species composition) into more detailed sub-categories (flora) to inform a given project's goals and objectives. Specific, measurable indicators are then used to evaluate an ecosystem's attributes before and after rehabilitation efforts to determine whether desirable change is being achieved or not. Effective indicators include details of the attribute (e.g.: physical conditions) to be evaluated; desired outcomes, e.g., soil rations; magnitude of the effect, e.g., 40% increase in plant cover) and specific timeframes in which outcomes are to be achieved. Please refer to Table E1 below for the six main ecosystem attributes that can be measured in a rehabilitation or restoration project.

Table E1: Six important attributes of a target ecosystem and their goals and objectives, to help measure ER success.

Attribute	Examples of broad goals – for which more specific goals and objectives appropriate to the project would be developed
Absence of threats	Cessation of threats such as overutilization and contamination; elimination or control of invasive species.
Physical conditions	Reinstatement of acceptable topographical landscape features.
Species composition	Presence of desirable plant and animal species and absence of undesirable species.
Structural diversity	Reinstatement of layers, faunal food webs, and spatial habitat diversity.
Ecosystem functionality	Appropriate levels of growth and productivity, reinstatement of nutrient cycling, decomposition, habitat elements, plant-animal interactions, normal stressors, on-going reproduction, and regeneration of the ecosystem's species. Appropriate provision of goods and services to the local community.
External exchanges	Reinstatement of linkages and connectivity for migration and gene flow; and for flows including hydrology, fire, or other landscape scale processes.

Key Concept 2: Implementation (Approaches to ecosystem regeneration):

There are three approaches to facilitating ecosystem regeneration: "natural", "assisted" and "reconstruction". The diagram below describes what each approach entails, and where each approach is warranted, along the trajectory of ecosystem recovery. The more degraded and less functional an ecosystem, greater is the effort that is required to restore it. Reconstruction by means of engineering (e.g., earth works and artificial soil fertilisation) is required when the land has poor capability. However, as abiotic barriers are overcome by reconstructive efforts, natural processes take over and humans involved in the Ecological Repair project, begin to only assist what is naturally occurring by adding biotic factors. The ultimate goal is to get the ecosystem to the point of self/natural regeneration where human inputs are minimal. Refer to Figure E3 below for an illustration of the three approaches to ecosystem regeneration.

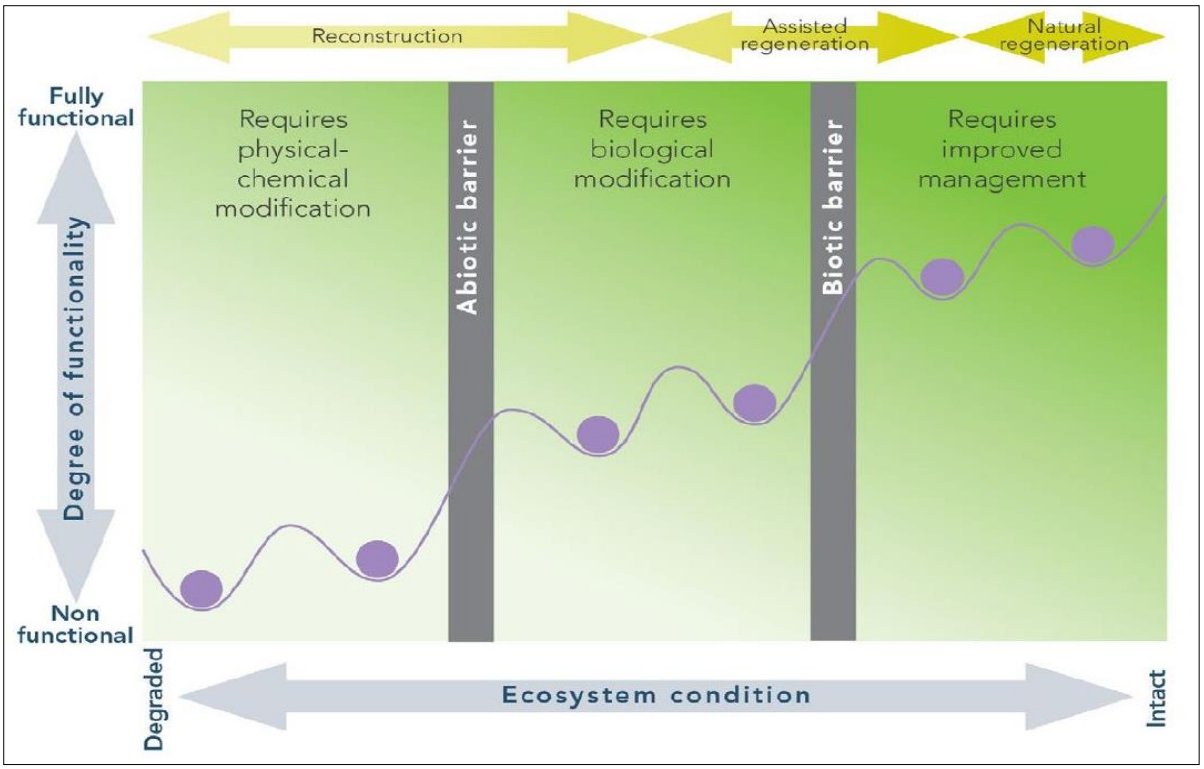


Figure E3: Conceptual model of ecosystem degradation and responses to it through restoration (McDonald *et al.,* 2016).

Key Concept 3 and 4: Maintenance and monitoring.

The next stage in the procession of an Ecological repair project after implementation, **is monitoring and maintenance**. Successful Ecological repair projects rely on well-developed monitoring and maintenance programs. These programs inform managers whether rehabilitation and restoration interventions and treatments are successful and what approaches need to be taken for future work. The management body is responsible for ongoing maintenance to prevent negative impacts and carries out any required monitoring of the site after completing the project. This is to ensure that the site does not regress into an unacceptable state. Comparison with an appropriate reference ecosystem will be ongoing. Important aspects of monitoring are as follows:

- Monitoring evaluated results i.e., determines whether goals and objectives are being achieved or not, and why;
- Collects baseline ecosystem data prior to works, to compare ecosystem before and after interventions and treatment;
- Makes use of appropriate sampling techniques for the area, that are scientifically sound. Sampling design can be simple but should still be scientifically rigorous and produce high confidence in results. In other words, data collection should be repeated at regular intervals, in the same sampling plots, using the same survey techniques. The simplest method that can be used, is fixed-point photography, with accompanying species composition and ecosystem descriptions. Ecological change is however, best expressed when quantified;
- Adequate records of interventions and treatments are maintained to ensure adequate implementation, inform adaptive management and enable future evaluation of results relative to the implemented actions. All treatment data, along with all evaluation monitoring records are maintained for future reference; and
- The management body is responsible for ongoing maintenance to prevent deleterious impacts and carries out any required monitoring of the site after completion of the project to ensure that the site does not regress into an undesirable state. Comparison with an appropriate reference ecosystem will be ongoing.

Ecosystem recovery may take many years to accomplish. As such, managers should adopt strategies of continuous improvement. To help managers track progress towards project goals over time, a star rating tool (5-levels or ‘stars’) for assessing and ranking degree of recovery over time can be used. Please see Table E2 for an example of how the “five-star” system for recording ecosystem recovery

can be used against the six main ecosystem attributes referred to in key concept 2. Alternatively, a recovery wheel depicted in Figure E4 below can be used to track recovery overtime. Some key notes for interpreting the 5-star evaluation system are presented below:

- The system serves to evaluate the progression of an ecosystem along a trajectory of recovery;
- The system represents a conceptual gradient, providing a framework that can be interpreted by managers in more quantitative terms to suit a specific ecosystem;
- Evaluation can only be as rigorous (and therefore as reliable) as the monitoring that it informs; and
- Evaluation using the 5-star system must be site- and scale-specific.

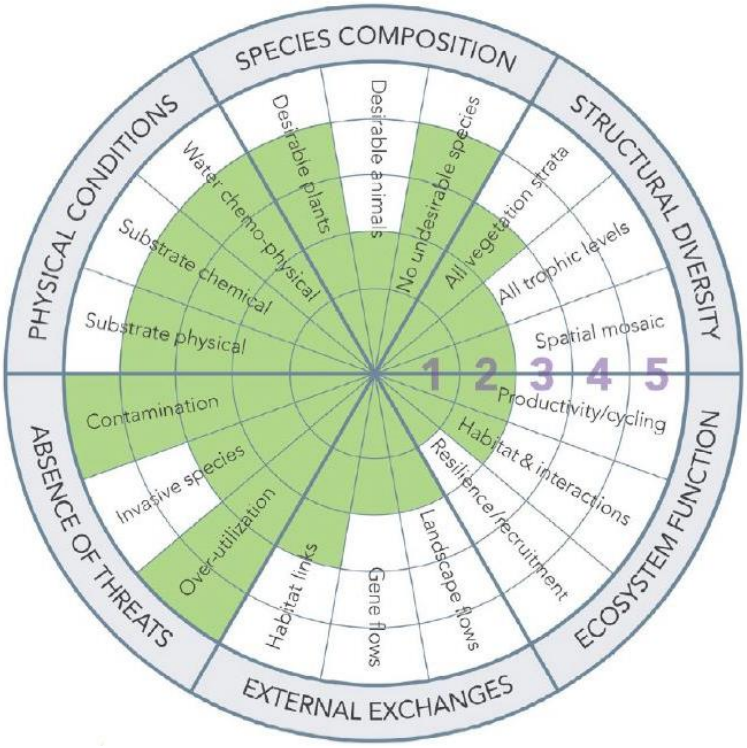


Figure E4: Progress evaluation 'recovery wheel' depicting a hypothetical 1-year old reconstruction project on its way to a 4-star condition. This template allows a manager to illustrate the degree to which the ecosystem under treatment is recovering over time. Note: Sub attribute labels can be adjusted or more added to better represent a particular ecosystem.

Table E2: A generic 1–5-star recovery scale interpreted in the context of the six key ecosystem attributes used to measure progress towards a self-organizing status (McDonald *et al.*, 2016).

ATTRIBUTE	★	★★	★★★	★★★★	★★★★★
Absence of threats	Further deterioration discontinued and site has tenure and management secured.	Threats from adjacent areas beginning to be managed or mitigated.	All adjacent threats managed or mitigated to a low extent.	All adjacent threats managed or mitigated to an intermediate extent.	All threats managed or mitigated to high extent.
Physical conditions	Gross physical and chemical problems remediated (e.g., contamination, erosion, compaction)	Substrate chemical and physical properties (e.g., pH, salinity) on track to stabilize within natural range.	Substrate stabilized within natural range and supporting growth of characteristic biota.	Substrate securely maintaining conditions suitable for ongoing growth and recruitment of characteristic biota.	Substrate exhibiting physical and chemical characteristics highly similar to that of the reference ecosystem with evidence they can indefinitely sustain species and processes.
Species composition	Colonising native species (e.g., ~2% of the species of reference ecosystem). No threat to regeneration niches or future successions.	Genetic diversity of stock arranged and a small subset of characteristic native species establishing (e.g., ~10% of reference). Low onsite threat from exotic invasive or undesirable species.	A subset of key native species (e.g., ~25% of reference) establishing over substantial proportions of the site. Very low onsite threat from undesirable species.	Substantial diversity of characteristic biota (e.g. ~60% of reference) present on the site and representing a wide diversity of species groups. No onsite threat from undesirable species.	High diversity of characteristic species (e.g., >80% of reference) across the site, with high similarity to the reference ecosystem; improved potential for colonization of more species over time.
Structural diversity	One or fewer strata present and no spatial patterning or trophic complexity relative to reference ecosystem.	More strata present but low spatial patterning and trophic complexity, relative to reference ecosystem.	Most strata present and some spatial patterning and trophic complexity relative to reference site.	All strata present. Spatial patterning evident and substantial trophic complexity, developing, relative to the reference ecosystem.	All strata present and spatial patterning and trophic complexity high. Further complexity and spatial pattering able to self-organize to highly resemble reference ecosystem.
Ecosystem functionality	Substrates and hydrology are at a foundational stage only, capable of future development of functions similar to the reference.	Substrates and hydrology show increased potential for a wider range of functions including nutrient cycling, and provision of habitats/resources for other species.	Evidence of functions commencing - e.g., nutrient cycling, water filtration and provision of habitat resources for a range of species.	Substantial evidence of key functions and processes commencing including reproduction, dispersal and recruitment of species.	Considerable evidence of functions and processes on a secure trajectory towards reference and evidence of ecosystem resilience likely after reinstatement of appropriate disturbance regimes.
External exchanges	Potential for exchanges (e.g., of species, genes, water, fire) with surrounding landscape or aquatic environment identified.	Connectivity for enhanced positive (and minimized negative) exchanges arranged through cooperation with stakeholders and configuration of site.	Connectivity increasing and exchanges between site and external environment starting to be evident (e.g., more species, flows etc.).	High level of connectivity with other natural areas established, observing control of pest species and undesirable disturbances.	Evidence that potential for external exchanges is highly similar to reference and long-term integrated management arrangements with broader landscape in place and operative.

APPENDIX F: AIPCP METHODOLOGY / APPROACH

Control Methods to be employed

A range of different management practices should be strategically combined to achieve the goals of the developed AIPCP:

- The strategic combination of all available and appropriate methods may optimise the prospect of achieving stated goals; and
- An overview of available species-specific control methods is provided in Table F6, with more detail on AIP Control Planning is presented in this appendix.

An AIPCP is a long-term management project. To ensure long-term success of the AIPCP, the management plan for alien vegetation must include the following three phases:

- Phase 1: Initial control;
- Phase 2: Follow-up control; and
- Phase 3: Maintenance control.

Provided below are basic approaches and guidelines for **initial control**. Follow-up control and maintenance will be the responsibility of the proponent and/or the maintenance team in consultation with a suitably qualified contractor.

Phase 1: Initial Control Phase

Integrated Strategies to Control Alien Trees (Standing trees; Campbell, 2000):

- Basal bark: Recommended herbicide is mixed with diesel as carrier and applied to the basal part of the stem;
- Strip bark: Bark is stripped from stem at waist height to ground level;
- Hand pull: Saplings and seedlings must be pulled out by hand and regrowth should also be controlled by hand pulling, or foliar spray;
- Frill: Use a cane knife and make frills into the stem. Herbicide must be applied (1-2mm per frill) and must be done in 30min after frilling;
- Foliar spray: Foliar spray application of specific herbicides; and
- Soil application: Herbicide is applied to the soil by means of foliar spray of specific herbicides and taken up by the plant's roots.

Fell trees – control stumps:

Trees should be felled and as soon as the trees are down, the stumps need to be treated with a registered herbicide mix with suitable dye and applied with a paintbrush, hand sprayers or knapsack sprayers. A low pressure must be used when using the hand- and knapsack sprayers, and a solid cone nozzle, e.g., CE1 or TG1. Wood needs to be removed, and areas must be revegetated with grass species occurring naturally in the area (Campbell, 2000).

The following equipment must be used to cut trees and saplings:

- Chainsaw;
- Bow saw;
- Brush cutter;
- Cane knife; and
- Trolley mounted roll saw, e.g., "Bosvreter".

Methods for controlling trees:

- Cut stump treatment (NB The height of the cut stump must not exceed 15cm);
- Total stump treatment; and
- Using herbicide plugs.

Methods for controlling coppice, saplings and seedlings:

- AIP infestation can comprise of different growing forms, and some of the growth forms cannot be utilised. These plants need to be cut with a brush cutter and the stumps need to be treated with herbicide that was mixed with a dye to show where treatment was applied. Foliar spray of the coppice tends to be the most effective method to use.

Placement of disposed wood is very important because if a fire breaks out, the brushwood can increase the intensity of the fire. When the fire intensity is too high, soil structure will be broken down and seedbanks in the soil will also be destroyed and bare patches of sterilized ground will be formed. The best practice is to use the branches to control erosion, create habitat or chip and remove for compost, bricketing or even as a fuel source. The utmost care must be taken to prevent any seeds of AIPs from spreading when using branches as brush packing.

Integrated Strategies to Control Alien Shrubs:

- **Alien shrubs that are less than 1m tall (Campbell, 2000):**
  - Registered herbicide must be used for foliar application;
  - Selective broadleaf herbicide that will not negatively impact on grass must be used when foliar application is done. When grass is not present, a selective or non-selective registered herbicide can be used;
  - Whenever dense seedling growth that are of uniform height are present, a flat fan nozzle with knapsack must be used; and
  - Seedling growth that is of uneven height (root suckers, short saplings, and coppice growth) a cone nozzle must be used.
- **Alien shrubs that are taller than 1m (Campbell, 2000):**
  - Shrubs that are taller than 1m must be reduced by using a brush cutter or cane knives; and
  - Mechanical uprooting of shrubs is not always a preferred method because the soil is disturbed, and this increases the risk of alien vegetation infestation. Erosion is also promoted by this activity, and soil loss will occur. Mechanical uprooting can be done in areas that have a dense grass cover, as the roots of the grass will keep the soil intact. After uprooting the soil must be levelled and, if grass seeds are present, some grass seeds must be placed on these areas to promote grass regrowth.
  -

Integrated Strategies to Control Alien Herbs (Milton, 2016):

Mechanical Control

Obstructive / encroaching indigenous vegetation or AIP species are to be manually or mechanically removed as far as possible. In order to prevent chemical contamination of the watercourses, chemical control should be avoided.

- **Manual removal:**
  - Immature, broad-leaved herbaceous weeds can be removed easily with a hoe or spade; and
  - Should the weeds have seed heads they must be gathered up, put in garbage bags or waste drums, transported and disposed of at a licensed waste disposal facility.

Chemical Control: taken from Safe and Effective Herbicide Use: A handbook for near-water applications. Online available at: https://www.epa.sa.gov.au/files/477387_pesticide_water.pdf**:**

Where manual removal consistently fails to reach control targets of AIP species and chemical control is deemed necessary, the following considerations are important:

- Prior to using herbicides in a watercourse or its edge, ensure you have considered all non-chemical options. If there is no alternative, then ensure that appropriate herbicide and application techniques are selected for the site as per herbicide label information and the Working for Water Herbicide guideline;
- **Pre-emergent herbicides are not suitable for watercourse use** – These herbicides are typically applied before the pest plant germinates and are often residual in the soil for long periods. They are generally not considered to be safe for use near waterbodies and are not recommended for use due to their persistence in the environment;
- **Selective herbicides** are designed to act on only one type of pest plant. Generally, selective herbicides will control either broadleaf species, grasses or woody weeds. These herbicides are useful when the focus may be on controlling a particular weed species. These herbicides may persist as residues in the environment and only registered herbicides for targeted species should be used;
- **Non-selective herbicides, if applied correctly, could have a minimal impact on the environment**. These herbicides are designed to be applied directly to the target pest plant, either through being sprayed onto foliage or applied directly to the cambium layer;
- If herbicide use is deemed necessary, the time of herbicide application needs to coincide with a time when rainfall, and t run-off, is likely to be low so to minimise impacts on aquatic life; and

- Preventing re-establishment will require follow-up control and revegetating the area with native grasses and shrubs.

Integrated Strategies to control alien grasses:

- **Burning**: Not recommended as burning can stimulate alien grasses and lead to in-effective management.
- **Hand clearing**: Not recommended for dense infestations as hand clearing / pulling can lead to significant soil disturbance and, consequently, can promote the establishment of alien grasses or other pioneer alien species.
- **Mowing**: Effective for dense stands of annual grasses if performed where grasses are in flower and seed has not yet set.
- **Chemical control**: Most effective method of controlling alien grasses. Pre-emergent systemic herbicides are most effective. Use within the riparian zone or a watercourse is however not recommended.
- Chemical control to be restricted to registered herbicides only.

Phase 2: Ongoing Control Phase

Follow up Control (Campbell, 2000):

Follow-up control is essential to control AIP saplings, seedlings and coppice regrowth in order to achieve and sustain the progress that was made with the initial control work. If the follow-up control phase is neglected, the AIP infestation will likely re-emerge and will be more severe and denser than before the control proses started. It is essential to sustain the follow-up phase because it will prevent alien seedlings from suppressing planted grasses.

After initial control operations, dense regrowth may arise, because of re-sprouting in the form of stump coppice, seedlings and root suckers. Follow up treatment control must use the following methods (Campbell, 2000), **for dense regrowth:**

- **Chemical control / foliar application:**
  - Plants that are less than 1m in height must be controlled by foliar application;
  - Dense seedling growth must be controlled with knapsack sprayers with a flat fan nozzle;
  - If grass is present, the use of a registered selective herbicides must be used as to not harm the grass, and if grass is not present a registered non-selective or selective herbicide can be used; and
  - Suitable dye must be used at all times as to limit over- or under spray of areas.

- **Mechanical control:**
  - Areas with dense stands of seedlings should not be uprooted or hoed out unless active revegetation with correct species will be done, as these areas will result in soil disturbance and will in return promote flushes and germination of AIP seedling growth; and
  - When stump density is high, plants should be cut with brush cutters and the top growth must be removed. Stumps will start to coppice, and foliar spray must be used to control the coppice regrowth.

- **Biological control:**
  - As a rule, biological agents are only released within dense infestations of AIPs, as this will ensure that the biological agent will have enough food and will also increase the chances of establishment;
  - Unfavourable climatic factors (too wet or drought) can play a major role in biological agents not establishing in the area;
  - Dispersal of agents between infested areas can also be problematic and the need of separate introduction might be required for each separate site;
  - It is of utmost importance that any biological agent that is released on dense infestation must be noted during the AIP survey, as this will affect the AIP control program; and
  - Areas where a biological agent is established, and nursery areas may not be sprayed with herbicide. Areas where biological agents are released must be mapped and record must be kept of these sites.

For low-medium density regrowth:

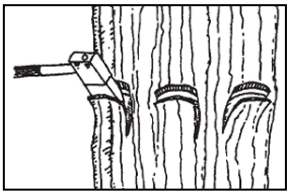
Neglecting to control low-medium density regrowth will result in densification and spreading and will result in a more costly to control situation. Low- medium density areas must be controlled, and these methods are considered:

- **Chemical control:**
  - Cut stump method must be used, and stumps must be cut up to a height of 15cm and must be sprayed within an hour of cutting the plant with a registered herbicide. Herbicide must be applied with knapsack sprayers set to a low pressure, using cone nozzles e.g., TG1 or CE1. Hand sprayers can also be used to apply herbicide. A suitable dye must be used to prevent any stumps from not being treated. Only the cut surface must be treated with herbicide and the side of the stumps must not be treated; and
  - Foliar spray can be applied to regrowth that is up to the height of 1m. Herbicide must be applied using knapsacks with solid cone nozzle and must be mixed with a suitable dye as to prevent over- or under spraying of treated areas.
- **Mechanical control:**
  - Seedlings can be removed from wet soil by hand pulling. Gloves can be used to protect hands during the operation.

In order to control AIP successfully, one must use a number of control methods as listed in this report. When using herbicides, one must adhere to the recommendations that are stated on the label of the specific product (Campbell, 2000), which must be applied by a suitably trained person or organisation. Furthermore, with herbicides/chemicals use, it must be applied by a suitably trained person or organisation. Control measures that disturb the soil or result in the clearance of AIP vegetation (e.g., hand pulling or cutting and removing) should be used with caution, especially in areas of high AIP infestation. Areas subjected to these control measures will require rehabilitation of the soil and rigorous follow-up and repeat control to ensure that reestablishment of the cleared species or establishment of other AIP species is prevented.

Table F1: Manual and Mechanised Methods of Clearing.

Risk to Ecosystem	Infestation density & plant size targeted	Required Tools	Reference Photograph
HAND-PULLING All seedlings Must be pulled out by hand. All root material should be removed to avoid re-sprouting of the plant.			
Safe to use throughout the subject property including watercourses as no chemicals are used. Hand pulling does create soil disturbance, but if the area is sparsely invaded such disturbances are unlikely to be ecologically damaging.	Low or sparse infestation. Aimed at seedlings and saplings: Plants that are small enough to be pulled out with roots intact.	No special tools required Gloves and spade optional.	
WRENCH PULLING A weed wrench is a manually operated, all-steel tool designed to remove woody plants by uprooting it.			
Safe to use throughout the subject property including watercourses as no chemicals are used. Wrench pulling does create soil disturbance, but if the area is sparsely invaded such disturbances are unlikely to be ecologically damaging.	Low or sparse infestation. Aimed at saplings: Plants that are small enough to be pulled out with roots intact.	A weed wrench	
RING-BARKING Removal of a ring of bark at least 25 cm wide and pull down to just below ground level. Ring barking interferes with the circulation of the tree and results in tree mortality.			

Risk to Ecosystem	Infestation density & plant size targeted	Required Tools	Reference Photograph
Low No contamination of watercourses with herbicides as these are applied directly to the tree.	Low or sparse infestation. Aimed at killing large / mature trees.	A cane knife or axe is used to remove the bark of the tree and cambium, in a horizontal band about 30 cm wide (about 50 cm from the ground).	
STRIP-BARKING			
Low No contamination of watercourses with herbicides as these are applied directly to the tree	Low or sparse infestation. Most effective for large / mature trees: The bark of large trees can be stripped completely, from waist height down to the base of the trunk.	Cane knife or axe. ***Herbicide, if used, should be applied to the stripped surface immediately after strip-barking. This is an effective but time-consuming method.*	
FRILLING *more cost-effective than ringbarking or strip-barking. The technique where an axe or cane knife is used to chip/cut around the base of a tree (±2 mm deep) in order to place herbicide into the cuts (cutting not to be as deep as to ringbark). Herbicide to be applied within 30 minutes from frilling.			
Low No contamination of watercourses with herbicides as these are applied directly to the tree	Low or sparse infestation. Most effective for mature trees: Small trees can be frilled by cutting an angled groove into the bark and cambium, right the way around the tree trunk.	Cane knife or axe, depending on how hard the bark and cambium layers of the tree are. Herbicide is then applied into the groove, which kills the tree as it seeps into the cambium tissue.	
CUT-STUMPING			
Low No contamination of watercourses with herbicides as these are applied directly to the tree. **Stumping can also imply the treatment of the remaining stump after felling with an appropriate herbicide.	Low or sparse infestation. Most effective for large / mature trees, but works on saplings too: Plants with a stem/ trunk diameter larger than 10 mm can be cut as low to the ground as possible with a saw or cane knife.	Saw or cane knife	
SLASHING			
Low No contamination of watercourses with herbicides as these are applied directly to the tree. ***Care should be taken to prevent plant material and propagules from ending up in surrounding natural areas.*	Low or sparse infestation. The seed stalks/branches of annuals (plants that die each year after they set seed) can be slashed before the seeds have matured.	Slashed with a cane knife, mattock, bill hook or slasher before the seeds have matured. ***CoSAS are generally low for controlling annuals in this way, as no herbicide is required.*	
BRUSH-CUTTER			

Risk to Ecosystem	Infestation density & plant size targeted	Required Tools	Reference Photograph
Possible pollution caused by bar oil[19]., spills from refuelling or mixing of oil and fuel.	Dense stands can be cleared. Popular for controlling low-growing thickets of AIPs.	Heavy duty motorised brush-cutters that are usually powered by a small two-stroke engine.	
CHAINSAW			
Possible pollution caused by bar oil, spills from refuelling or mixing of oil and fuel.	Dense stands can be cleared. For felling large trees and can be used to cut logs and branches into shorter lengths.	A chainsaw	

Table F2: Manual and Mechanised Methods of clearing, with the application of herbicide (taken from Safe and Effective Herbicide Use: A handbook for near-water applications. Online available at: http://www.epa.sa.gov.au/files/477387_pesticide_water.pdf

Picture reference	Method	Type of Weed	Equipment Required	Notes
	Foliar Spray	Herbs, Bulbs, Woody weeds	Knapsack, Vehicle mounted tank, Herbicide mix	Ensure herbicide is being applied at the right concentration and rate to cover the foliage of the pest plant with fine droplets and avoid run-off. A flat-fan nozzle and low pump pressure will assist in reducing spray drift.
	Cut and Swab	Woody weeds, Shrubs and Trees	Saw, chainsaw, Loppers, Herbicide mix, Bush for herbicide application	Ensure herbicide is applied quickly to cut stump (usually within 30 seconds). Apply during active growing period of plant for best results. Do not apply herbicide to the point of run-off.
	Frill and Paint	Shrubs and Trees	Axe, hatchet, Herbicide mix, Brush for herbicide mix application	Frill trunk thoroughly and treat major surface roots where visible. Expose sapwood and apply herbicide immediately. For deciduous species, apply herbicide during active growth period.
	Drill and Fill	Shrubs and Trees	Drill, Application bottle, injection gun, Herbicide mix.	Drill to sapwood only and apply herbicide to drill hole immediately. Drill and fill major surface roots where appropriate. For deciduous species, apply herbicide during active growth period.

[19] Bar oil is designed to stick to the chain and bar of a chainsaw

Picture reference	Method	Type of Weed	Equipment Required	Notes
	Scrape and Paint	Woody weeds	Knife or sharp blade, Paintbrush, applicator bottle, Herbicide mix.	Scrape main or major stems of the plant. Apply herbicide immediately after scraping.

Implement Annual Alien and Invasive Control Plan (Campbell, 2000):

- An Annual Operation Plan (AOP) Must be implemented for areas that are of high priority. The following Must be included into the budget for the specific resources e.g., equipment, herbicide and labour. Care Must be taken not to control too large of an area at a time. The following is an approximate indication of how much of the budget Must be dedicated to each aspect:
  - 75% Must be used to follow-up control and also rehabilitation of the previous year's work;
  - 20% Must be used to control new areas; and
  - 5% will be for an emergency e.g., loss of planted grass, mass seed regeneration or coppice.
- Timetables Must be created for the control operations. Care Must also be taken to include the time when operations fall behind due to unfavourable weather or labour strikes; and
- The plan Must be set out in such a way that it should be flexible enough as to adjust it, so progress is made.

STEP 4: Monitor performance and change actions as necessary

It is important that monitoring of the AIPCP be carried out to determine the efficiency of the plan and to determine the costs and the allocation of time and manpower for such an exercise. Methods to obtain this data could include fixed-point photography as a further means of documenting change. Annual monitoring of AIPs must be performed to determine the extent of an infestation and to monitor if the AIP control program is efficient or not.

Gathering of information (Campbell, 2000):

- The subject property/ AIP Priority area Must be divided into specific control areas. Use man-made or natural boundaries to specify specific areas e.g., roads, fences. Each area Must be numbered to simplify record keeping;
- A detailed AIP survey Must be performed in each numbered area, and the following information Must be recorded:
  - AIP species that are present during the survey and their specific growth form e.g., herb, shrub and trees, including any coppice present;
  - Density of infestation Must be recorded in an estimation of percentage (%) cover:
    - 0-5% Scattered infestation;
    - 5-25% Sparse;
    - 25-50% Medium;
    - 50-75% Dense;
    - 75-100% Very dense;
  - These areas Must be ranked Low, Medium or High priority for control of AIP and rehabilitation. The following criteria Must be used to rank the area according to importance: Threat to biodiversity, carrying capacity and water yield; and
  - Suitable grass species for the specific land use Must be determined and grass naturally occurring in the area Must be used to rehabilitate the area.

Prudent AIP fixed monitoring points of the subject property is of utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage biodiversity-related progress and issues. To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- Fixed point monitoring (radius transect method) should be applied as the preferred method of monitoring (while the line transect method is an alternative method which can be considered from a site dependant respective);
- All data gathered should be measurable (qualitative and quantitative);
- Monitoring reports should be repeatable and temporally and spatially comparable;
- Data should be auditable; and
- Data, when compared to previous sets, should show spatial and temporal trends.

Fixed monitoring points should form the key aspect of the AIP monitoring plan with each priority area represented by several monitoring points. The information presented in Section 10.4.2 of the main report can be used a guideline to assess priority area and fixed monitoring points in relation to the study area and priority management areas identified in this appendix (Table F1).

General Health and Safety Requirements for AIP clearing

All personnel to be provided with the appropriate Personal Protective Equipment (PPE) for clearing of AIPs and/or encroaching indigenous vegetation. The use of PPE by staff controlling AIPs in the field is required by law. The PPE specifications differ for the different types of control. Mechanised control includes the use of a chainsaws and brush-cutters and will therefore require slightly different PPE from someone using manual control (cane knife, slasher, knapsack sprayer, etc.). Tables F3 – F5 below specify the minimum required PPE for AIP clearing.

Table F3: PPE for manual control.

Item	Specification
Overall	100% cotton, two-piece overalls are the best for absorbing perspiration; they last longer and are cooler. However, various cotton/polyester blends are available and suitable.
Rubber gloves	Standard rubber gloves for fieldwork are sufficient. Wrist length gloves are preferable over elbow length gloves for a warm climate.
Leather gloves	Standard wrist length leather gloves are appropriate.
Safety boots	Gumboots or standard safety boots, which support the ankles, are acceptable. Steel toecaps are recommended for workers working with hand tools or with large trees.
Hat – (hardhat/ wide brim hat)	If working with large trees, on steep gradients or if any other safety risks may be present, then wearing a hardhat is advisable. Alternatively, a wide brim hat can be used to protect the worker from the sun.
Safety glasses	Large, clear safety glasses, which allow air to pass through, are acceptable. Glasses with elastics, (e.g., welding glasses) are not acceptable as they tend to fog when a person perspires.
Face mask	A face mask which covers the nose and mouth is essential when mixing herbicides and for foliar application.
Raincoat	A raincoat is necessary in case workers are caught in the rain or can be worn early morning to avoid getting wet from dew.

Table F4: PPE for mechanised control.

Item	Specification
Chainsaw safety pants	Standard long safety chainsaw pants that provide protection against the chainsaw.
Leather gloves	Standard wrist length, leather gloves.
Safety boots with steel cap	Steel toecaps are essential for safety of the workers. Safety boots, not gumboots, are to be worn as they provide support around the ankle.
Hardhat	A hardhat with a visor and earmuffs is necessary for all mechanised control.
Safety glasses	Chainsaw safety glasses provide total cover around the eyes, thus preventing wood chips, stones, etc. entering.
Raincoat	A standard two-piece raincoat. However, it is better not to use mechanised control when it is raining.

Table F5: PPE for chemical control.

Suitable protective clothing must be available and use thereof is compulsory.	- Goggles or face shield to protect the eyes; - Chemical-resistant gloves to protect hands; - Overalls to protect legs, arms, torso and groin; - Respirator with filter cartridges to prevent inhalation of herbicide vapour or mist. Rubber or PVC boots to protect feet. Washable or chemical-resistant hat to protect head and scalp; and - PVC apron for use during mixing.
	NB Adequate hygiene aids must be readily available e.g., plentiful water, soap, towels and eye wash. Dedicated mixing of herbicide must be established, this area must be able to control a possible spill as to not contaminate surrounding areas.

Table F6 provides an indication of the species-specific control methods for the AIP species recorded within the Offset Areas.

Table F6: Control options (as provided by Working for Water Alien Species and Herbicide List v2.10 (Sharp 2012)) for Alien and Invasive species. Hand pull only refers to seedlings. (Campbell, 2000). Care Must me given as to not use herbicides containing Glyphosate close to water bodies. NEMBA Category status information is given at the bottom of the table.

Species	Common Name	NEMBA category	Size Class	Treatment Method	Herbicide
Woody Species					
Acacia saligna	Port Jackson Willow	1b	Seedling	Hand pull	No herbicide needed
			Seedling	Foliar spray	Clopyralid + Triclopyr (as amine salt)
					Fluroxypyr
					Glyphosate (as ammonium salt)
					Glyphosate (as isopropylamine salt)
					Glyphosate (as potassium salt)
					Glyphosate (as isopropylamine salt)
					Glyphosate (as potassium salt)
					Glyphosate (as sodium salt)
					Triclopyr (as butoxy ethyl ester)
					Triclopyr (as butoxy ethyl ester) + Aminopyralid
					Triclopyr (as triethyl ammonium) + Aminopyralid
					Glyphosate (as isopropylamine salt)
			Young	Lopping / Pruning	Clopyralid + Triclopyr (as amine salt)
					Glyphosate (as ammonium salt)
					Picloram (as potassium salt)
					Triclopyr (as triethyl ammonium) + Aminopyralid
					Triclopyr (as amine salt)
			Adult	Cut stump / Frill	Clopyralid + Triclopyr (as amine salt)
					Glyphosate (as ammonium salt)
					Picloram (as potassium salt)
					Triclopyr (as triethyl ammonium) + Aminopyralid
					Triclopyr (as amine salt)
Acacia cyclops	Red eye	2	All	Aerial application	Clopyralid + Triclopyr (as amine salt)
			Seedling	Hand pull	No herbicide needed
			Seedling	Foliar spray	Clopyralid + Triclopyr (as amine salt)
					Fluroxypyr
					Triclopyr (as butoxy ethyl ester)
					Triclopyr (as butoxy ethyl ester)
					Triclopyr (as triethyl ammonium) + Aminopyralid
					Triclopyr (as butoxy ethyl ester) + Aminopyralid
			Young	Lopping / Pruning	Triclopyr (as amine salt)

Species	Common Name	NEMBA category	Size Class	Treatment Method	Herbicide
Woody Species					
			Adult	Cut stump / Frill	*Cylindrobasidium leave* (species of fungus)
					Triclopyr (as amine salt)
Eucalyptus conferruminata	Bald island Marlock	2	Adult	Cut stump / Frill	Triclopyr (as amine salt)
Leptospermum laevigatum	Australian Myrtle	1b	Seedling	Hand pull	No herbicide needed
			Young	Cut below ground	No herbicide needed
				Foliar spray	Clopyralid + Triclopyr (as amine salt)
Myoporum serratum	Manatoka	NL	Adult	Cut stump / Frill	Triclopyr (as amine salt)
Nerium oleander	Oleander	1b	Adult	Cut & Spray	Imazapyr
			Young	Foliar spray	Imazapyr
Herbaceous Speices					
Cirsium vulgare	Spear thistle, Scotch thistle	1b	Young	Foliar spray	Clopyralid + Triclopyr (as amine salt)
					Fluroxypyr + Picloram
					Picloram (as potassium salt)
Echium plantagineum	Patterson's curse	1b	Young	Foliar spray	Glyphosate (as phosponic acid)
					Picloram (as potassium salt)
Graminoid Species					
Bromus diantrus	Great brome	NL	All	Foliar spray or Soil application	Trifluralin and Isoxaban
					Gallant Super (Haloxyfop-R Methyl Ester)
Bromus pectinatus	Japanese Brome	NL	All	Foliar spray or Soil application	Trifluralin and Isoxaban
					Gallant Super (Haloxyfop-R Methyl Ester)
Lolium multiflorum	Ryegrass	NL	All	Foliar spray or Soil application	Trifluralin and Isoxaban
					Gallant Super (Haloxyfop-R Methyl Ester)
Pennisetum clandestinum	Kikuyu grass	NL	All	Foliar spray or Soil application	Trifluralin and Isoxaban
					Gallant Super (Haloxyfop-R Methyl Ester)

NL – Not listed**; 1a: Category 1a** – Invasive species that require compulsory control; **1b: Category 1b** – Invasive species that require control by means of an invasive species management programme; **2: Category 2** – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; **3: Category 3** – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, if all reasonable steps are taken to prevent their spread (Bromilow, 2001).

APPENDIX G: LETTER OF SUPPORT & OFFSET AGREEMENTS

CoCT BIODIVERSITY MANAGEMENT BRANCH – STSTUS OF ACQUISITION FOR OPTION 8:

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

SPATIAL PLANNING & ENVIRONMENT
ENVIRONMENTAL MANAGEMENT
BIODIVERSITY MANAGEMENT BRANCH

Clifford Dorse

T: 021 444 1768 M: 083 440 1751
E: clifford.dorse@capetown.gov.za

To whom it may concern

6 December 2024

STATUS OF THE ACQUISITION OF PORTIONS OF BURGHERSPOST AND CLOOF WINE FARMS

The City of Cape Town's Biodiversity Management Branch is in the advanced stages of acquiring the following portions of the farm Burgherspost Wine Estate,:

- Remainder Farm 707(133.5687 ha)
- Remainder Farm 754 (501.6057 ha)
- Remainder Farm 713 (22.3517 ha)
-

and the following portion of the Cloof Wine Estate:

- Portion of Farm 708 (168.4438 ha)

Together, these portions form a contiguous 820 ha area of extremely high quality Endangered Swartland Granite Renosterveld and Endangered Atlantis Sand Fynbos. The land abuts the City's Dassenberg Section of the Witzands Nature Reserve and a portion of Cape Natures Riverlands Nature Reserve and is part of the greater Dassenberg Coastal Catchment Partnership landscape initiative.

To date the parties have agreed on the selling price, the City has obtained MAYCO approval for the acquisition, the Deed of Sale documents have been signed and the funds have been paid to the relevant transferring attorney. The properties in question require subdivision before the land is registered with the City at the Deeds office. The public participation process concluded on 28 November and the land surveyors are currently plotting the subdivision lines.

The transfer of the property to the City's title is expected to occur before July 2025.

Please feel free to contact the City's Biodiversity Management Branch for additional information.

Kind regards,

Cliff

Cliff Dorse

Head: Conservation Services Biodiversity Management Branch City of Cape Town

Tel: 021 444 1768
Cell: 083 440 1751
Fax: 086 5503697

www.capetown.gov.za/environment

CoCT BIODIVERSITY MANAGEMENT BRANCH - LETTER OF SUPPORT:

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

SPATIAL PLANNING & ENVIRONMENT
ENVIRONMENTAL MANAGEMENT

Julia Wood
Manager: Biodiversity Management Branch

T: 021 444 1760 **F**: 021 444 3531 M: 0844649153
E: julia.wood@capetown.gov.za

Attention: Stephen van Staden and Samantha-Leigh Daniels

Scientific Terrestrial Services
29 Arterial Road West
Oriel, Johannesburg, Gauteng
2007

30 October 2024

Dear All

RE: BMB comment on proposed offset options for the expansion of the Macassar WWTWs

The Biodiversity Management Branch (BMB) of the City of Cape Town (the City) values the opportunity to engage on the proposed offset requirements for the Macassar Wastewater Treatment Works (WWTW) expansion project. The Macassar WWTW is located within the City's Macassar East Nature Reserve and the sound functioning of this plant is critical to the ecological integrity of the Eerste River estuary and the neighbouring Helderberg Marine Protected Area.

The BMB hereby confirm that the three preferred offset areas proposed in the Technical Memorandum dated 25 October 2024 are within our Protected Area Expansion vision and are identified as priority areas on the fine scale conservation plan for the Cape Town area, the BioNet. Below are comments with regards to each of the proposed offset areas:

- **Option 1** – onsite mitigation:
  The proposed onsite offset option of approximately 25 ha of extremely high quality Cape Flats Dune Strandveld on Ptn 0 of Erf 1205 to be conserved is fully supported. This area will be consolidated into the Macassar East Nature Reserve and will be managed and proclaimed as Nature Reserve in terms of section 23 of the National Environmental Management: Protected Areas Act (the NEM: PAA). The BMB can confirm that we have sufficient operational resources in place to manage this area to the standards required of a Nature Reserve.

- **Option 7** - The Paardevlei wetland ecological link to the coast:
  With recent changes in the overarching Paardevlei development precinct, a Paardevlei Nature Reserve will be established and proclaimed in terms of the NEM: PAA. Critical to the viability of this new reserve is a meaningful ecological link to the coast and to the Helderberg Marine Protected Area. The land is owned by the City and a potential corridor could encompass a portion of ST794-0 RE, ST791-5 and ST791-4 RE. The BMB is in full support of any land made available for this ecological corridor and extension to the Paardevlei Nature Reserve to contribute to the required offset. The CCT: Human Settlements Department is the project management team responsible for the Paardevlei project and they need to be engaged to confirm what land could be made available for this purpose. Operational budget will need to be sourced in order to manage any offset area. A Strategic Management Framework (SMF) budget request will need to be submitted by the applicant supported by the BMB.

BIODIVERSITY MANAGEMENT BRANCH: 1ST FLOOR, OLD ABATTIOR BUILDING, 53 BERKLEY ROAD, MAITLAND 7505
P O BOX 11, MAITLAND 7404
www.capetown.gov.za

Making progress possible. Together.

- **Option 8** - A portion of the CCT's Burgherspost offset land bank
  The City is in the process of purchasing over 800 ha of Endangered Swartland Granite Fynbos and Atlantis Sand Fynbos in the landscape conservation initiative known as the Dassenberg Coastal Catchment Partnership. The deeds of sale have been signed and the payment has been made. The subdivision and transfer process is underway. The City is busy purchasing this Critical Biodiversity Area as a development facilitation land bank for City projects. The BMB would be in full support for it being used to mitigate for any residual offset requirements for the Macassar WWTW, however some operational budget would need to be secured. A Strategic Management Framework (SMF) budget request will need to be submitted by the applicant supported by the BMB.

Please continue to liaise with us with regards to the outcome of the offset considerations and do not hesitate should there be a need for any additional information.

Yours faithfully,

Julia Wood
Digitally signed by Julia Wood
Date: 2024.10.31 08:42:30 +02'00'

Julia Wood

Manager: Biodiversity Management Branch

Letter: offset Macassar WWTWs

CAPENATURE LETTER OF SUPPORT:

CONSERVATION OPERATIONS: LANDSCAPE WEST

Postal	PO Box 26, Porterville, 6810
Physical	72 Voortrekker Street, Porterville, 6810
Website	www.capenature.co.za
Enquiries	Ismat Adams
Telephone	0870873188
Email	iadams@capenature.co.za
Reference	SSD14/2/6/1/4/S_Erf 1205_Macassar
Date	29 November 2024

Zutari (Pty) Ltd

Via email: Corlie.Steyn@Zutari.com

Attention: Corlie Steyn

Dear Corlie

RE: Macassar Wastewater Treatment Works, Capacity Extension and Associated Infrastructure Refurbishment – Comments Response

DEA&DP Ref: 16/3/3/1/A3/39/2054/24

Your letter dated 29 November 2024 refers, herewith further comments considering your responses.

1. The biodiversity offset proposal is supported as per previous comments, considering that site alternatives are not practicable or feasible, and that the upgrade requirements should mitigate longer term environmental degradation.

CapeNature reserves the right to revise initial comments and request further information based on any additional information that may be received.

Kind regards,

Ismat Adams Digitally signed by Ismat Adams Date: 2024.11.29 10:13:26 +02'00'

Land-Use Scientist: Landscape West
Conservation Operations

OFFSET AGREEMENT:

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

T: 086 010 3089
E: contact.us@capetown.gov.za

DEA&DP REF NO: 16/3/3/1/A3/39/2054/24

DATE 29 November 2024

TO Western Cape Department of Environmental Affairs and Development Planning (DEA&DP)
Private Bag X9086
Cape Town
7800

ATT Ms Taryn Dreyer

SUBJECT **BIODIVERSITY OFFSET AGREEMENT FOR THE PROPOSED MACASSAR WASTEWATER TREATMENT WORKS (WWTW) EXPANSION PROJECT ON A PORTION OF ERF 1205, MACASSAR, WESTERN CAPE PROVINCE**

Dear Ms Taryn Dreyer

1. The Offset Technical Memorandum dated 25 October 2024[1], refers.
2. In accordance with the recommendations included in the Offset Technical Memorandum, the City of Cape Town Directorate: Water and Sanitation Department ("WSD") herein represented by the Department: Wastewater Treatment Branch ("WWTB") together with the City of Cape Town's Environmental Management Department ("EMD") [represented by the Biodiversity Management Branch ("BMB")] commits to:

   2.1 Secure, and through the provision of the necessary resources, ensure the formal protection and effective ecological management of identified 'Offset Sites' to offset the required 176.25 hectares (ha) of endangered (EN) Cape Flats Dune Strandveld. The identified Offset Sites include 25.0 ha within the remaining portion (Ptn) of Erven 1205 (in which the existing WWTW is situated), as well as potentially about 25 ha of designated land

[1] Scientific Terrestrial Services (STS) Project no. 24-2052 (2024). Technical Memorandum: High-Level Alternatives Analysis for the Proposed Biodiversity Offset Initiative for the Macassar Wastewater Treatment Works (WWTW) Expansion Project, Macassar, Western Cape. Prepared for Zutari (Pty) Ltd.

near the Paardevlei Wetland (encompassing Ptn 0 of Erven 702 and Ptn 0 of Erven 703) and a portion (126.25 ha) of the City of Cape Town's Burgherspost Offset Landbank (including Ptn 0 of Farm 713, Ptn 0 of Farm 707, Ptn 0 of Farm 708, Ptn 0 of Farm 754, and/or Ptn 2 of Farm 754). The exact area at Paardevlei needs to be confirmed and it is currently unclear what may be available to contribute to the offset. What is unavailable at Paardevlei will need to be added to the area allocated from the Burgherspost Offset Landbank.

2.2 The WWTB and the BMB hereby agree to the following:

2.2.1 The City of Cape Town will submit an application to declare all selected Offset Areas as a Nature Reserve in terms of Section 23 of the National Environmental Management Protected Areas Act (Act No. 57 of 2003) (including title deed restrictions and rezoning).

2.2.2 The City of Cape Town will take full operational responsibility of the area for the initial establishment and ongoing ecological management of 176.25 ha of terrestrial habitat (i.e., the offset sites) in perpetuity.

2.2.3 Subject to the required operation resources being made available, the BMB will ensure that the Offset Sites are managed to the required ecological standard of a Nature Reserve under the National Environmental Management: Protected Areas (Act No. 57 of 2003) (NEMPAA).

2.2.4 The BMB, and the WWTB, will pursue the standard municipal budget request processes in an endeavour to obtain the required operational and capital budgets. A Strategic Management Framework (SMF) budget must be submitted. The SMF budget request must be from both Departments and linked to the DEA&DP approval conditions of the Offset.

2.2.5 Subject to the required operation resources being made available, the BMB will provide the Management Effectiveness Tracking Tool (METT) scores detailing the performance of the Offset Sites and their compliance with requirements of a Nature Reserve (where applicable) in terms of meeting management effectiveness thresholds.

2.2.6 Should any dispute arise between the Parties in relation to this Agreement or any matter arising out of this Agreement, then the

WWTB and the BMB shall endeavour to resolve such dispute by negotiation.

2.2.7 Either party shall invite the other, in writing, to attend a meeting to attempt to resolve the dispute within 7 (seven) days from the date of the written invitation. This meeting shall be held between the representatives of the Parties.

2.2.8 Should the Parties be unable to resolve the dispute or should the dispute remain unresolved within 7 (seven) days of the date of the meeting referred to in clause above, the DEA&DP will be notified of the dispute.

3. The BMB in correspondence dated 31 October 2024 (attached as Addendum 1), indicated their support for the proposed offset project. This correspondence confirms that the three preferred offset areas proposed in the Technical Memorandum dated 25 October 2024 align with the City's Protected Area Expansion vision and are identified as priority areas on the BioNet conservation plan. The details for each proposed offset area are as follows:

a) Option 1 - Onsite Mitigation: the onsite offset option of approximately 25 ha of high-quality Cape Flats Dune Strandveld on Portion 0 of Erf 1205 is fully supported. This area will be consolidated into the Macassar East Nature Reserve and managed as a Nature Reserve under section 23 of the NEMPAA. The BMB confirms that sufficient operational resources are available to manage this area to Nature Reserve standards.

b) Option 7 - Paardevlei Wetland Ecological Link to the Coast: the BMB supports the establishment of a meaningful ecological corridor linking the Paardevlei Nature Reserve to the coast and Helderberg Marine Protected Area. This corridor would encompass portions of City-owned land (ST794-0 RE, ST791-5, and ST791-4 RE), subject to confirmation and negotiation from the City's Human Settlements Department. An operational budget will need to be sourced, with a Strategic Management Framework (SMF) budget request submitted by the applicant, supported by the BMB.

c) Option 8 - Burgherspost Offset Land Bank: the City is in the process of securing over 800 ha of endangered Swartland Granite Fynbos and Atlantis Sand Fynbos within the Dassenberg Coastal Catchment Partnership. The BMB supports its use to mitigate any residual offset

requirements for the Macassar WWTW expansion, provided an SMF budget request is submitted and approved.

4. The WWTB, therefore, commits to support in full all the budget requests submitted by the EMD to ensure that the 176.25 ha offset sites are managed to the required ecological state.

Lorraine Gerrans Digitally signed by Lorraine Gerrans Date: 2024.11.29 11:49:10 +02'00'

Director: Environmental Management Department
Spatial Planning and Environment Directorate
Lorraine Gerrans

M.A. KILLICK Digitally signed by M.A. KILLICK Date: 2024.11.29 14:19:46 +02'00'

Director: Bulk Services Department
Water & Sanitation Directorate
Michael Killick

APPENDIX H: DETAILS OF SPECIALISTS

Bianca Bleuler	MPhil Environmnetal Management (Stellenbosch University)
Candice Lamb	MSc Zoology (University of Pretoria)
Samantha-Leigh Daniels	PhD Plant Science (University of Pretoria)
Stephen van Staden	MSc (Environmental Management) (University of Johannesburg)

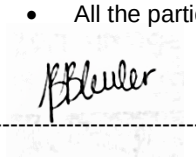
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	**Scientific Terrestrial Services**		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Fax:	086 724 3132
Telephone:	011 616 7893		
Name	**Bianca Bleuler**		
E-mail:	bianca@sasenvgroup.co.za		
Qualifications	MPhil Environmental Management (Stellenbosch University) PGD Environmental Management (Stellenbosch University) BSc Hons Biodiversity and Ecology (Stellenbosch University) BSc Biodiversity and Ecology (Stellenbosch University)		
Name	**Candice Lamb**		
E-mail:	candice@sasenvgroup.co.za		
Qualifications	MSc (Zoology) (University of Pretoria) BSc (Hons) Zoology (University of Pretoria) BSc (Environmental Sciences) (University of Pretoria)		
Registration / Associations	Awaiting registration finalisation as a candidate member of the South African Council for Natural Scientific Professions (SACNASP)		
Name / Contact person:	**Samnatha-Leigh Daniels**		
E-mail:	samantha@sasenvgroup.co.za		
Qualifications	PhD (Plant Science) (University of Pretoria) MSc (Plant Science) (University of Pretoria) BScHons (Zoology & Entomology) (University of Pretoria) BSc (Zoology & Entomology) (University of Pretoria)		
Registration / Associations	Member of the South African Association of Botanists (SAAB) Member of the Botanical Society of South Africa (BotSoc) Member of the Association for Tropical Biology and Conservation (ATBC)		
Name / Contact person:	**Stephen van Staden**		
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BScHons (Zoology: Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Bianca Bleuler, declare that -

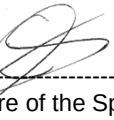
- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Candice Lamb, declare that -

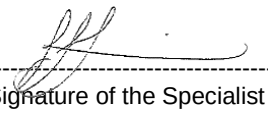
- I act as the **independent specialist (GIS and Mapping)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Samantha-Leigh Daniels, declare that -

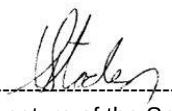
- I act as the **independent Offset and botanical specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Stephen van Staden, declare that -

- I act as the **independent Offset and Freshwater specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF BIANCA BLEULER

PERSONAL DETAILS

Position in Company	Field Specialist
Joined SAS Environmental Group of Companies	2023

MEMBERSHIP IN PROFESSIONAL SOCIETIES

None

EDUCATION

Qualifications

MPhil Environmental Management (Stellenbosch University)	2022
PGD Environmental Management (Stellenbosch University)	2018
BSc Hons Biodiversity and Ecology (Stellenbosch University)	2017
BSc Biodiversity and Ecology (Stellenbosch University)	2016

Short Courses

Tools for Wetland Assessment presented by Prof. F. Ellery and Rhodes University	2020

AREAS OF WORK EXPERIENCE

South Africa – Western Cape

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Environmental Control Officer (ECO) work
- Environmental Management Programme (EMPr) compilation

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Wetland Offset Reporting

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CANDICE LAMB

PERSONAL DETAILS

Position in Company	Junior Faunal Specialist
Joined SAS Environmental Group of Companies	January 2024

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Awaiting registration finalisation as a candidate member of the South African Council for Natural Scientific Professions (SACNASP)

EDUCATION

Qualifications

MSc Zoology (University of Pretoria)	2022
BSc (Hons) Zoology (University of Pretoria)	2018

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Limpopo, Northern Cape, KwaZulu-Natal
Africa - Lesotho

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Faunal Assessments
- Avifaunal Assessments
- Desktop Studies, Mapping and Background Information Research

Freshwater Assessments

- Desktop Studies, Mapping and Background Information Research
- Desktop Freshwater Delineation
- Freshwater (wetland / riparian) Delineation and Assessment

GIS

- Mapping and GIS for various sectors and various disciplines (biodiversity, freshwater, aquatic, soil, and land capability).

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF SAMANTHA-LEIGH DANIELS

PERSONAL DETAILS

Position in Company	Senior Floral Ecologist
Joined SAS Environmental Group of Companies	2020

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Association of Botanists (SAAB)
Member of the Botanical Society of South Africa (BotSoc)
Member of the Association for Tropical Biology and Conservation (ATBC)

EDUCATION

Qualifications

PhD (Plant Science) (University of Pretoria)	2023
MSc (Plant Science) (University of Pretoria)	2017
BSc (Hons) Zoology & Entomology (University of Pretoria)	2014
BSc Zoology & Entomology (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Free State, Western Cape, Northern Cape
Africa – Lesotho.

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Terrestrial Ecological and Biodiversity Scoping Assessments
- Terrestrial Ecological and Biodiversity Screening Assessments
- Floral Assessments
- Alien and Invasive Control Plan (AICP)
- Terrestrial Monitoring
- Protected Species Marking and Reporting
- Species Rescue and Relocation
- Terrestrial Rehabilitation and Management Plants
- Desktop Studies, Mapping and Background Information Research

Offsets

- Biodiversity Offsets
- Wetland Offsets

Training

- Plant species identification
- Herbarium usage and protocols

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination

- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments