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WETLAND REHABILITATION AND MANAGEMENT PLAN (WRMP), INCLUDING AN ALIEN INVASIVE CONTROL AND MANAGEMENT PLAN (AIPCP) FOR THE PROPOSED HLOMENDLINI SPORTS FIELD IN MANDENI, KWAZULU-NATAL PROVINCE.

Prepared for

SRK Consulting (Pty) Ltd

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GLOSSARY OF TERMS[1]

Alien invasive plants:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome - usually international in origin.
Alien species (syn. exotic species; non-native)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Biome - as per Mucina and Rutherford (2006); after Low and Rebelo (1998).	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate and major large-scale disturbance factors (such as fires).
Biota:	Living organisms, plants, animals, bacteria
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flow into a river, wetland, lake, and ocean or contributes to the groundwater system.
Category 1a Listed Invasive Species	Invasive species contemplated in Regulation 2 [Government Notice (GN) number R.1020: Alien and Invasive Species Regulations (2020)]. "(1) Category 1a Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be combatted or eradicated."
Category 1b Listed Invasive Species	Invasive species contemplated in Regulation 3 [GN number R.1020: Alien and Invasive Species Regulations (2020)]. "(1) Category 1b Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be controlled."
Category 2 Listed Invasive Species	Invasive species contemplated in Regulation 4 [GN number R.1020: Alien and Invasive Species Regulations (2020)]. "(1) Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be."
Category 3 Listed Invasive Species	Invasive species contemplated in Regulation 5 [GN number R.1020: Alien and Invasive Species Regulations (2020)]. "(1) Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of the Act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of Act, as specified in the Notice."
Degradation	The many human-caused processes that drive the decline or loss in biodiversity, ecosystem functions or ecosystem services in any terrestrial and associated aquatic ecosystems.
Delineation:	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Disturbance	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
Driver (ecological)	A driver is any natural or human-induced factor that directly or indirectly causes a change in ecosystem. A direct driver clearly influences ecosystem processes, where indirect driver influences ecosystem processes through altering one or more direct drivers.
Ecological Importance and Sensitivity	Ecological importance refers to the diversity, rarity or uniqueness of the habitats and biota. Ecological sensitivity refers to the ability of the ecosystem to tolerate disturbances and to recover from certain impacts.

[1] Most definitions on the Alien Invasive Plants are based on terms and concepts elaborated by Richardson et al. (2011), Hui and Richardson (2017), Wilson et al. (2017) and Skowno et al. (2019), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), and the associated Alien and Invasive Species Regulations, 2020).

Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Eradicate	The complete removal of invasive species from within the Republic, including all living parts of that species.
Habitat (as per the definition in NEMBA)	A place where a species or ecological community naturally occurs.
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Indigenous vegetation (as per the definition in NEMA listings)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Invasive species	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.
Listed alien species	All alien species that are regulated in South Africa under the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), Alien and Invasive Species Regulations, 2020.
Monitoring	The repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time to assess the efficiency of control measures
Native species (syn. indigenous species)	Species that are found within their natural range where they have evolved without human intervention (intentional or accidental). Also includes species that have expanded their range as a result of human modification of the environment that does not directly impact dispersal (e.g., species are still native if they increase their range as a result of watered gardens but are alien if they increase their range as a result of spread along human-created corridors linking previously separate biogeographic regions).
Present Ecological State	The current state or condition of a water resource in terms of its biophysical components (drivers) such as hydrology, geomorphology and water quality and biological responses viz. fish, invertebrates, riparian vegetation). The degree to which ecological conditions of an area have been modified from natural (reference) conditions.
Problem plants	A problem plant is any plant, shrub or tree which has a negative environmental impact in a particular locality and result in the subsequent loss of biodiversity, and (potential) excessive water consumption. These species have not been listed or classified as alien (thus can include native species) or invasive plants by the current South African *National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA).*
Riparian Areas (as per the NEMBA: Alien and Invasive Species Regulations, 2020)	"riparian area" means within 32 metres of the edge of a river, lake, dam, wetland or estuary, or within the 1:100 year floodline, whichever is the greater
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50 cm of the surface
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50 cm of the surface for less than three months of the year
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; and a reference to a watercourse includes, where relevant, its bed and banks
Weeds	A plant is a weed '*if, in any specified geographical area, its populations grow entirely or predominantly in situations markedly disturbed by man (without, of course, being deliberately cultivated plants*)' (Baker 1965); in cultural terms, weeds are plants (**not necessarily alien**) that grow in sites where they are not wanted and that have detectable economic or environmental impacts (Pyšek et al. 2004).
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

LIST OF ACRONYMS

AIP	Alien invasive plant
AIPCP	Alien Invasive Plant Control and Management Plan
CBA	Critical Biodiversity Areas
CMA	Catchment Management Agency
CVB	Channelled Valley Bottom Wetland
DFFE	Department of Environment, Forestry and Fisheries
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
ESA	Ecological Support Areas
FEPA	Freshwater Ecosystem Priority Areas
GN	Government Notice
HGM	Hydrogeomorphic
Km	Kilometer
KZN	KwaZulu-Natal
M	Meter
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NWA	National Water Act, 1998 (Act No 35 of 1998)
PAs	Priority Areas
PES	Present Ecological State
PPE	Personal Protective Equipment
REC	Recommended Ecological Category
RoD	Record of Decision
SAS	Scientific Aquatic Services
STS	Scientific Terrestrial Services
WRMP	Watercourse Rehabilitation Management Plan
WUA	Water Use Authorisation

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed by SRK Consulting (Pty) Ltd to develop a Wetland Rehabilitation and Management Plan (WRMP) including an Alien and Invasive Plant Control and Management Plan (AIPCP) as part of the Environmental Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed Hlomendlini sports field and associated infrastructure (hereafter referred to as "the proposed sports field development") in Mandeni, Kwazulu-Natal Province. The proposed site to be developed will hereafter be referred to as "the study area" (Figures 1 and 2). The design drawing of the sports field layout is provided in Figure 3.

As part of the freshwater ecological assessment conducted by Scientific Aquatic Services (SAS 2021a)[2], the following freshwater ecosystems were identified within the study area:

- A modified channelled valley bottom (CVB) wetland was identified within the western portion of the study area, occurring < 10 m from proposed sports field development;
- A valley head seep wetland was identified within the eastern portion of the study area of which the western portion of this wetland will be traversed by the proposed sports field development; and
- Both systems are connected to drainage features which were identified in the larger investigation area but not further assessed in the SAS 2021a assessment.

This WRMP serves as a management tool to ensure the negative impacts on the identified wetlands associated with the proposed sports field development are rehabilitated, managed and monitored. The key objectives of this WRMP include:

- Maintenance of the Present Ecological State (PES) of the identified modified CVB and the valley head seep wetlands identified to be potentially impacted by the proposed sports field development;
- Erosion control and siltation management;
- Reinstatement of ecological services and topographical sequences;
- Revegetation with indigenous plant species; and
- Monitoring to ensure timeous detection of, and response to, damage caused by the historic as well as proposed activities associated with the proposed sports field development.

[2] SAS. 2021a. Freshwater Ecosystem Assessment as Part of the Environmental Assessment and Water Use License Authorisation Process for the Proposed Hlomendlini Sports Field in Mandeni, KwaZulu-Natal Province.

Rehabilitation and AIP eradication and control activities (encircled in red in Figure 3) will only take place within the areas that have been affected by historic activities (rubble), the proliferation of Alien Invasive Plants (AIP) along wetlands as well as the areas with existing culverts along the modified CVB wetland. Two main priority areas, with specific rehabilitation focus areas have been identified and these are discussed further in Section 4. The intention is to ensure that rehabilitation of these areas improves the ecological condition of the wetland, and as such leaving this area as an open space. In addition, the rehabilitation of wetlands within the study area will also contribute to the offset of functional hectare equivalents given the residual loss of wetland habitat as a result of the proposed sports field development.

As part of the WRMP, the AIPCP was developed to ensure that the AIPs are adequately managed within the study area at both the species level and the habitat level. The aim of the AIPCP is to aid the development to comply with Section 73(2) and 75 of the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) and to reduce and/or control the subsequent spread of AIP species into the surrounding natural habitat, thereby promoting and increasing the habitat integrity and biodiversity associated with the proposed sports field development.

This WRMP is seen as a critical component to provide guidance for the rehabilitation and management of the affected wetlands. This plan should be implemented by the proponent as soon as it has been approved by the relevant authorities and once the proposed sports field development has reached the phase during which rehabilitation activities become viable.

1.2 Structure of the plan

This WRMP outlined the rehabilitation and maintenance plan as well as AIPCP for activities associated with the proposed sports field development from a wetland management perspective. The report has been structured in the following way:

Section 1: Introduction

This section provides an introduction, background to the project, structure of this WRMP and the assumptions and limitations associated with this plan.

Section 2: Legal Framework for the Wetland Rehabilitation and Management Plan

A breakdown of the legal framework relevant to the rehabilitation and management of the proposed sports field development located at Mandeni, Kwazulu-Natal Province.

Section 3: Receiving Environment

This section includes a summary of the freshwater ecological assessment undertaken by SAS in February 2021. A brief description of the geomorphology, soil and geology is also provided.

Section 4: Wetland Rehabilitation and Management Plan

This section includes details pertaining to the management and rehabilitation activities to be implemented. A summary of the impacts and rehabilitation objectives are provided, including a list of the recommended roles and responsibilities of the individuals involved in the implementation of this WRMP. This section also presents the required monitoring actions for the WRMP. The WRMP report also considers the stormwater management plan for the proposed Hlomendlini sports field (July 2020).

Section 5: Detailed Alien and Invasive Plant Control and Management Plan (AIPCP)

This section includes details on the control and management plan developed to ensure that the AIPs are adequately managed within the proposed sports field development.

Section 6: Conclusion

This section provides the way forward and the conclusion of this WRMP.

The rehabilitation and management plan is compiled in order to ensure that impacts associated with the proposed sports field development on the modified channelled valley bottom (CVB) wetland and the valley head seep wetland are managed in line with the mitigation hierarchy (i.e. avoided and where this is not feasible minimised). The proposed activities associated with the proposed sports field development trigger Section 21 (c) & (i), and (g) water uses as defined in the National Water Act (Act No. 36 of 1998) as well as activities 12 and 19 of the Environmental Impact Assessment Regulations, Listing Notice 1 of 2014 (as amended) as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). Please refer to Annexure A for additional legislative requirements.

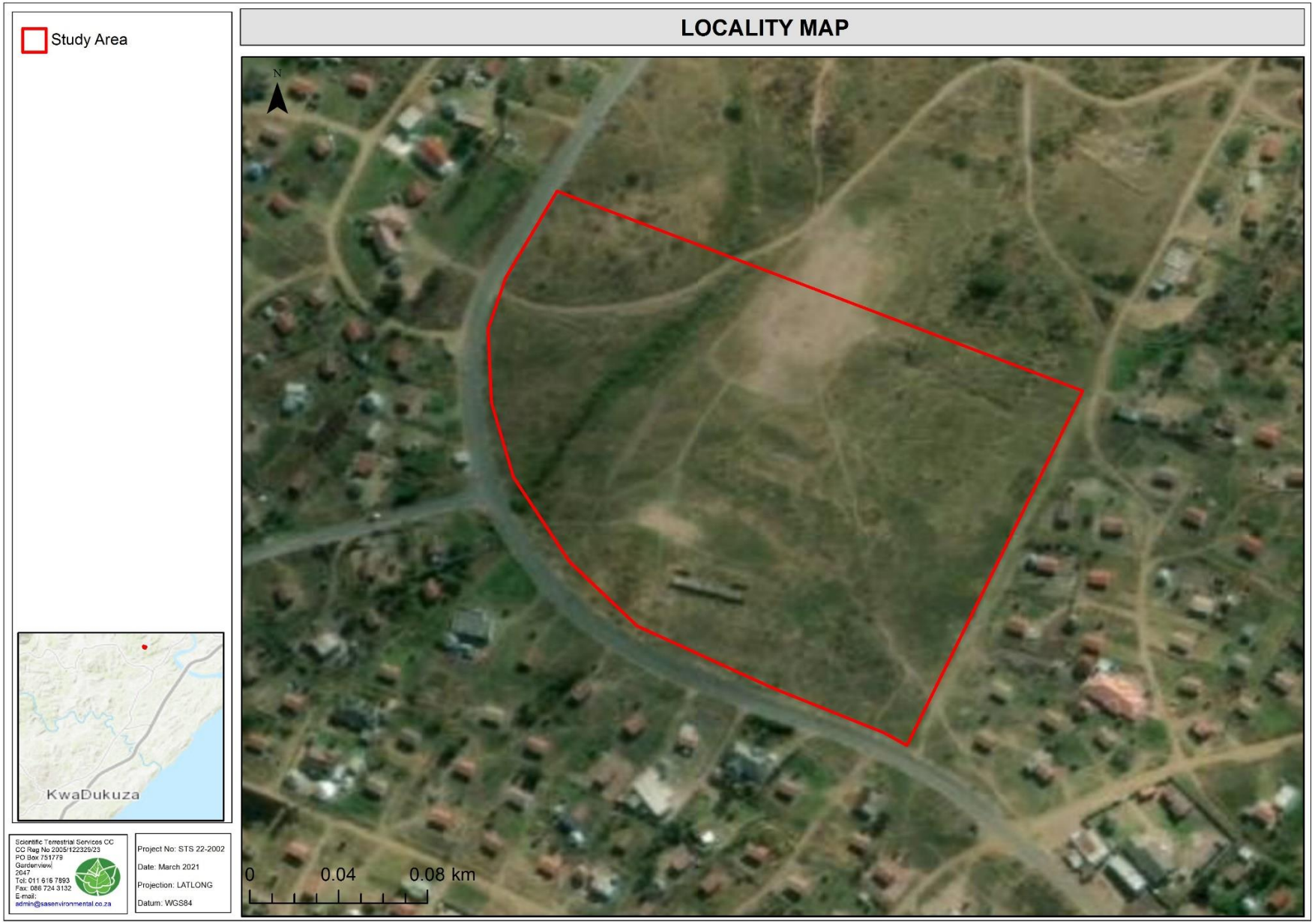


Figure 1: Digital Satellite image depicting the location of the study area in relation to surrounding areas.

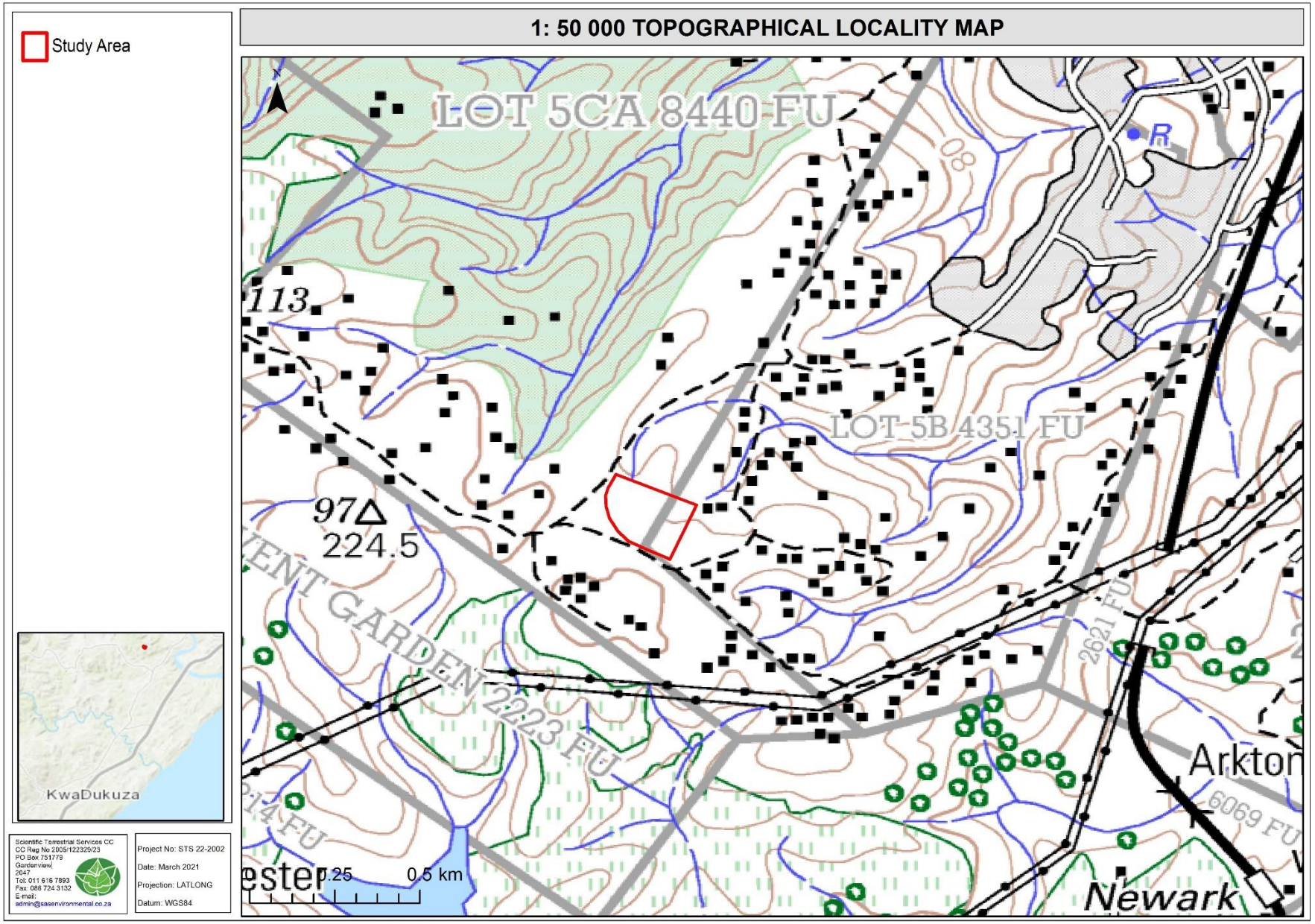


Figure 2: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

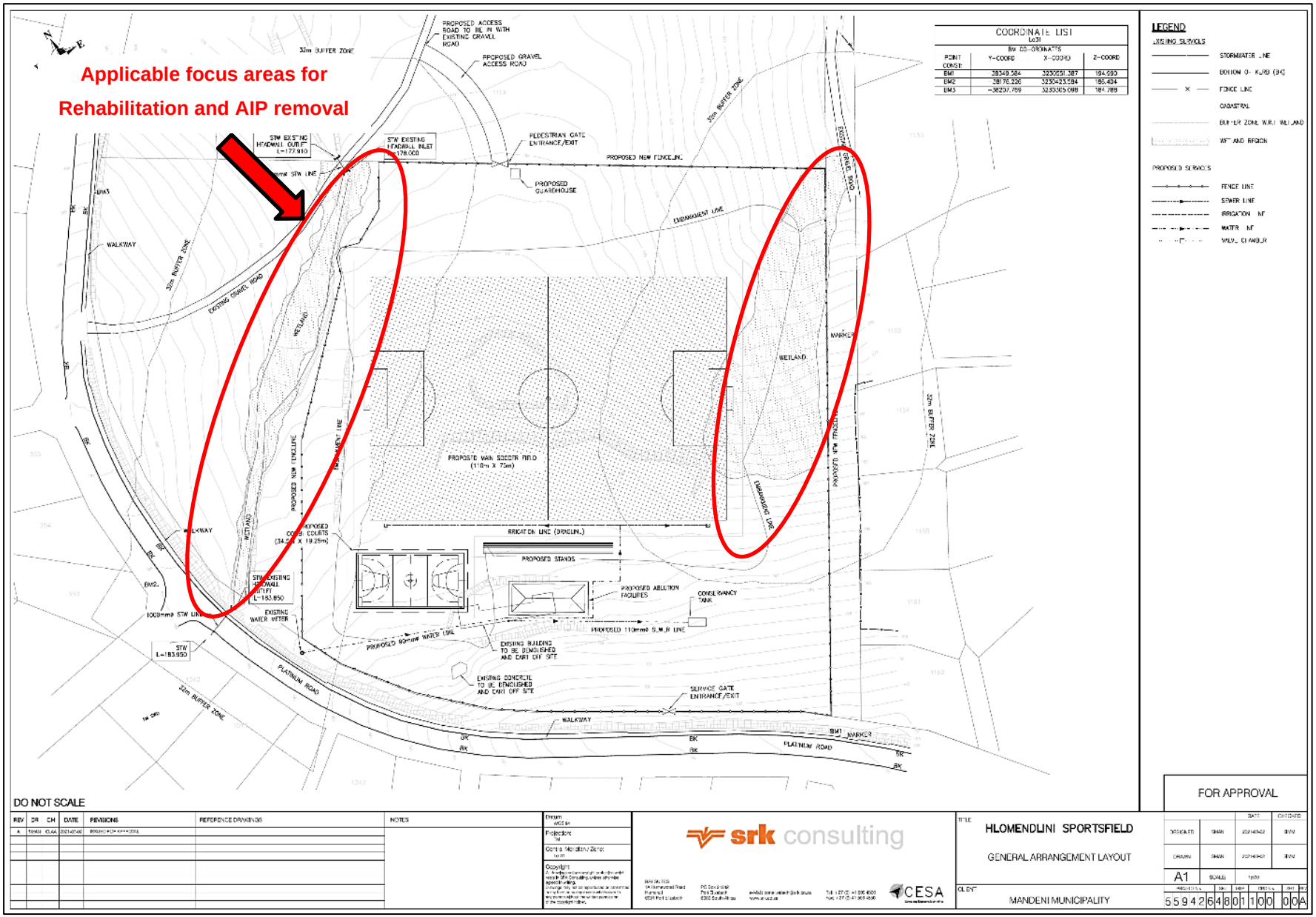


Figure 3: General arrangement layout of the proposed sports field development (as provided by SRK Consulting, 2021).

2. LEGAL FRAMEWORK FOR THE WETLAND REHABILITATION AND ALIEN INVASIVE PLANT MANAGEMENT PLAN

The following legislative documents were considered pertinent to wetland management, including the rehabilitation of the wetlands that may potentially be impacted by the proposed development, were utilised.

- Constitution of the Republic of South Africa Act, 1996[3] ;
- The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
    - GN number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated September 2020 as it relates to the NEMBA; and
    - GN number 1003: Legislation to come into force on the 1st of September 2021: Government Notice number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the NEMBA.
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Guidelines for Biodiversity Impact Assessments in KwaZulu-Natal (Ezemvelo KZN Wildlife 2009) and
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).
- The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (OHSA).

The details of each of the above, as they pertain to this study, are provided in Appendix B of this report.

[3] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

3. RECEIVING FRESHWATER ENVIRONMENT

The following information on the ecological characteristics associated with the proposed sports field development taken from SAS (2021a) titled: *Freshwater Ecosystem Assessment as Part of the Environmental Assessment and Water Use License Authorization Process for the Proposed Hlomendlini Sports Field in Mandeni, KwaZulu-Natal Province which also provides further information if required*. Table 1 below provides an overview of the desktop database investigation. The delineations of freshwater ecosystems associated with the proposed sports field development are visually depicted in Figure 6 that follows.

Table 1: A summary of outcomes from the desktop database assessment as presented in SAS (2021a).

Desktop database information	
Ecoregion	North-Eastern Coastal Belt
Catchment	Tugela
Quaternary Catchment	V50D
WMA	Thukela
Wetland Vegetation Type (Mbona *et al*, 2015)	The study and investigation areas are located within the Indian Ocean Coastal Belt Group 2 Wetland Vegetation Type considered critically endangered according to Mbona et al. (2015)
KwaZulu Natal (KZN) Biodiversity Spatial Planning (2016)	According to the KZN biodiversity spatial plan, the study area is not located within Critical Biodiversity Areas (CBAs). However, the northern, eastern, western, and southern portions of the investigation area are located within areas classified as irreplaceable Critical Biodiversity Areas (CBAs). Irreplaceable CBAs are considered critical for meeting biodiversity targets and thresholds and are required to ensure the persistence of viable populations of species and the functionality of ecosystems. The northern portion of the investigation area is also located within Ecological Support Areas (ESAs). ESAs are required to support and sustain the ecological functioning of CBAs. For terrestrial and aquatic environments, these areas are functional but are not necessarily pristine natural areas. They are however required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the CBAs, and which also contribute significantly to the maintenance of ecological infrastructure.
National Web Based Environmental Screening Tool (2020)	The entire study and investigation areas are considered to be of very high aquatic importance as these areas coincide with Critical Biodiversity Areas, forest, focus areas for land-based protected areas expansion, and critically endangered ecosystems.

3.1 Topography

The topography within the study area is gentle sloping topography both in a west to east (Figure 4) and south to northeast (Figure 5), as indicated below.

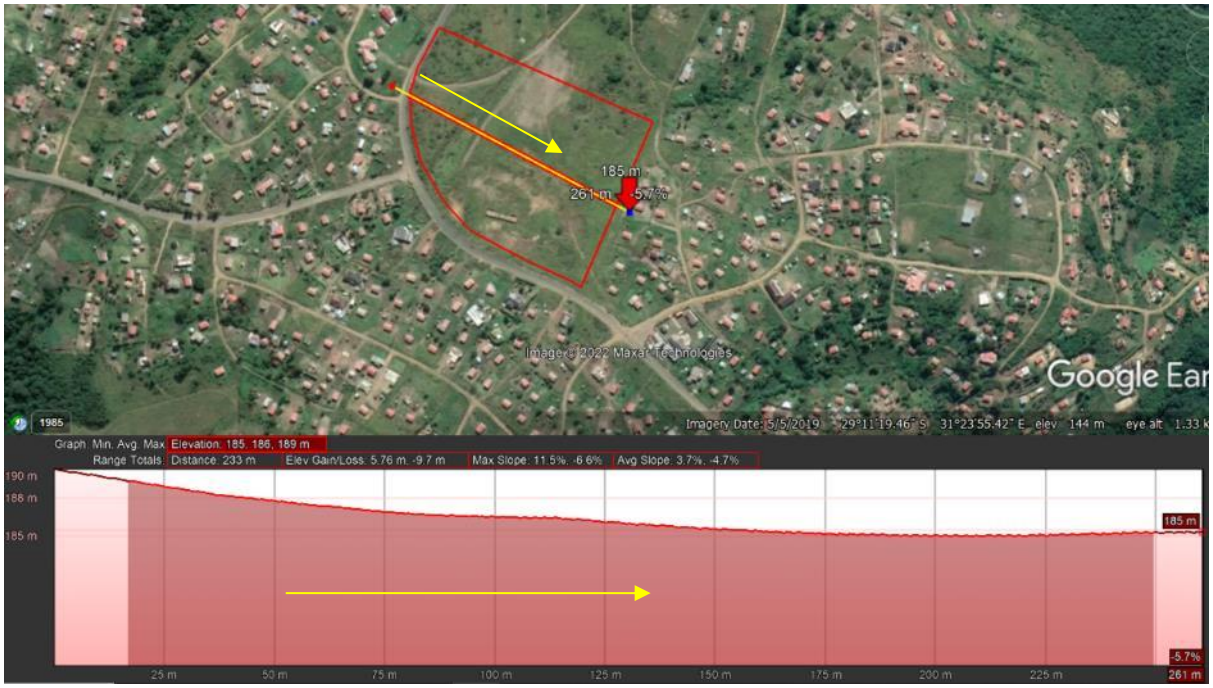


Figure 4: The elevation profile from the western to the eastern portion of the study area, associated with the proposed sports field development.

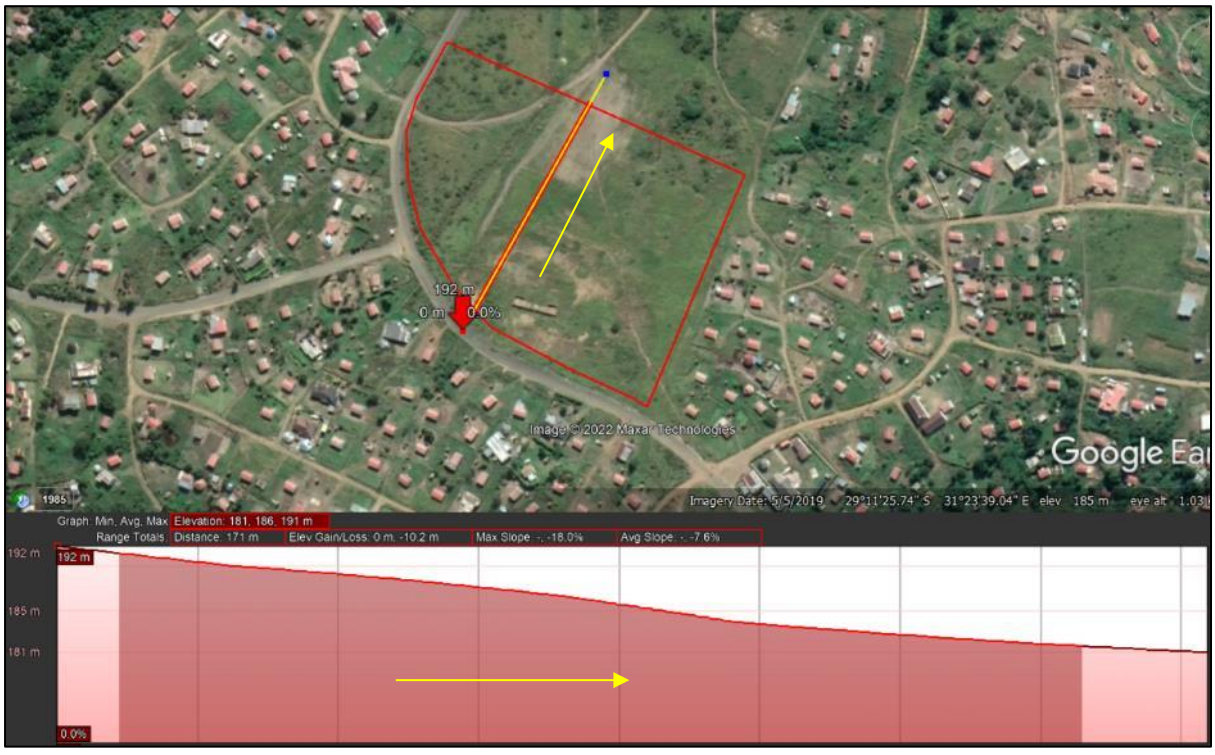


Figure 5: The elevation profile from the southern to northern portion of the study area associated with the proposed sports field development.

The site assessment confirmed the presence of two wetlands that are potentially at risk of being impacted by the proposed sports field development. These wetlands were classified as follows:

- A modified channelled valley bottom (CVB) wetland was identified within the western portion of the study area, occurring < 10 m from proposed sports field development; and
- A valley head seep wetland was identified within the eastern portion of the study area of which the western portion of this wetland will be traversed by the proposed sports field development.

The digital satellite image of the study area associated with the proposed sports field development and the delineated wetlands are illustrated in Figure 6. The following figure indicated the delineated wetlands in relation to the layout of the proposed sports field development.

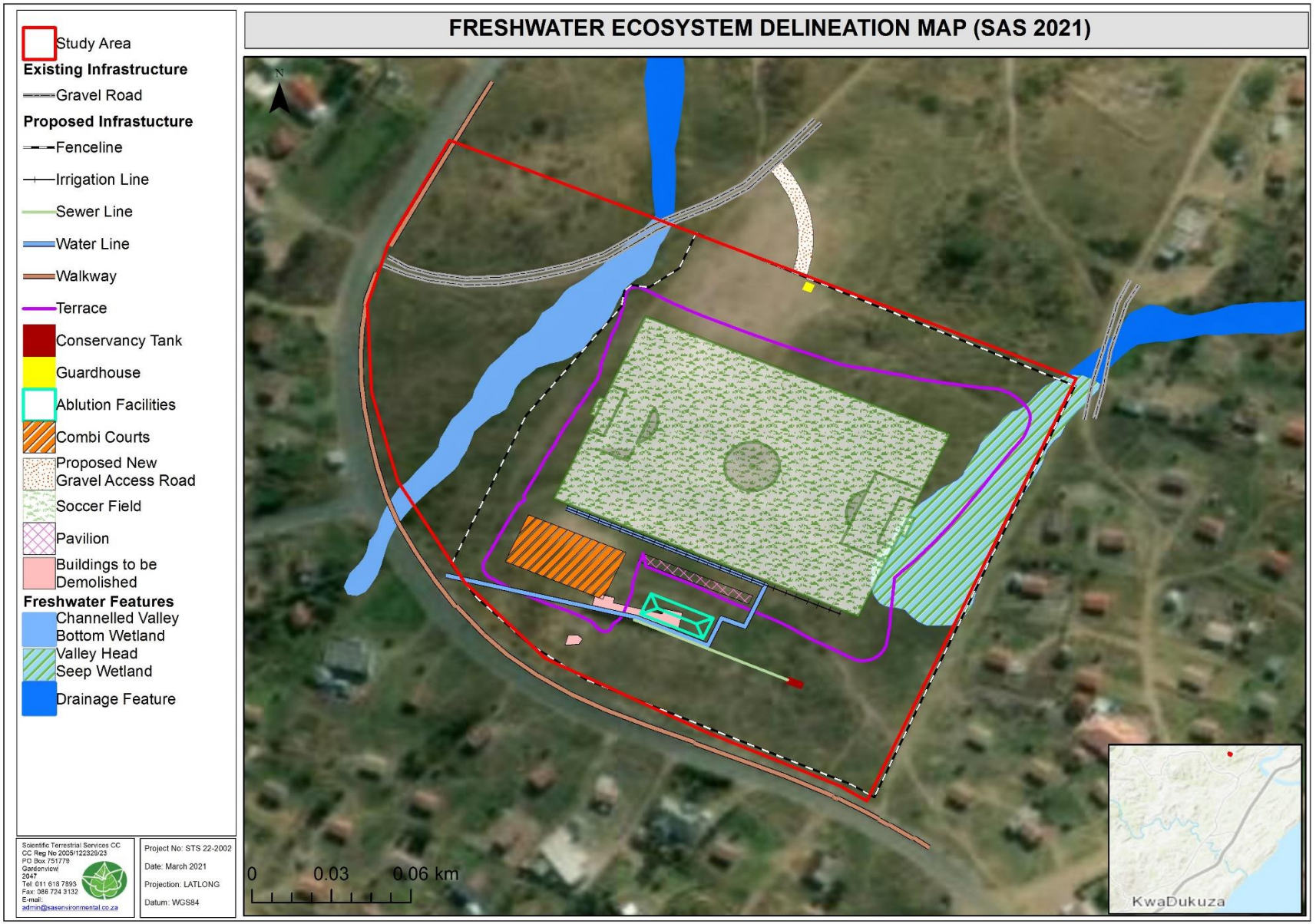


Figure 6: The delineation of the wetlands associated with the study area in relation to the proposed sports field development depicted on digital satellite imagery (SAS 2021a).

Table 2 and Table 3 present summaries of the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS), Ecoservice Provision and the Recommended Ecological Category (REC) of the modified CVB wetland and valley head seep within the study area.

Table 2: Summary of the PES, EIS, ecoservice provision and REC of the modified CVB wetland.

PES	**E (Seriously Modified)**	**EIS**	**Moderate**
Ecoservice Provision	**Intermediate**	**REC**	**D (Largely Modified)**

Figure 7: Representative photographs showing the delineated CVB wetland located along the western portion of the study area.

PES Discussion	**PES Category: E (Seriously Modified)** The CVB wetland has been impacted by various anthropogenic activities in the surrounding catchment, including the surrounding housing development and associated road infrastructure which have altered the pattern, flow and timing of stormwater in the surrounding landscape. Infilling and modifications to the active channel particularly from the road and culvert crossing within the wetland further impact the hydrological and geomorphological integrity of the system. The CVB wetland is invaded by Alien and Invasive Plant (AIP) species, contributing to the overall disturbance to the system.
Ecoservice provision	**Intermediate** The CVB wetland is considered of moderately high importance for stream flow regulation, and of intermediate importance for flood attenuation, sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control, largely as a result of the high surface roughness provided by the vegetation within the CVB wetland. The biodiversity maintenance is considered moderately low, mainly due to the significant anthropogenic impacts and the low buffer zone associated with the system. The assessed reach of the CVB wetland is not considered of value for tourism and recreation.
EIS discussion	**EIS Category: Moderate** The CVB wetland is considered to be ecologically important and sensitive on a landscape scale, due to the protection status of wetland within a peri-urban setting. Furthermore, the vegetation type associated with the CVB wetland (according to NFEPA, 2011) is considered to be critically endangered and moderately protected, although no remnants were identified at the time of the site visit and it is considered unlikely that any species that are representative of this vegetation type will be found due to the large scale surrounding impacts. The hydro-functional importance of the system was considered to be moderate due to important services such as streamflow regulation and hydrological connectivity.
REC Discussion	**REC: Category D** **BAS: Category: D** **RMO: Improve** The determined Recommended Management Objective (RMO) is to improve the PES of the CVB wetland since it is considered seriously modified and of moderate ecological importance and sensitivity. Thus, it is recommended that no further degradation to the wetland should be permitted as a result of the proposed sports field development. Careful planning of the stormwater management plan is imperative to ensure the hydraulic regime is retained and not further impaired by stormwater influxes. It is further recommended that portions of the wetland be improved as part of the overall landscaping for the sports field development. This will also assist in improving the ecological condition of the wetland which is considered ecologically unacceptable (Malan and Day 2011).

Table 3: Summary of the PES, EIS, ecoservice provision and REC of the valley head seep wetland.

PES	C (Moderately Modified)	EIS	Moderate
Ecoservice Provision	Intermediate	REC	C (Moderately Modified)

Figure 8: Representative photographs of the of the valley head seep wetland.

PES Discussion	**PES Category: C (Moderately Modified)** The valley head seep wetland has been impacted by land use changes in the surrounding catchment, including the surrounding housing development and associated road infrastructure which have resulted in the increase of impervious surfaces in the surrounding landscape, altering the pattern, flow and timing of flood peaks into the wetland, thus impacting the hydrology regime of the wetland. Signs of sediment deposition were also noted, albeit limited, but having a marked effect on the geomorphology and vegetation of the affected areas.
Ecoservice provision	**Intermediate** The CVB wetland is considered of moderately high importance for sediment trapping, phosphate, nitrate and toxicant assimilation and erosion control, largely as a result of the high surface roughness provided by the vegetation within the valley head seep wetland. Sediment trapping capability evidenced by signs of sediment deposition within the wetland. The valley head seep wetland is of intermediate importance for flood attenuation, stream flow regulation and cultivated food. The biodiversity maintenance is considered moderately low, mainly due to the anthropogenic impacts and the low buffer zone associated with the system. The assessed reach of the valley head seep wetland is not considered of value for tourism and recreation.
EIS discussion	**EIS Category: Moderate** The valley head seep wetland is considered to be ecologically important and sensitive on a landscape scale, due to the protection status of wetland within a peri-urban setting. Furthermore, the vegetation type associated with the valley head see wetland (according to NFEPA, 2011) is considered to be critically endangered and moderately protected, although no remnants were identified at the time of the site visit and it is considered unlikely that any species that are representative of this vegetation type will be found due to the large scale surrounding impacts. The hydro-functional importance of the system is considered to be moderate while the direct human benefits are considered to be low.
REC Discussion	**REC: Category C** **BAS: Category: C** **RMO: Maintain** Although the determined RMO is to maintain the PES of the valley head seep wetland since it is considered moderately modified and of moderate ecological importance and sensitivity, it is recommended that no further degradation to the wetland should be permitted as a result of the proposed development. Development of the surrounding area will decrease surface roughness and increase surface stormwater run-off; thus rehabilitation (including revegetation with indigenous species and AIP control) of this system is necessary to maintain and/or improve its present ecological state. Careful planning of the stormwater management plan is imperative to ensure the hydraulic regime is retained and not further impaired by stormwater influxes.

3.2 Risk Assessment Summary

The following table provides a summary of the anticipated risks associated with the proposed sports field development and the recommended rehabilitation objectives, as undertaken as part of the Freshwater Assessment (SAS, 2021a)

Table 4: A summary of the risk assessment outcomes.

Phases	Activity	Wetland impacted	Risk Rating	Mitigation Measures
Construction Phase	Site preparation prior to construction activities. • Loss of wetland vegetation, associated habitat and ecosystem services, associated with the proposed sports field development; • Exposure of soil, leading to increased runoff, and erosion, and thus increased sedimentation of the wetlands and/or down gradient wetlands.	CVB wetland	L	• **It is imperative that all construction works be undertaken during the dry, winter months when surface flow is very low within the wetlands, and no diversion of flow would be necessary;** • Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the wetlands and their associated 32 m NEMA Zone of Regulation (ZoR); and • The removed vegetation must be stockpiled outside of the delineated boundary of the wetlands. The footprint areas of these stockpiles should be kept to a minimum. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site..
		Valley head seep wetland	M	
	Ground-breaking: excavation of foundations, earthworks and building associated with the construction of the proposed main soccer field, terrace, conservancy tank, gravel access road, fence line, parking area and a guardhouse, combi courts, ablution facilities and stands, and walkway within the 500 m GN509 Zone of Regulation. • Earthworks within the western portion of the valley head seep wetland associated with the proposed main soccer field and terrace; • Removal of vegetation and infilling within the seep wetland and associated disturbance of soil, potentially resulting in altered runoff patterns.	CVB wetland	L	• **Vegetation clearing and movement within the wetlands to be limited to what is absolutely essential. Retain as much indigenous vegetation as possible;** • **Given the topography of the site, it is recommended that that silt traps be installed downgradient of the construction works to limit any sediment entering the downgradient wetland areas, especially considering the excavation activities associated with the valley head seep wetland. Sediment traps should allow for surface runoff should a rainfall event occur;** • All stockpiles should not exceed 2m in height and be located at least 10 m from the delineated wetlands. Stockpiling of removed materials may only be temporary (may only be stockpiled during the period of construction at a particular site) and should be disposed of at a registered waste disposal facility; • All exposed soil, including stockpiles, must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian sheeting) in order to prevent excessive dust generation, erosion and sedimentation of the receiving freshwater environment; • In order to create the proposed terrace all vegetation will need to be cleared. All indigenous vegetation can be stockpiled and mulched, to be used as organic matter during the rehabilitation phase. All exotic or alien
		Valley head seep wetland	M	

Phases	Activity	Wetland impacted	Risk Rating	Mitigation Measures
				vegetation must be removed from the watercourse and disposed of at a registered facility; • The proposed terrace should be designed in such a way that there are no steep slopes which may limit vegetation growth and result in erosion. A maximum slope with 1:4 is considered the most appropriate balance between reducing footprint and ensuring slopes are stable; and • Revegetation of the areas surrounding the walkways with suitable indigenous species of the Indian Ocean Coastal is recommended.
	Installation potentially via open trenching of: • The proposed water pipeline within the 32 m NEMA ZoR of the CVB; • The proposed irrigation line within the 32 m NEMA ZoR of the valley head seep wetland; and • The proposed sewer line within 40 m of the wetlands (outside the 32 m NEMA ZoR).	CVB wetland	L	• During trenching, soil may be stockpiled on the upgradient edges of the excavation in order to limit potential sedimentation of the downgradient wetlands; and • Mixture of the lower and upper layers of the excavated soil should be kept to a minimum. The soil must be used to backfill the trenches, immediately after inserting the pipeline.
		Valley head seep wetland	L	
	Stormwater management • Establishment of stormwater channels and outlet structures are recommended for the management of stormwater and sustainable discharge into the wetlands.	CVB wetland	L	• An adequate stormwater management plan must be incorporated into the design of the proposed sports field development. Stormwater must be released in an attenuated manner outside of the wetlands; • Energy dissipating structures should be installed at the stormwater outlets to prevent erosion and scouring of the wetlands where the stormwater will be discharged into; and • It is strongly recommended that the developer consider Sustainable Drainage Systems (SuDS) for stormwater management (as opposed to underground stormwater pipelines) and that these systems be vegetated with indigenous freshwater vegetation as this will assist with sediment trapping and "polishing" of stormwater before releasing into the wetlands
		Valley head seep wetland	L	
Operational Phase	Small-scale rehabilitation of the area • Proactive monitoring to identify early signs of alien vegetation encroachment; • Small-scale rehabilitation of the wetlands including removal of alien invasive species and revegetation with suitable wetland species.	CVB wetland	L	• Following construction, a suitable alien invasive management plan must be implemented to ensure that alien invasive plant species do not become established within the areas disturbed by construction activities; • Rehabilitation of the wetlands must be undertaken, including clearing of all alien and invasive vegetation and reinstatement of indigenous wetland vegetation (particularly for the valley head seep wetland where portions of the proposed main soccer field and terrace are proposed;
		Valley head seep wetland	L	

Phases	Activity	Wetland impacted	Risk Rating	Mitigation Measures
				• These rehabilitation recommendations should be read in conjunction with the rehabilitation measures following the offset to improve the functionality and ecological integrity of the identified target wetlands.
	Operation of the proposed sports field development • Operation of the proposed water pipeline • Operation and maintenance of conservancy tanks and associated infrastructure.	CVB wetland	L	• Adequate stormwater run-off measures must be put in place and no stormwater may be directly released into the wetland. Attenuation ponds and/or SuDs must be installed to assist with water "polishing" and reducing the velocity of water before entering the wetlands. This will ensure no erosion or scouring occurs as a result of stormwater inputs; • Incorporate as much indigenous terrestrial and wetland vegetation into the open space areas, SuDS, and stormwater attenuation facilities (where applicable) associated with the proposed sports field development; • Any spills to be immediately cleaned up and treated accordingly; and • No vehicles are permitted to enter into the freshwater ecosystems. Any maintenance works must be undertaken by foot or the relevant authorisations obtained beforehand; • It is recommended that the integrity of the water pipelines be tested at least once every five years or more often should there be any sign of a leak; and • It should be ensured that the hydrological regime of the downgradient wetlands not be impacted as a result of leaks or bursting of the pipeline, and that an emergency plan should be compiled to ensure a quick response and attendance to the matter in case of a leakage or bursting of the pipeline.
		Valley head seep wetland	L	
	Operation of the stormwater management systems.	CVB wetland	L	• The likelihood of erosion is reduced due to a higher surface roughness of SuDs (earth swales), allowing for water to enter the wetlands at a lower velocity; • The SuDs should be inspected regularly to ensure proper functioning, monitoring of erosion and clearing of any debris or litter in the SuDs;

Phases	Activity	Wetland impacted	Risk Rating	Mitigation Measures
		Valley head seep wetland	L	• Water will be diverted around the soccer field in earth cut off trenches and stone pitched swales will be sued to discharge wate into the wetland in an attenuated manner. • Hot spots for the build-up of debris and excess sediment within the wetlands must be identified and when necessary, debris/excess sediment must be removed by hand to prevent future flooding and potential damage to infrastructure. In this regard, special mention is made of periods following high rainfall and subsequent high instream water volumes. Removal of debris must be undertaken in line with the above listed construction mitigation measures; and • Any erosion or gully formation must be identified on an ongoing basis and re-profiled and revegetated accordingly.

The risk assessment indicated that activities associated with the proposed sports field development, which include site preparation, vegetation clearing and excavation and levelling of the platforms for the construction of the proposed sports field development and associated stormwater management, pose a Moderate risk to the overall integrity of the wetlands. **The majority of the impacts are considered fully reversible, except those associated with loss of wetland vegetation of the valley head seep wetland that will be traversed by the proposed main sports field and terrace, resulting in 0.089 ha of wetland habitat loss.** Indirect impacts may arise from potential water quality concerns and increased sediment loads entering the wetlands through the stormwater channels. According to the stormwater management plan (SRK 2021), earth cut-off drains will be provided along the southern side parallel to the sports field for the purpose of capturing and diverting overland stormwater.

4. WETLAND REHABILITATION AND MANAGEMENT PLAN

According to the freshwater report (SAS 2021a), an anticipated unavoidable loss of 0.089 ha of wetland is still anticipated. Due to complete avoidance and recreation of wetland HGM units not being a feasible mitigation option, the residual impacts as a result of the proposed sports field complex development needs to be compensated for and the best alternatives (including onsite rehabilitation of the remaining portions of the wetlands) has therefore been identified as part of this project (SAS 2021a).

Due to the limited extent of the wetland loss and the location of the development, a formal offset initiative is not deemed possible, and it is therefore proposed to compensate for the loss by improving the functionality of the remaining wetland extent.

Based on the on the above, the following rehabilitation measures/objectives were recommended to improve functionality and ecological integrity of the identified target wetlands:

- Implementation of an alien invasive vegetation plan, to eradicate as far as possible all alien floral species which are identified within wetland areas.
- Re-introduction of indigenous vegetation, in particular, graminoid species and sedges where vegetation is sparse. Manure sourced from local farmers is likely to contain seeds of naturally occurring floral species, and this could be utilised in the rehabilitated areas to further encourage growth of indigenous flora;
- Erosion control within the wetlands and their buffer zones in order to prevent sedimentation, enable natural vegetation to become re-established, and improve water quality. Examples of possible management methods include monitoring of access by domestic livestock, protection of small areas of exposed soils with suitable geotextiles or

organic material (e.g. branches) until such time as vegetation is re-established, appropriate stormwater management practices and installation of erosion berms.

A site-specific rehabilitation plan was developed in order to ensure that the above measures to improve the functionality of the remaining wetlands is achieved.

4.1 Site Specific Rehabilitation, Implementation and Management Plan

The implementation of the WRMP is based on four (4) key actions illustrated in Figure 9 and discussed in detail in Section 4.1.1 – Section 4.1.4.

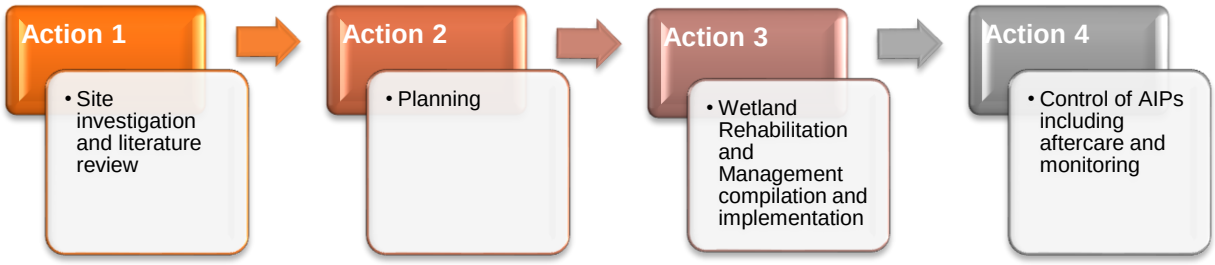


Figure 9: The four (4) key actions of the WRMP implementation.

4.1.1 Action 1: Site Investigation and Literature Review

The wetland rehabilitation plan focuses on rehabilitation of open areas around the proposed Hlomendlini sports field, with specific focus on the removal of alien and invasive plants within areas where these species have been identified, revegetation of areas which will be impacted during the construction activities and these activities must be included as part of the landscaping plans for the proposed sports field development.

Table 5: A description of the historic activities and existing negative impacts associated with the CVB and valley head seep wetland.

- Historical activities including the disposal of waste construction rubble and large boulders potentially excavated during the construction of the adjacent school or residential houses was observed within the study area. Where this has occurred, the natural distribution, and retention patterns of flow has been impacted, resulting in altered overland flow patterns and the creation of potentially artificial wetter areas (Figure 11).

Figure 10: Representative photographs of the disposal of waste construction rubble and large boulders in the landscape associated with the proposed sports field development.

- The anthropogenic disturbances have led to the proliferation of alien invasive plant species (AIPs) and encroacher plant species such as *Bidens pilosa, Verbena bonariensis* (Category 1b), and *Lantana camara (*Category 1b) among others identified within the study area.

Figure 11: Photograph illustrating alien and invasive species such *Lantana camara and Verbena bonariensis.*

- The stormwater outlet was observed within the CVB, significant litter was observed within the outlet and as a result of the litter build-up and increased alien vegetation within the channel, and distribution of flow and sediment to downstream reaches of the CVB wetland has been altered.

Figure 12: Representative photographs of the culverts associated with the CVB wetland along the western section of the study area.

For ease of reference, two main areas associated with the wetlands were identified for rehabilitation, namely Priority Area 1 to the east of the site associated with the valley head seep wetland and Priority Area 2 to the west of the site associated with the modified CVB wetland. Three individual focus areas falling within these areas where then identified for rehabilitation for the measures addressed in the report, specifically:

1. Areas along the modified CVB wetland where the culverts conveying water from the southern residential areas was observed. As a result of the development of the sports field and increase of impervious surfaces in the landscape, management of stormwater in the landscape is considered to be important;
2. Areas where historical disposal of waste construction rubble and large boulders potentially excavated during the construction of the adjacent school or residential houses must form part of the rehabilitation activities especially since this will help in the managing how water moves in the landscape; and
3. Alien and invasive species, including encroacher species were observed within areas surrounding the proposed sports field footprint. These species include *Bidens pilosa, Verbena bonariensis, and Lantana camara* among others. The control and management of identified alien and invasive species is discussed in detail in Section 5 of the WRMP report.

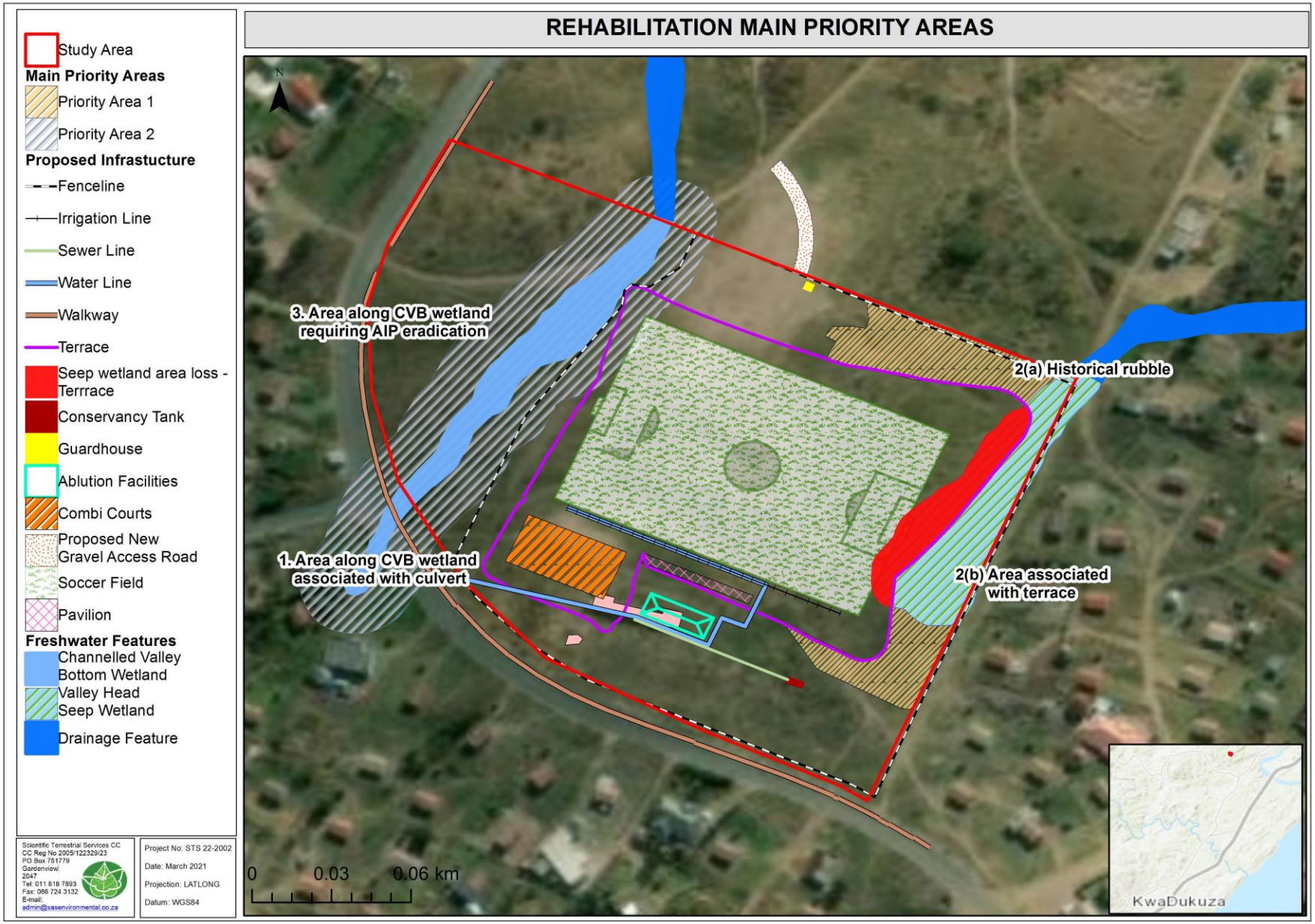


Figure 13: A digital satellite image depicting the focus areas for the rehabilitation associated with the proposed sports field development.

Table 6: Summary of activities, impacts and rehabilitation objectives for the CVB and valley head seep wetland associated with the focus areas.

Rehabilitation Vision	To ensure that the wetland and associated buffer area forms a functional part of the landscape, which enhances the value of the proposed development while supporting the drainage features of the area in such a way as to ensure that, as a minimum the ecostatus of the system is maintained and where possible improved.	
Rehabilitation Areas	**Impacts**	**Rehabilitation Objectives**
Areas along the modified CVB wetland where the culverts conveying water from the southern residential areas was observed.	• Litter was observed within the CVB wetland resulting in dammed flows immediately below the culvert; and • The presence of culverts along the reach of the CVB wetland further impact the hydrology of the wetland through confining flow and increased the risk of incision.	• The litter observed within the CVB wetland must be cleared in order to allow for sufficient distribution of sediment and water to downstream reaches of the wetland; • This will also result reduce proliferation of alien vegetation within the channel which continues to grow due to sediment deposition in this area; and • The scale rehabilitation of the modified CVB as part of the proposed sports field development, including AIP control and management of hydraulic regime has the potential to assist with achieving an improvement in the ecological functioning of the CVB wetland and achievement of the Recommended Ecological Category of Category D (Largely Modified) (SAS 2021a).
Areas where historical disposal of waste construction rubble and large boulders.	• The landscape has been historically impacted disposal of waste rubble material resulting in altered flow patterns; and • The altered water retention and distribution patterns within the landscape have resulted in the presence of artificially wetter areas in the landscape.	• Removal of rubble and historically infilled material to allow free draining landscape adjacent to the valley head seep wetland; • Reduce compaction and undertake activities to reshape the disturbed wetland areas to a gently sloping and free draining landscape; and • Undertake revegetation using indigenous species to reinstate basal vegetation cover at the disturbed areas to prevent further erosion, sedimentation and alteration of surface water quality.
Alien and invasive species including encroacher species were observed within areas surrounding the proposed sports field footprint.	• Stands of alien and invasive species outcompete indigenous terrestrial and wetland species, thus reducing the ability of the wetland to support biodiversity.	• Long- term control of AIPs and opportunistic species to ensure heterogenous vegetation composition within the wetlands and open areas post development of the proposed sports field; • Alien and invasive species should be manually removed, and chemical control is not recommended to prevent chemical contamination of the wetlands; • Edge effects from the construction activities must be managed to ensure that the ecostatus of the wetlands is improved/maintained during the period of the construction. To achieve this, it must be ensured that no indiscriminate movement of construction vehicles or personnel is allowed within the wetlands and that careful planning of the construction footprint be undertaken; and • An alien and invasive management and control plan has been compiled and is presented in Section 5 of the report.

4.1.2 Action 2: Planning

The intention of the WRMP is to achieve the rehabilitation vision by means of the implementation of the rehabilitation objectives (Table 7) in the most economical and feasible manner by maintaining and, where possible, restoring the ecological condition and function of the wetlands associated with the sports field development. The achievement of the rehabilitation objectives is dependent on cogent conceptual planning, which is essential if the desired results are to be achieved. Below are requirements to be considered during the planning phase prior to implementation of the WRMP.

Table 7: Planning requirements to be considered prior to the implementation of the WRMP.

1.1 Obtaining all relevant authorisations and permits
Before rehabilitation activities can commence all necessary permits and authorisations will be required, including but not limited to:

- Environmental Authorisation (as applicable); and
- Water Use Authorisation from the Department of Water and Sanitation (DWS) .

Note: If any plants or seeds will be harvested from the surrounding area for revegetation purposes, a permit may be required from the KZN Department of Economic Development, Tourism and Environmental Affairs prior to plant harvesting.

1.2. Appointment of a Contractor
During the planning phase certain aspects need to be considered in order to effectively implement this plan. This includes:

- Appointment of a suitably qualified Contractor(s) to undertake the required work;
- Appointment of an Environmental Officer to audit and monitor the rehabilitation activities as well as to undertake the required post rehabilitation monitoring; and
- Appoint any specialist consultants required for guidance, management and monitoring.

1.3 Alien Invasive Plant Species (AIP) control
The National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) Section 73 requires every person to exercise a Duty of Care relating to alien invasive plant (AIP) species within their property, and as such the local municipality is responsible for AIP species control. AIPs have a number of detrimental effects on biodiversity, from nutrient enrichment of wetlands, increased erosion, out-competing indigenous floral vegetation and limiting habitat diversity and for availability for faunal species. Further information on the Alien Invasive Plant Species (AIP) control plan is provided in Section 5.

1.4 Reinstatement of a functional drainage landscape (distribution and retention of water)
The design of the proposed sports field must ensure that the movement of water in the landscape is managed appropriately in order to mitigate risk of potential flooding while improving/maintaining the functionality of the surrounding wetlands.

According to the preliminary design report (2020), diversion measures must be put into place during the construction and operation of the sports field. The earth cut off drains will be installed along the southern side parallel to the sports field, and the purpose of the drains would be to capture and divert overland stormwater flow within the catchment. Furthermore, stoned pitched v-drains to be provided along the eastern boundary. These will serve, firstly to divert the flow from existing infrastructure and to collect all overland flow water from the earth cut-off drains along the southern side

1.5 Budgetary Allowance
A rehabilitation budget needs to be prepared prior to the commencement of rehabilitation activities. The preparation of a budget is a crucial step in planning of a project, as it allows for the prediction and calculation of all the costs related to implementation of the rehabilitation activities, including, but not limited to labour, material, expertise and post rehabilitation maintenance and management.

1.6 Timing
Rehabilitation of the Focus Areas should commence as soon as possible. Rehabilitation should have a fixed deadline for completion.

1.7 Kick-off meeting

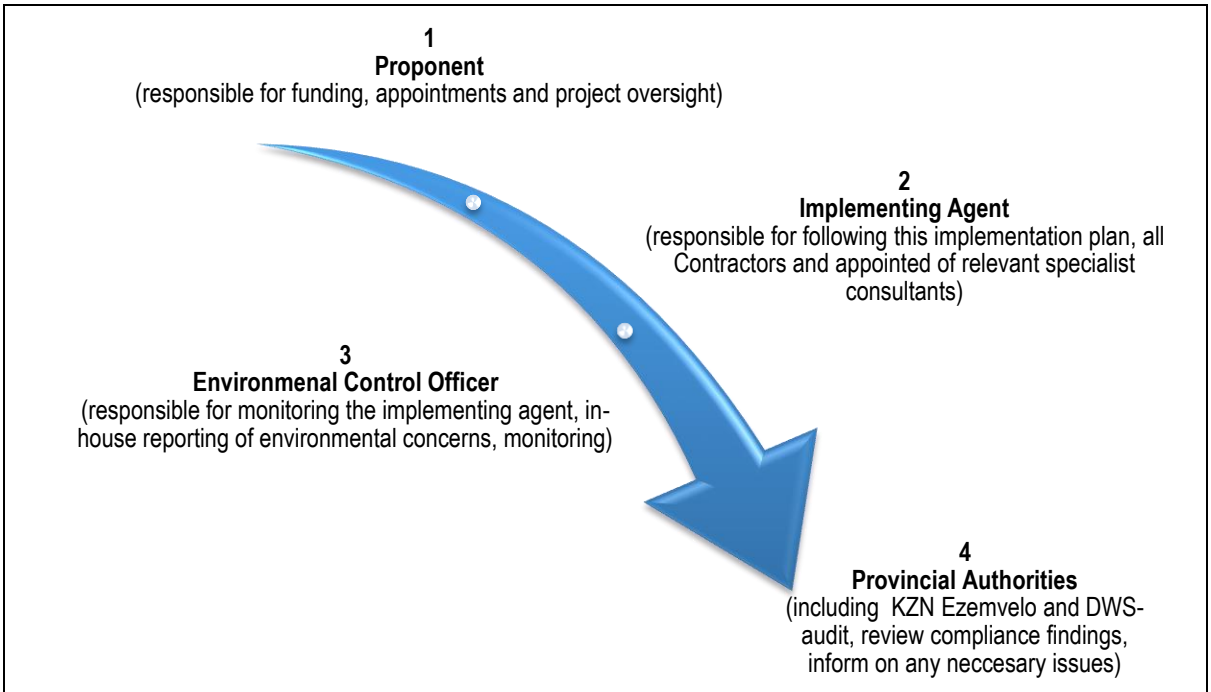
Before commencing with the rehabilitation activities, a kick-off session associates all the responsible persons involved in the implementation of the WRMP. The key aims of the meeting are:

- Agreeing on the timeline for rehabilitation activities;
- Identifying the rehabilitation expectations and limitations; and
- Validating the WRMP rehabilitation strategies and the involvement of all the responsible persons in the implementation process.

4.1.3 Action 3: Wetland Rehabilitation and Management Plan Compilation and Implementation

A site-specific WRMP has been developed to provide step-by-step implementation measures to rehabilitate the landscape surrounding the proposed sports field. Rehabilitation and management activities will focus on management of water movement in the greater landscape, removal and management of AIPs in the landscape and reconstruction of the natural topography within impacted areas. The implementation of these measures is the core of the WRMP, as this entails execution and shaping of the rehabilitation and management activities into visible outputs. A list of the roles and responsibilities of the individuals involved in the implementation of this WRMP is provided in Table 8.

Table 8: Summary of various parties involved with the implementation of this WRMP.



Party	Responsibility
Proponent	➢ The Proponent must ensure sufficient funding for the implementation and long-term maintenance of the mandated rehabilitation requirements as stipulated in this WRMP; ➢ The Proponent will be responsible for the appointment of an ECO to monitor and audit the rehabilitation requirements, the Implementing Agent, as well as an independent auditor;

	➢ The Proponent will be responsible for ensuring the Implementing Agent receives a copy of this document and understand its contents; ➢ The Proponent must ensure that that suitable penalties are in place for non-conformance of the conditions of authorisations, licence as well as this WRMP by the Implementing Agent and any sub-contractors; ➢ The proponent must give the authority to the ECO to stop works on site should he/she feel that there is a serious threat to or impact on the surrounding environment; and ➢ Should ownership of the property change, the role and responsibility for compliance with this WRMP as well as long-term maintenance must also be transferred.
Implementing Agent	➢ An overarching Contractor should be appointed as the Implementing Agent, to manage all sub-contractors and appoint specialists, as required; ➢ The Implementing Agent must ensure that all sub-contractor/s take full responsibility for each of his/her employees and any penalties imposed; ➢ The Implementing Agent must immediately inform the Proponent and ECO if any changes to the project are envisaged and if any aspects of this WRMP or the Record of Decision (RoD) cannot be complied with; ➢ It is the responsibility of the Implementing Agent to ensure that the measures stipulated within this WRMP are adhered to; and ➢ Should the Implementing Agent require clarity on any aspect of this implementation plan, the Implementing Agent must contact the ECO for advice or alternatively, a suitably qualified specialist. **Training of Rehabilitation Workers** The Implementing Agent is to facilitate an initial environmental induction to all sub-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. **Contractor Performance** ➢ The Implementing Agent must ensure that the relevant sub-contractors adhere to the conditions of this WRMP. Should the Contractor require clarity on any aspect of this WRMP, the Contractor must contact the Implementing Agent directly, who, if needed can consult with the specialists involved in preparation of the WRMP. Should the ECO feel that the requirements of this WRMP are not being met by the Contractor(s), the ECO 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.
Environmental Control Officer (ECO)	➢ The ECO is responsible for the implementation of the activities and for reporting on the degree of compliance. The ECO should ideally be appointed at the start of rehabilitation activities and be responsible for ensuring that all rehabilitation activities are implemented. The ECO is mandated to do the following: o Monitor site activities on a regular basis to ensure further environmental impact due to rehabilitation activities are avoided. A monitoring report should be submitted to the Proponent, Contractor, the Engineer (should there be any design changes required) and the Implementing Agent; o Ensure that a 'hotline' exists for reporting incidents and resolving any problems rapidly; o The ECO must regularly audit the operation and establish whether the measures in the WRMP are applied, where after the ECO reports to the Implementing Agent;

	○ All reports compiled by the ECO must be submitted to the relevant compliance office within any legal authorities; ○ The ECO has the authority to stop works if in his/her opinion there is/may be a serious threat to or impact on the environment caused directly by the rehabilitation activities; and ○ Conduct a final WRMP audit and a review of management and rehabilitation measures. ➢ Should the appointed ECO not have any freshwater ecological experience, a suitably qualified Freshwater Ecologist should be appointed to assist the ECO as and when needed.

The WRMP includes practical rehabilitation and management methods to achieve rehabilitation objectives and a desired end result. The rehabilitation and management methods of the WRMP were grouped into six (6) tasks to guide the implementation thereof (Figure 14). Table 9 that follows provides a description of each task, the responsible person(s) for implementing the task, reference to the relevant section in the WRMP and estimated timeframes.

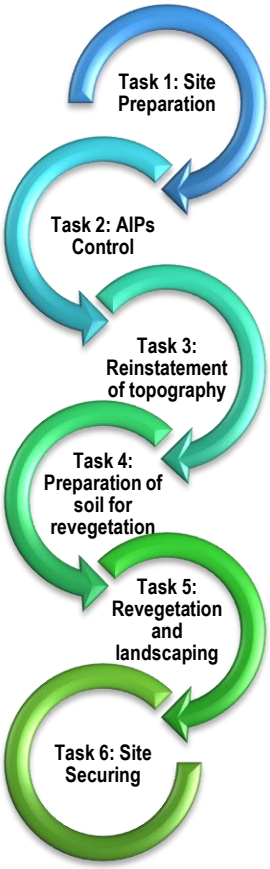


Figure 14: Grouped tasks for the rehabilitation and management method implementation.

Additionally, Section 4.1.4 provides generalised management methods to be implemented post-rehabilitation activities as part of the general periodic maintenance activities. The

timeframes suggested below must be confirmed with the proponent prior to commencement of rehabilitation activities.

Table 9: A summary of the description of each task, the responsible persons, section of the WRMP and estimated timeframe.

Task	Description	Responsible persons	Timeframe (TBC)
Task 1: Site Preparation	Site preparation requirements before commencing with rehabilitation activities.	Proponent, site manager, ECO, and Contractor	1 Week
Task 2: AIP Control	Measures are provided to control the AIPs identified within the wetland habitats.	Proponent, site manager, ECO, and Contractor	Ongoing
Task 3: Reinstatement of the topography.	The section provides measures to reinstate the topography to the condition prior to the construction of proposed sports field development in the surrounding landscape particularly along the wetlands.	Proponent, site manager, ECO and contractor	3 Weeks
Task 4: Soil preparation for revegetation.	The requirements to be taken during soil preparation and the application of topsoil to increase the revegetation success.	Proponent, site manager, ECO and Contractor.	
Task 5: Revegetation	The guidelines and indigenous plant species are provided for the revegetation of the rehabilitated focus areas.	Proponent, site manager, ECO and Contractor	1 -2 Weeks
Task 6: Site securing	Measures are provided to secure the rehabilitated areas to prevent disturbance.	Proponent, site manager, ECO and Contractor	

Task 1: Site Preparation

The following actions need to be undertaken during the site preparation for undertaking the specified rehabilitation activities at the focus areas:

- Management of edge effects during the construction phase must be conducted in order to ensure that the ecological integrity and functionality
- Undertake rehabilitation activities within the modified CVB and valley head seep wetlands, preferably when expectancy of rain is the lowest (during the dry winter months) but leading up to the rainy season;
- Make all persons involved in the implementation of the WRMP aware of the content of the plan procedures and requirements;
- Remove all waste and construction rubble found within the study area particularly within the CVB wetland. It is therefore recommended that manual removal of waste and rubble is undertaken. The waste and rubble removed need to be disposed at a licensed waste disposal facility; and
- Demarcate the extent of the wetlands as a “no -go” area to prevent any unauthorised entry and further impacts to these systems (Figure 15). The barrier used should be removed once all rehabilitation and management activities have ceased.

Figure 15: An example of a barrier used to demarcate a sensitive area as a "No-Go area".

Task 2: Alien Invasive Plant (AIP) Species Control

The management and control of alien and invasive plant species is discussed in detail in the Section 5 of the report.

Task 3: Reinstatement of the topography

The landscape associated with the study area and portions of the valley head seep wetland have been historically subjected to impacts associated with deposition of rubble material resulting in an unnaturally uneven landscape. In addition, as part of the construction activities associated with the proposed sports field, it will be necessary to infill portions of the study area in order to ensure that the landscape is even for sporting events. Within open areas surrounding the sports field where this has been done, it is recommended that these areas are rehabilitated in order to ensure an adequate slope is reinstated to enable revegetation and ensure free draining landscape post rehabilitation. Techniques and guidelines for the reinstatement of topography are provided in the table below.

Table 10: Techniques and guidelines for the reinstatement of topography within areas historically impacted by rubble disposal and areas to be impacted by construction edge effects.

Technique and Guidelines
➢ Rubble material must be cleared from these areas in order to allow for a naturally drainage landscape and ensure that the pattern, flow and timing of wate reporting to the wetlands is not altered; ➢ Reinstate any cut and fill slopes associated with the disturbed areas along and in the wetland to a minimum slope ratio of the pre-infilled landscape (or 5:1 ratio) to prevent erosion and to provide a stable slope to allow for the establishment of vegetation; ➢ It must be ensured that work undertaken to remove the material within the wetland is undertaken using manual labour to limit soil compaction and any potential further disturbances to the wetland; ➢ Reshape the above-mentioned disturbed areas to ensure the area is gently sloping, free draining and that no preferential flow paths during rainfall events are created which could lead to scour and sedimentation. Sloping should tie in with the up and downstream areas and/or 3:1 ratio, whichever is applicable.
Stabilisation of slopes associated with the construction of service infrastructure According to the Geotechnical report (SRK 2021), the following recommendations have been made: ➢ Slope instability should not prove problematic across the site, however in the steeper areas, slope instability must be considered, specifically where cuts are made into the slope. Removal of existing vegetation should only take place when absolutely necessary, as the vegetation significantly increases slope stability; and ➢ Where cut to fill platforms are constructed, it is recommended that all structures are kept in the cut portion of the platforms to ensure long term stability.

Task 4: Soil preparation for revegetation for areas impacted by construction activities

Soil preparation is a critical element to increase the success of the establishment of vegetation, predominantly where the soil properties are a fundamental determinant of the vegetation composition and abundance.

Historical activities in the study area have disturbed the soil in the landscape resulting in the loss of a basal vegetation cover and erosion in some areas adjacent the wetlands. The activities associated with the proposed sports field are also likely to result in further disturbances such as infilling, vegetation loss and increased impervious surfaces. The following six (6) steps are proposed for the preparation of soil and the addition of topsoil to increase the revegetation success at the disturbed areas associated with the focus areas.

- **Step 1:** Rip the disturbed soil, including areas where alien invasive plant species and areas where infilled material were removed to a depth of 100 mm. Ripping of compacted soil should preferably be undertaken when the soil is dry to increase soil decompaction;
- **Step 2:** Loosen all compacted soil using manual methods. Rotary decompaction equipment may be used for soil decompaction and to aerate soil for revegetation to be undertaken during Task 5;
- **Step 3**: Spread topsoil evenly over the ripped surface to a minimum depth of 300 mm. Topsoil used for rehabilitation must have comparable soil characteristics of the focus areas and must be free from alien invasive plant species seeds and weeds;
- **Step 4:** Ensure the final prepared topsoil surface follows the natural topography of the surrounding landscape and the natural topography of the landscape to ensure water flows in a natural way within the landscape;
- **Step 5:** in steep areasCover topsoil with a stalked biodegradable textile geotextile (such as Geojute®) blanket or other plant fibre-based geotextiles subject to decomposition. The use of the geotextile will aid in the stabilisation of soil, prevent erosion and sedimentation of the wetlands. This is particularly essential to be used at areas where steep slopes are evident; and
- **Step 6:** Extend the geotextile beyond the edge of the area to be covered and secure with biodegradable stakes. Ensure there is maximum soil contact to minimise erosion underneath.

Task 5: Revegetation

Revegetation needs to commence within the rehabilitation areas soon after the soil has been prepared to prevent further AIPs proliferation and to provide a basal vegetation cover to limit sedimentation of the wetlands. The successful establishment of a vegetation cover will also

improve the wetland habitat, providing a preferred habitat with adequate vegetation density for faunal species dispersal.

Note: *All indigenous graminoid and sedge species mixes used for revegetation must be free from alien invasive plants, disease and pests. Pennisetum clandestinum (Kikuyu), alien and invasive vegetation species or potentially invasive and robust reed species e.g. Phragmites australis* (Common reed) and *Typha capensis* (Bulrush) *should not be used for revegetation within the wetlands.*

Revegetation: Disturbed areas along the CVB wetland and valley head seep Wetland

Disturbed areas within the 30m KZN Biodiversity recommended buffer associated with the valley head seep and CVB wetland should be reinstated with suitable sedges graminoid and shrub species as suggested in the list below in (Table 10).

Table 11: Suggested sedges and grass species for revegetation within the study area.

Sedges	Grass	Trees and shrubs
Cyperus textilis	*Eragrostis chloromelas*	*Rauvolfia caffra*
Cyperus prolifer	*Diheteropogon amplectens*	*Bridelia micrantha*
Cyperus dives	*Schizachyrium sanguineum*	*Mimusops zeyheri*
Cyperus latifolius	*Andropogon eucomis*	
Juncus kraussi	*Andropogon appendiculatus*	
	Digitaria eriantha	
	Eragrostis capensis	
	Imperata cylindrica	
	Chloris virgata	
	Chloris gayana	

The post-rehabilitation maintenance period should be at least 24 months, dependent on the seeding time and seasonal rainfall in this period to ensure the establishment of an adequate vegetation cover. Should an acceptable plant cover not be achieved within the specified post rehabilitation maintenance period, revegetation of these areas shall continue until at desired vegetation coverage of a minimum of 60% is achieved. Additional seeding or planting techniques e.g. hydroseeding may be necessary to achieve acceptable plant cover.

Task 6: Site Securing

The final and key task as part of Action 3 is securing the protection of rehabilitated areas from eventual external disturbances (unauthorised entry) which might affect rehabilitation activities' progress. Areas under rehabilitation need to be demarcated with a barrier or a temporary fence securing the revegetated area, which will increase the success of the establishment of a basal vegetation cover. The type of fence used, must not restrict the movement and migration of faunal species.

4.1.4 Action 4: Aftercare and monitoring

Prudent monitoring of the rehabilitated areas associated with the valley head seep and the CVB wetland 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 particularly for the monitoring of alien and invasive species, water retention and distribution patterns in the landscape. To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- Water quality monitoring (during construction activities and upon completion of the construction phase);
- Revegetation surveys;
- Site walk through surveys should be applied as the preferred method of monitoring (at specified frequencies) with specific focus on:
  - Erosion and sedimentation monitoring (for the duration of the raining season); and
  - Alien and invasive vegetation proliferation.
- All data gathered should be measurable and auditable (qualitative and quantitative);
- Monitoring actions should be repeatable; and
- Reports should present and interpret the data obtained.

Table 12 summarises data capturing for the monitoring programme.

Table 12: Data capturing for the monitoring programme.

Aspect	Monitoring Location	Frequency of sampling	Performance Indicator	Reporting Requirement
Water Quality	Water quality samples to be taken where water is available along the CVB, closest to the monitoring points as illustrated in Figure 16. The coordinates are as follows: 1 29°11'25.45"S; 31°23'33.65"E 2 29°11'20.83"S; 31°23'37.12"E	Baseline *in-situ* water quality assessment to be undertaken before construction commences with monitoring continuing until completion of all construction and rehabilitation. The water quality assessments should be undertaken monthly until rehabilitation activities were completed.	Monitor water quality (with a handheld water quality probe) for the physical water quality conditions during the rehabilitation phase for the following parameters: • pH; • Temperature; • Electrical Conductivity; • Total dissolved solids; and • Turbidity.	Reporting to be included as part of the annual ECO monitoring report to be submitted to the competent authority.
Erosion	Rehabilitated Areas	Visual inspections must take place after rainfall events for the first year. Annual erosion monitoring to be undertaken for the first-year post-rehabilitation.	To monitor the extent of erosion within the wetlands. Provide a report addressing the following: 1. Brief indication of the method of assessment; 2. Assumptions and Limitations must be listed; 3. Photographs and GPS point locations taken of existing erosion in the wetlands and wetland areas prior to and post rehabilitation activities must be incorporated into the report. 4. Any erosion observed must be discussed in detail; 5. Map indicating where erosion is present; and 6. Recommended mitigation and remediation actions should be presented.	Reporting to be included as part of the annual ECO monitoring report to be submitted to the competent authority.
Alien Invasive Species Plant Control.	Rehabilitated Areas	Monitoring must be undertaken as stipulated in the AIP control plan (Section 5 of the report).	To monitor the AIP control undertaken at the focus areas.	Reporting to be included as part of the annual ECO monitoring report to be submitted to the competent authority.
Revegetation	Rehabilitated Areas	Post rehabilitation monitoring to ensure that an appropriate trajectory is reached to ensure that rehabilitation targets are met. Although monitoring should take place as required, a minimum assessment of twice in the first year of development should take place.	To monitor the reinstatement of vegetation. The report needs to address the following: 1. A list of species occurring within the focus areas; 2. Discuss the density of species; 3. Fixed point photo (Taking photo at specific point within focus area to identify the success of revegetation; and 4. Focus areas requiring remedial action and proposed corrective actions.	Reporting to be included as part of the annual ECO monitoring report to be submitted to the competent authority.

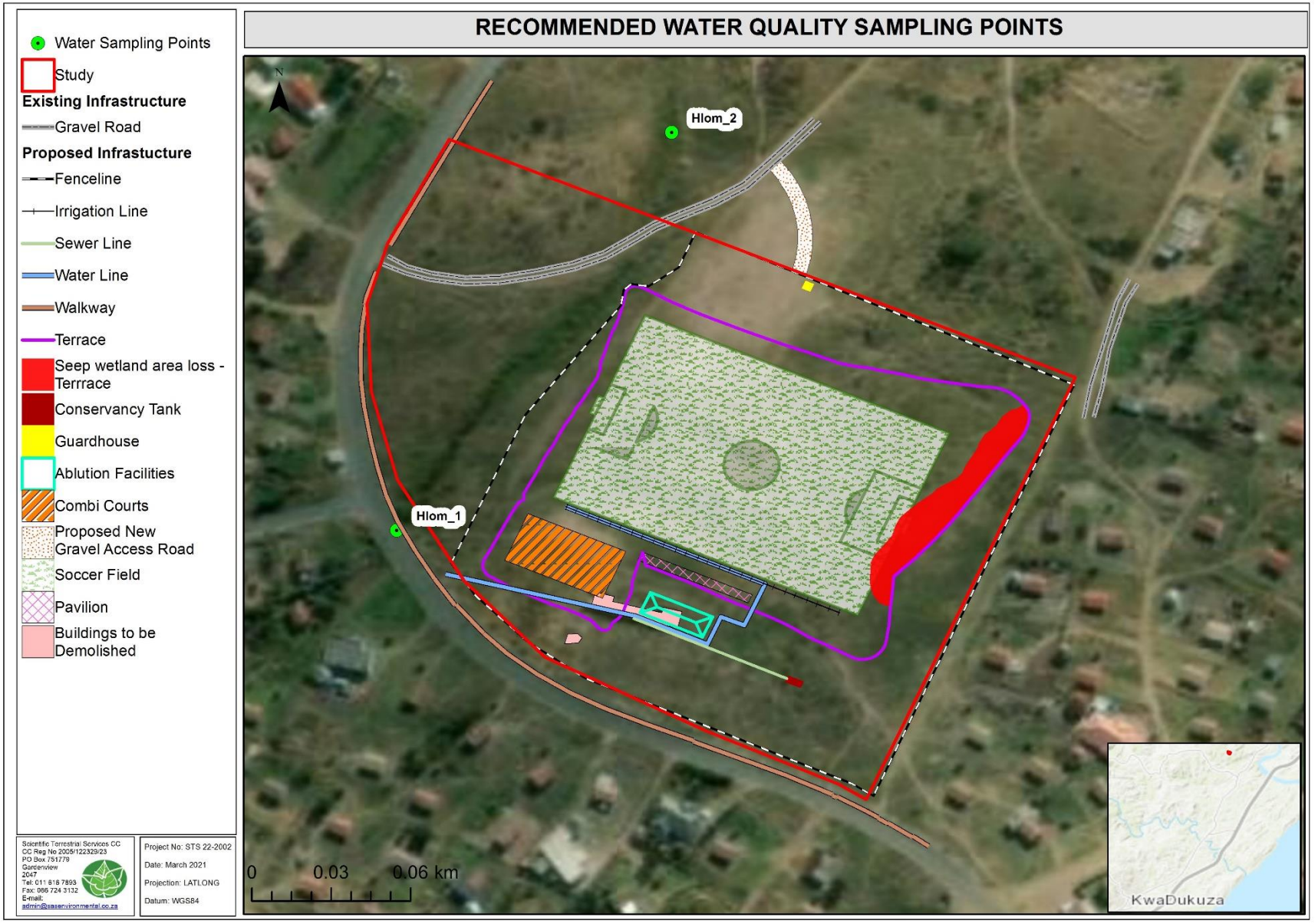


Figure 16: Digital satellite image depicting the in-situ water quality monitoring points in relation to proposed Hlomendlini sports field layout.

5. ALIEN AND INVASIVE SPECIES CONTROL AND MANAGEMENT PLAN (AIPCP)

This AIPCP is developed to ensure that the AIPs[4] are adequately managed within the study area at both the species level and the habitat level. The AIPCP has been developed in line with the guidelines for control and monitoring plans required by section 76 of the NEMBA for species listed as invasive (refer specifically to section 76(4) in Box 1).

BOX 1

NEMBA Section 76(4): An invasive species monitoring, control and eradication plan must include-

a) a detailed list and description of any listed invasive species occurring on the relevant land;
b) a description of the parts of that land that are infested with such listed invasive species;
c) an assessment of the extent of such infestation;
d) a status report on the efficacy of previous control and eradication measures;
e) the current measures to monitor, control and eradicate such invasive species; and
f) measurable indicators of progress and success, and indications of when the control plan is to be completed.

In preparing this AIPCP the following assumptions are applicable:

- This report only presents the initial control measures/guidelines and does not focus on follow-up or maintenance. Controlling AIPs is not a single occurrence, and follow-up control of all areas where AIPs have been cleared is essential for the project to be successful. This should be undertaken by the appointed contractor/mine personnel responsible for the implementation of the AIPCP, to monitor and control the re-establishment of seedlings;
- Additional AIP species not recorded during the initial or historic site assessments [2] can emerge from time to time as seeds are dispersed (either naturally or by anthropogenic means), and control methods would need to be adjusted accordingly. Information from previous studies and field experience within the area were used in conjunction with the field assessment to make appropriate conclusions and recommendations; and
- Timing of AIP control is essential as it must be done during the growing season, preferably before the flowering season. If not done this way, follow-up control will be extended/prolonged.

[4] In this report, AIP species refer to both "listed species" (as listed under the NEMBA: Alien and Invasive Species Regulations, 2020) and "problem plants" (species which are not considered listed alien species in the current NEMBA Alien Invasive Species List (2020), but which still pose a significant threat to the biodiversity and ecosystem functionality of the Hlomendlini Sports Field Boundary). Distinctions are made between the two categories where needed.

5.1 AIPCP Methodology / Approach

The approach of the AIPCP follows the recommendations of NEMBA 76(4), the recommendations of the Department: Forestry, Fisheries and the Environment (DFFE)[5] as well as the DFFE Guideline document[6] of 2015, as follows and discussed in the sections that follow:

- Carry out a site assessment;
- Set objectives based on resources available and priorities;
- Develop and implement an action plan to achieve objectives and
- Monitor performance and change actions as necessary

5.1.1 Carry out a Site Assessment

STS undertook a site assessment on 24 January 2022 to record the AIPs encountered and the assessment of the Priority Areas (PAs) requiring control. All AIPs encountered were recorded and photographs of the specimens were taken for record-keeping and identification purposes.

5.1.2 Set Objectives based on resources available and priorities

The objectives of the AIPCP includes:

- To ensure that AIPs are managed on site to reduce or completely eradicate their populations (where applicable) and to prevent AIPs from establishing in areas where they do not yet occur;
- To ensure that AIPs do not spread to areas outside of the study area and adjacent wetland habitats; and
- To recommend a monitoring programme to detect the presence of AIPs (early detection is key in AIP control) and to monitor the implementation and success of the AIPCP.

It should be noted that this report identifies areas and species of highest priority for control; however, it is the responsibility of the landowner to determine available resources for control and to allocate such resources to best meet the performance indicators set out in this report (see Section 5.1.4 and Appendix **E**).

[5] See e.g., https://www.dffe.gov.za/projectsprogrammes/wfw/alienplantcontrol_managementplan

[6] Guidelines for Monitoring, Control and Eradication plans as required by Section 76 of the NEMBA for species listed as invasive in terms of Section 70 of this Act.

5.1.3 Development of an Action Plan to achieve Objectives

As per the DFFE guidelines, the following approach has been taken for the development of the AIPCP to achieve the AIPCP objectives.

- **Compilation of a comprehensive AIP list**: a list of both invasive species and problem plants was compiled during the site assessment, with species recorded in previous assessments also incorporated into this list. For each species, the below data were recorded and is presented in this report (Section 5.3.2):
- **Defining Priority Areas (PAs)**: in line with the WRMP, key PAs have been identified to allow for the coherent management interventions based on the priority of control required AIPs at both the habitat and species level. For AIP PAs, the density of AIP infestation is not the only contributing factor, but the sensitivity of the receiving environment, the likelihood for further spread to surrounding natural areas, as well as potential corridors such as roads are also considered. The AIP PAs were classified as follows:

High Priority	Areas requiring immediate control. This includes i) areas where immediate control can significantly reduce further spread of AIPs, ii) areas of increased sensitivity where immediate control can drastically reduce impacts to sensitive areas that result from AIP proliferation (e.g., AIPs infestation in watercourses), and iii) areas of increased AIP abundance/dominance which hinders the establishment of indigenous flora.
Medium Priority	Areas to be controlled once initial control of high priority areas have been undertaken. Although these might include areas of high-density AIP stands, immediate control is not required as the risk of further spread is not considered as likely as opposed to the risk of spread of AIPs associated with High priority areas. These areas also include sections where AIP abundance/dominance was noticeably lower than for High priority areas.
Low Priority	Areas of low AIP density, or where AIPs consists of non-invasive species that do not pose a risk of spreading to new, uninvaded environments. Specific control and monitoring must be taken during the construction period, as this might change to a high priority category.

- **Control methods to be employed**: 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. **The scope of this report includes approaches and guidelines for initial control.** Follow-up control and maintenance will be the responsibility of the maintenance team in consultation with a suitably qualified contractor. Details on the AIP available species-specific control methods is provided in Appendix C, with more detail on AIP Control Planning presented in Appendix D.

All information gathered is presented on a map to allow for easier planning of control operations. AIP PAs must be amended and mapped as the AIPCP is updated.

5.1.4 Recommended Targets and Timeframes for the AIPCP

The DFFE 2015 Guideline recommends that the goals set out for the AIPCP should be "SMART", i.e.,

- **S**pecific (the nature and level of the performance required must be clearly identified);
- **M**easurable (the indicators chosen must be meaningful, easily understood and measurable);
- **A**ssignable (who will carry out the actions?);
- Realistic (what can realistically be achieved, given the available resources?); and,
- **T**ime-bound (the timeframe for the achievement of goals must be clear).

5.2 Monitoring performance and Change actions as Necessary

It is important that monitoring of the AIPCP as presented in Section 5.3.4 and Appendix F (Proposed Field Monitoring Form) 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 AIP must be performed to determine the extent of an infestation and to monitor if the AIP control program is efficient or not. The monitoring of the AIPCP details the below:

- What is to be recorded about the listed invasive species and about the implementation of the management plan in the land parcel;
- How and how frequently these data are to be collected;
- How the data are to be stored, and how they are to be analysed; and
- The frequency of the analyses and their evaluation and feedback to the Managing Authority should also be recorded.

5.3 Implementation of the Alien Invasive Control and Management Plan

The study area is approximately 3.5ha and comprises systems such as wetlands and grasslands. The study area is situated within a peri-urban rural community and is characterised by residential development and associated network of linear infrastructure (Figure 17) and therefore has an association with AIP species.

As per the Terrestrial Ecological Impact Statement report undertaken by Scientific Aquatic Services (2021b)[7], the habitats associated with the study area can be divided into (i) **transformed areas**, such as residential areas, existing paved and gravel roads, (ii) **open veld areas (grassland)**, including historic construction dumping areas that have been left to recover without rehabilitation, and (iii) **wetland habitat**, comprising areas of increased moisture (watercourses as per the NWA). The open veld areas generally had a low to medium abundance of AIPs, with an increased abundance of AIPs observed within areas where historic dumping took place but was never rehabilitated. The CVB wetland and associated culverts as well as the valley head seep wetland generally had a medium to high abundance of AIPs.

The subsequent sections provide the data collected for species (section 5.3.1) and habitats (section 5.3.2) during the field and background data investigations. These sections provide the control methods required at both the species level and the habitat level.

Figure 17: Historic (2006) and current (2021) land uses associated with the study area.

5.3.1 AIP Priority Areas

Successful plant invasions are most likely if (i) the alien plant has the necessary characteristics to make it invasive in a novel environment and (ii) the environment is susceptible to being invaded (Vicente et al. 2013). As such, to determine priority areas, firstly the invasiveness of the species was examined as per section 3.1 (based on site observations, NEMBA category and available literature), thus targeting AIP management at the species level. Priority areas, however, were determined at the **habitat level**, examining the susceptibility[8] of a site to

[7] SAS. 2021b. Terrestrial Ecological Impact Statement as Part of The Basic Assessment Process for The Proposed Hlomendlini Sports Field and Associated Infrastructure In Mandeni, KwaZulu Natal Province.

[8] The susceptibility of the novel habitat to invasion is also an important factor, since it can either inhibit or provide the ideal conditions for the alien to thrive (Rejmánek et al. 2005).

become invaded (including factors such as availability of dispersal pathways, sensitivity of the environment, and current level of infestation).

The study area was divided into three categories of control priority, i.e., high, medium and low. Most of the study area obtained either a **high** or **medium** priority score, whereas only a small section was regarded to be of **low** priority for control.

Where AIPs were particularly abundant, e.g., within the wetland areas and historically degraded and transformed areas, a high priority was assigned (Figure 20). Example photos of High Priority areas are provided in the below figure. The AIP tree stands were examined utilising historic aerial photography and Google satellite imagery and it was evident that there was no indication of these stands spreading to nearby natural habitat.

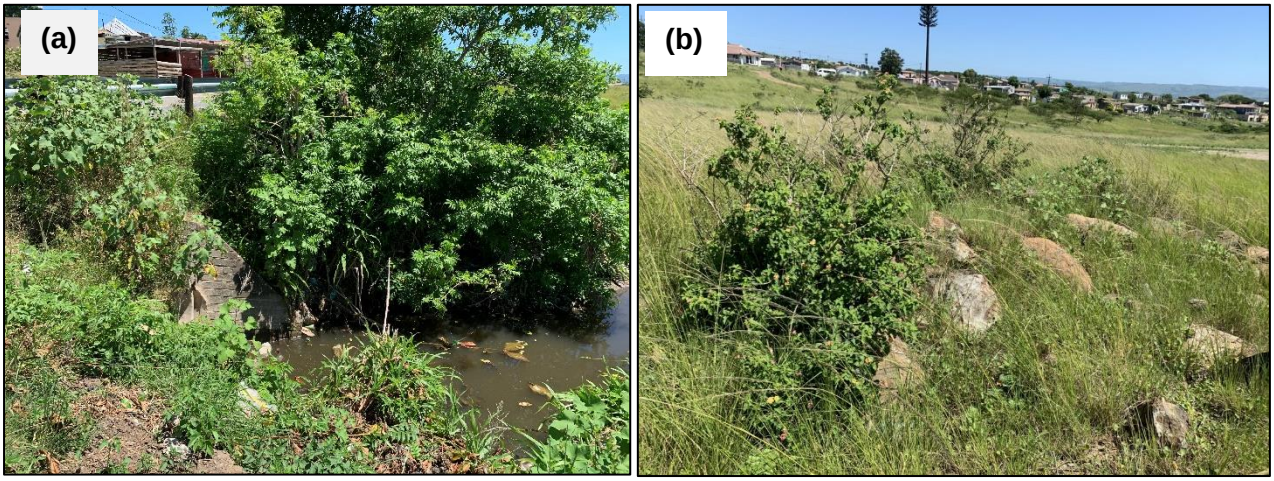


Figure 18: Example photos of areas considered high priority for targeting AIPs as part of the AIPCP. These include areas with high abundance of (a) habitat serving as corridors of spread, areas with high abundances of AIPs (b) and those susceptible to become invaded, associated with the wetland areas and historically disturbed areas.

Medium PAs were associated with either moderate abundances of AIPs or lower diversities of invasive species. Medium PAs included the majority of open veld areas where the terrace associated with the sports field would be constructed, areas where the supporting infrastructure would be constructed as well as the valley head seep wetland, requiring initial control. Only the small patches of AIP species scattered across the open veld were classified as Low PAs due to the absence of invasive species and/or the absence of an abundance of AIPs.

Figure 19: Example photos of Medium Priority areas (associated with the open veld and transformed areas). Despite being generally associated with medium AIP abundances, the AIPs that are present are typically considered serious invaders

Table 17 below tabulates the PAs as identified within the study area and provides additional justification for their priority classification. Refer to Figure 20 for a depiction of the PAs within the study area[9].

Table 13: AIP PAs for targeting AIP species that were identified within the study area.

Priority	Area	Justification
HIGH	AIP tree stands within wetland habitats	- The stand of *Tecoma stans* within the CVB wetland is of high concern.
	Areas where historical construction rubble dumping took place and was never rehabilitated	- **Important/ significant habitat**. As part of the rehabilitation requirements, alien vegetation management is essential to ensure the post-construction goals are met. - **Source population**. Given the sheer number and diversity of AIPs within these areas, further exacerbated by the extended association with AIPs and dispersal corridors, these areas are important source populations and have built up a seed bank that would likely need long-term, ongoing management. During the site assessment, it was noted that the open veld areas where historical dumping took place were infested with a medium to high abundance of AIPs such as *Lantana camara* and *Xanthium strumarium*. As such, using the topsoil for rehabilitation will thus further spread these species and hamper any AIP management and control that have already been implemented. Costs will be much higher than necessary in the long-term.
	Wetland and wetland buffers	- **Important/ significant habitat**. As mentioned previously, watercourses are corridors along which species disperse and should be managed to prevent ongoing movement and dispersal of AIPs within the study area and to neighbouring properties. - **Cumulative impacts**. Many of the AIPs recorded within the study area pose threats to biodiversity and watercourses. As such, their dispersal along watercourses must be prevented seeing that the development and the surrounding areas are associated with habitat of biodiversity significance.

[9] Due to the size of the study area and relatively low AIP species found on site, the AIP priority areas are represented in a dot distribution map to indicate areas that should be prioritized for AIP removal and control.

Priority	Area	Justification
MEDIUM	Open veld associated with terrace and support infrastructure areas	- **Medium abundance of AIPs**. These areas are fully transformed and actively used construction. As such, there is little opportunity for AIPs to become highly abundant in these areas. However, these are simultaneously associated with increased disturbances and therefore provides ideal conditions for the establishment of AIPs. This was particularly evident along the edges of these areas where AIPs were more abundant. - **AIP invasiveness**. The species recorded in these areas were not only problem plants but mostly included listed AIPs (category 1b). - **Linkage to dispersal corridors.** Several road networks surround and traverse these areas, facilitating the spread of AIP propagules to other areas.
LOW	Open grassland	- **Low AIP abundance**. Hardly any listed AIPs were recorded in this area, however, as a whole, the AIPs in the grasslands pose the smallest threat to AIP spread.

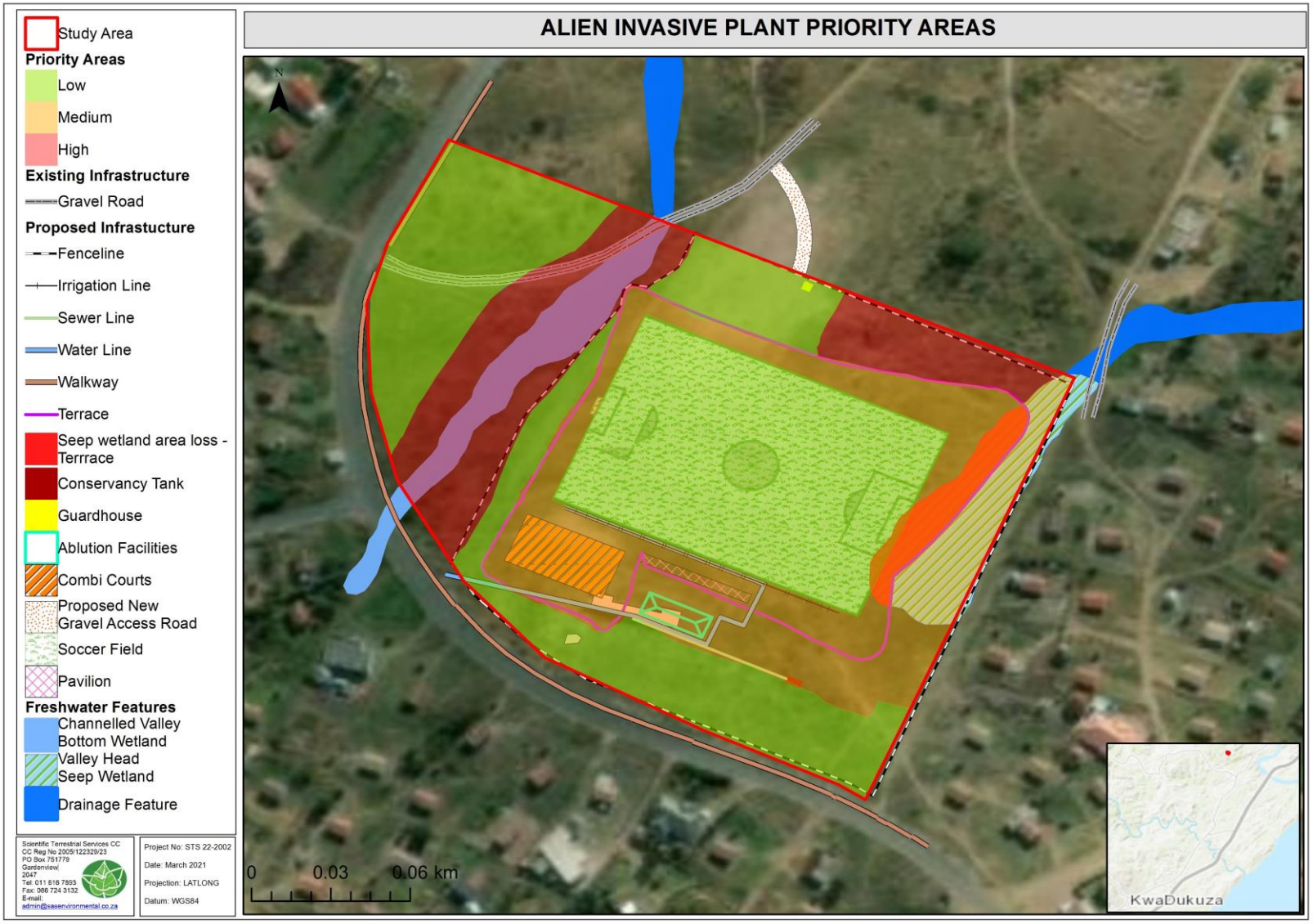


Figure 20: Priority Areas for the AIPs associated with the study area.

To best achieve the objectives set out in this report, it is recommended that control of AIPs within the areas of High Priority must be targeted first, moving on to the Medium PAs thereafter. Upon completion of initial control, follow-up control measures should be tackled in early spring before the rainy season starts (i.e., before flowers mature and set seed) to reduce the potential for flowers to mature and set seed; however, species-specific control times should be considered first. The boundary around the PAs is also important to monitor throughout the year to limit the spread and escape of AIPs to natural areas. The following guidelines must be used for different stages of control. For further detail, refer to Appendix C and D within this report:

- Stage 1: High PAs with dense infestation must be controlled by working from the centre and the outer edges and moving toward each other.
- Stage 2: Sparsely infested areas within High and Medium PAs must be cleared concurrently.
- Stage 3: Scattered individuals adjacent to dense infestations should be controlled, while edges of dense infestation must be prevented from extending and spreading further.
- Stage 4: Small isolated infestations must be cleared, starting with young, less dense sections to control the invasion and prevent the build-up of seed banks.

5.3.2 Comprehensive list of AIPs and species-specific control measures

In total, seven (7) AIP species were recorded across the study area, of which five (5) species fall under NEMBA category 1b (control required – Table 13), and two (2) species not listed (Table 14).

Species listed under Category 1b are presented first as these species are regarded as high priority species in the Regulations. The conditions of the regulations are as follows:

GN number R.1020: Alien and Invasive Species Regulations (2020): Chapter 3. Category 1b Listed Invasive Species

1) Category 1b Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as **species which must be controlled**.
2) A person in control of a Category 1b Listed Invasive Species must control the listed invasive species in compliance with sections 75(1), (2) and (3) of the Act.
3) If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must control the listed invasive species in accordance with such programme.

4) A person contemplated in sub-regulation (2) must allow an authorised official to inspect a property as provided for in terms of section 31K of the National Environmental Management Act and to monitor, assist with or implement the control of the listed invasive species, or compliance with the Invasive Species Management Programme contemplated in section 75(4) of the Act.
5) The Minister may require any person to develop a Category 1b Control Plan for one or more Category 1b species, which plan must be submitted to the Minister for approval, and such Control Plan must include the following:
    a) species identification;
    b) extent of invasion;
    c) control measures to be used;
    d) an action plan or schedule including timeframes for the clearing of each species;
    e) whether or not any species can be utilised as biomass; and
    f) any other information which the Minister may require.

Table 14: All AIP species identified in the study area and falling under NEMBA Category 1b.

Scientific name	Common Name	NEMBA category	Abundance	Environmental threats / known impacts	Prioritisation	Risk of spread / invasion
WOODY SPECIES						
Tecoma stans	Yellow bells	1b	Medium to High in wetland areas/wetter habitats	One of the most widespread of all alien invaders in South Africa and is commonly found along streams, on railway embankments and in waste areas. It establishes itself where it replaces indigenous vegetation, block waterways and is generally unsightly.	High	High
HERBACEOUS SPECIES						
Lantana camara	Lantana	1b	Medium to high in wetland areas and open veld	Forms extensive, dense and impenetrable thickets in forestry plantations, orchards, pasture land, waste land and in natural areas. The rapid spread of L. camara is associated with human induced disturbance	High	High
Xanthium strumarium	Large cocklebur	1b	High in wetland areas and where historical dumping has taken place and Medium in open veld areas	Competes with crop plants and indigenous species along riverbanks. Its spiny burs adhere to the wool of sheep wool and becomes entwined in tails, manes and coats of domestic livestock, causing the animals much discomfort. The seedlings are particularly toxic to domestic livestock. It readily invades overgrazed pastures and spreads at the expense of the indigenous species.	High	High

Scientific name	Common Name	NEMBA category	Abundance	Environmental threats / known impacts	Prioritisation	Risk of spread / invasion
Solanum mauritianum	Bugweed	1b	Medium in open veld and degraded areas	Forms dense spreading infestations which compete with crop plants. It is extremely difficult to eradicate as it has deep, spreading roots and the ability to regenerate from small root fragments. The plants are poisonous and unpalatable	Medium	Medium
FORBS						
Verbena bonariensis	Wild Verbena	1b	Moderate in wetland habitat	It is poisonous to livestock and invades roadsides, disturbed places, moist areas and grasslands.	High	High

Table 15: All AIP species identified in the study area that are listed as problem plants.

Scientific name	Common Name	Abundance	Environmental threats / known impacts	Prioritisation	Risk of spread / invasion
HERBACEOUS SPECIES					
Bidens pilosa	Common Blackjack	Occurred as small clumps	Aggressive weed in South Africa but has not yet been determined to be invasive. *Bidens pilosa* is a hardy weed capable of invading a vast range of habitats including grassland, heathland, forest clearings, wetlands, plantations, streamlines, roadsides, pasture, coastal areas and agriculture areas	Low	Low
FORBS					
Conyza bonariensis	Flax-leaf fleabean	Low and scattered across open veld	Major weed in South Africa but not yet deemed invasive	Low	Low

Species-specific Control Measures

Species-specific control measures are presented below for species that have registered herbicides (Table 15). Where herbicides are not recommended or registered for control, Table 16 provides a list of control measures for these species.

Table 16: Control options (as provided by Working for Water Alien Species and Herbicide List V2.9 AIP species). Hand pull only refers to seedlings (Campbell, 2000). Care Must be given as to not use herbicides containing Glyphosate close to water bodies. Refer to Marer (1999) for use of safe methods for herbicides.

Scientific Name	Herbicide registration status	Size class	Treatment method	Herbicide	Trade name	Dosage (mℓ / g)
Lantana camara	Registered	Young	Foliar spray	• Glyphosate (as isopropylamine salt) 480 g/L SL	• Seismic	• 300
Verbena bonariensis	Registered	Young	Foliar spray	• Glyphosate (as isopropylamine salt) 360 g/L SL	• Springbok	• 300
Xanthium strumarium	Large cocklebur	Young	Foliar spray	• 2.4D (as dimethylamine salt) 480g/L SL	• 2.4-D Amine	• 150

Table 17: Control measures for species not having registered herbicides (www.sanbi.org/resources/infobases/invasive-alien-plant-alert).

Scientific Name	Common Name	Treatment method
Conyza bonariensis	Flax-leaf fleabean	Shallow cultivation and pre- and post-emergence herbicides. Pre-emergence herbicides are recommended for the control of *Conyza* species (Bromilow, 2018). Where shallow cultivation and post-emergence herbicides will be applied, it must be done before the plant forms a rosette. **Resistance to glyphosate has been recorded for *Conyza bonariensis*. Cabi physical control: "*C. bonariensis* establishes from a small seed and the initial rosettes are readily destroyed by tillage. Once established, however, the plant becomes more difficult to control mechanically. Soil solarization is surprisingly ineffective (Silveira et al., 1988)[10]."
Bidens pilosa	Common Blackjack	Hand pull and post-emergence herbicides. Bromilow (2018) recommends that for both physical and chemical control should aim to prevent seeding so to reduce the seedbed. The Cabi website also lists both physical and chemical control as methods of control. For physical control the site recommends "persistent mowing, hoeing and hand pulling in order to prevent seed production". For chemical control, the use of "the use of herbicides such as glyphosate-trimesium, oxyfluorfen, atrazine, 2,4-D glyphosate, pendimethalin, metribuzin, diuron, paraquat, nicosulfuron, and simazine" have been recorded. However, both Bromilow (2018) and Cabi mentions that some biotypes of Bidens pilosa have developed resistance to certain herbicides. As such, physical control is recommended where chemical control reaches its limits.
Solanum mauritianum	Bugweed	Hand-pull, Cultivation and Pre- and post-emergence herbicides. Bromilow (2018) indicates that this it is easy to remove and control this species with both physical and chemical control methods. For physical control, both hand-pulling and cultivation has proven successful. The Cabi site further mentions that controlling these species with physical methods should be carried out before the plant flowers for best and quickest results. The species is susceptible to most conventional pre- and post-emergence herbicides

[10] Silveira HL, Caixinhas ML, Leitao A, Gomes R, 1988. Evolution of actual and potential weed flora after soil solarisation. VIIIe Colloque International sur la Biologie, l'Ecologie et la Systematique des Mauvaises Herbes, Paris, France: A.N.P.P., Vol. 1:59-69.

5.3.3 Recommended Targets and Timeframes for the AIPCP

Following the "SMART" approach, the below list provides the recommended targets and timeframes for the implementation of the AIPCP. It should be noted that the recommendations will be restricted by available manpower and funding. As such, this should merely be seen as a guideline and the Environmental Control Officer (ECO)/ landowner / body corporate should make use of the form in Appendix D to populate their own targets and timeframes which will fit into the mine's budget.

- **Specific Goal**: Clearance of all priority AIPs.
- **Measurable Goal**: AIP cover reduced to less than 10% of current occupied area.
- **Assignable Goal**: ECO and relevant contractors.
- **Realistic Goal**: Clearance of all AIPs within the Low and Medium PAs by the end of the AIPCP, with 90% of AIPs cleared and actively managed within the High PAs on an ongoing basis.
- **Time-bound Goal**: The overarching goal is to reduce the canopy cover of Listed Invasive Plant Species in the relevant area by 25% of its initial value by the end of year 1 of implementation, by 50% of this initial value by the end of Year 2, by 70% by the end of Year 3, and by 90% by the end of Year 4.

It is recommended that by the end of the 1st year of implementation the SMART approach be re-evaluated to see what was achievable and what was not.

5.3.4 Monitoring Requirements

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 to such an exercise (DEA Biosecurity 2015). Principles that should be followed as part of the monitoring of the AIPCP are presented in Table 18 below. Refer to Appendix F for a proposed field form to be used during monitoring activities.

Table 18: Maintenance activities & monitoring.

AIM:	Implementing maintenance activities and monitoring the re-emergence of AIP species.	**MOTIVATION**	There will always be some measure of regeneration of the cleared AIPs after the initial clearing work has been done. Appropriate follow-up work is thus essential and should be conducted regularly. If follow-up clearing is not done, the progress made in the initial clearing exercise will be lost within a few years as the AIPs become re-established. Additionally, to assess the impact of the clearing activities, follow-up and rehabilitation efforts, monitoring must be undertaken.

MAINTENANCE & MITIGATION MEASURES	
1	Monitoring of each of the AIP PAs should include the following (Refer to Appendix F): - Name or number of the AIP PAs; - Global Positioning System (GPS) location of the AIP PAs; - Date of assessment; - Description of the issues associated with each AIP PAs, e.g., vegetation clearing required and/or debris and runoff damage; and - Priority of the maintenance tasks.
2	The following principles should be followed to ensure adequate future management - After the implementation of initial control methods, the identified alien communities should be assessed in monthly intervals for a period of three months after the initial treatment to control any species that may re-sprout. Thereafter an annual assessment of the alien vegetation stands should take place after the spring flush of each year but prior to seed formation. The annual assessment should include: • Re-mapping (where applicable) of the extent of each alien vegetation community (AIP PAs). The areas mapped should then be compared to mapping done in the previous season. This will aid in determining if mitigation within each community is effective. • Determination of dominance by biomass and recruitment within each alien vegetation community. To identify any dominant species that may become a threat to the natural vegetation.
3	Preventing new AIPs from establishing is more cost-effective than implementing continual clearing programs. Consequently, un-invaded areas must be protected from invasion through the establishment of indigenous vegetation in disturbed or cleared areas.
4	All areas disturbed within watercourses should be monitored for erosion and incision.
5	Maintenance schedule to be strictly followed: - Monitoring and maintenance of emerging alien vegetation and the re-emergence of seedlings to take place annually. Remove by hand-pulling as far as possible.
6	All disturbed areas (where AIPs have been removed (especially where large infestations have been cleared), or as a result of construction activities) should be re-vegetated with an indigenous grass species mix, in consultation with a botanist / horticulturist, ensuring that only indigenous grasses, herbs and shrubs are used.
7	An active campaign for controlling invasive species must be implemented within disturbed zones to ensure that it does not become a conduit for the propagation and spread of invasive plants.
8	Photographs of the site should be taken to assist the process of monitoring the impact of the clearing programme.
9	Liaison with surrounding stakeholders, and the local municipality to control upstream and surrounding nodes of seed production should be undertaken.

5.3.5 Roles and Responsibilities

The ECO or Environmental Manager is the person responsible for the monitoring of the implementation of the AIPCP during all phases of the AIP control activities and for reporting on the degree of compliance. Please refer to Table 8 for a detailed description of the ECO /Environmental Manager role.

5.3.6 Training and Awareness

AIP Control workers must receive basic training in environmental compliance, including minimisation of disturbance to the environment within the study area, as well as fauna and flora with a no-poaching policy, no animal or plant introduction policy, management of waste and prevention of water pollution. Initially the objective will be to control AIP within the study area, and once this has been achieved, new objectives must be clearly defined and implemented.

6. CONCLUSION

This WRMP includes suitable management and monitoring measures to effectively manage, maintain and improve the ecological integrity and functioning of the CVB and valley head seep wetlands associated with the proposed sports field. Furthermore, with the implementation of the AIPCP procedures outlined in this report, the potential negative impacts on the receiving environment may be reduced to acceptable levels. The information gathered through AIP monitoring programs will assist in a better understanding of controlling AIPs and the effect of AIPs on the receiving environment.

The purpose of the WRMP is to provide a tool to ensure that the proposed development, at a minimum maintains, or at best improves the ecostatus of the delineated wetlands within the study area. In addition, the WRMP outlines the appropriate actions as well as the responsible parties to ensure that any potential activities which could negatively impacts on the wetlands rehabilitated, managed and monitored. Furthermore, the WRMP aims to ensure that the wetland and associated buffer area forms a functional part of the landscape, which enhances the value of the proposed development while supporting the drainage features of within the study area.

In line with the overall WRMP, controlling AIPs within the study area is of the high importance. In this regard, species-specific control methods have been identified and summarised in this report to assist with targeting AIPs at the species level. However, when AIP management is planned, controlling AIPs at the habitat level is the best and most efficient way to ensure a successful outcome. In this regard, AIP PAs were identified, ranging from High to Low priority throughout the study area. It is recommended that High PAs and High Priority species be targeted first, moving on to Medium PAs and species, with Low PAs and species to be targeted last.

Therefore, this WRMP and AIPCP should be implemented by the proponent as soon as it has been approved by the relevant authorities and once the proposed has reached the phase at which rehabilitation activities becomes viable.

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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 available information. The report is based on survey and assessment techniques which are limited by seasonality, time and budgetary constraints relevant to the type and level of investigation undertaken as well as the project program and STS CC and its staff, at their sole discretion, reserve the right to 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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This report must not be altered or added to or used for any other purpose other than that for which it was produced without the prior written consent of the author(s). This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

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APPENDIX B: LEGISLATIVE REQUIREMENTS

Table A1 presents each legislative document and the aspects, which are pertinent to wetland management, including the rehabilitation of disturbed areas to a level that will promote improved water quality and aquatic ecology.

Table A1: Legal Requirements

The Constitution of the Republic of South Africa, 1996	The Constitution is the most important piece of legislation that provides a framework for environmental management in South Africa. There are various sections that have implications for environmental management, hence for sustainable development. The Bill of Rights is fundamental to the Constitution of South Africa and in, section 24 of the Act. Other sections in the Constitution that are of importance are section 32 which deals with the right of access to information; section 33 which provides for just administrative action; section 38 which deals with the extended locus standi provisions. Section 24 therefore places a duty on all spheres of government to take reasonable steps, including to make laws, prevent pollution, promote conservation and ensure sustainable development. While no permitting or licensing requirements arise from this legislation. However, this Act will find application during the rehabilitation phase of the project in proper management of the environment. This WRMP has been compiled for this purpose, to ensure that the environment is protected throughout the phases of the development.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operation, phases.
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 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 purposes defined or adopted by the competent authority. The following EIA Regulation triggers the need for this WRMP. 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; and (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.
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. **Government Notice number R.1020: Alien and Invasive Species Regulations (2020), including the Government Notice number 1003: Alien Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)** NEMBA is administered by the Department of Environment, Forestry and Fisheries and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This act in terms of alien and invasive species aims to: ➢ Prevent the unauthorised 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 minimise harm to the environment and biodiversity; and ➢ Eradicate alien 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, 2020): ➢ **Category 1a: Invasive species that require compulsory control**. Invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. These species need to be controlled and removed from all areas, including private property and officials from the Department of Environmental Affairs (DEA) Must be allowed access to monitor or assist with control. ➢ **Category 1b: Invasive species that require control by means of an invasive species management programme**. Invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. Category 1b species are major invaders that may need government assistance to remove. All Category 1b species Must be contained, and in many cases, they already fall under a government sponsored management program. ➢ **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 2 species are invasive species that can remain in private gardens, but only with a permit, which is granted under very few circumstances. These species should be monitored and controlled to prevent spread to areas outside of permitted areas. Any Category 2 plants outside permitted areas should be dealt with as stipulated in Category 1b. ➢ **Category 3: Ornamentally used plants that may no longer be planted.** These are invasive species that may remain in private gardens. However, these species may not be sold or propagated and must be controlled. In riparian zones (within 32 metres of the edge of a river, lake, dam, wetland or estuary, or within the 1:100-year flood line, whichever is the greater) or wetlands all Category 3 plants fall within Category 1b.
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.
	The conditions for Section 21(c) and (i) activities, in terms of Government Notice 509 of 2016 of the National Water Act, 1998 (Act No. 36 of 1998) require that a WRMP be developed and must address the following: 1. Identify a WRMP domain, preferably from a whole -catchment perspective; 2. Identify an accountable, representative body that should take unbiased custodianship of the WRMP and drive its implementation; 3. Identify key stakeholders; 4. Identify major drivers of watercourse disturbance and instability - human and natural, and their primary and secondary effects; 5. Complete a risk assessment as per the Department of Water and Sanitation (DWS) Risk Assessment Matrix for identified impacts and their mitigation activities. Refer to (SAS, 2020); 6. Solicit input from stakeholders on their priorities and objectives; 7. Define best practice measures for rehabilitation and maintenance implementation; 8. Design a plan for ecological monitoring which is specifically linked to the stated objectives; and 9. Develop an implementation programme and review mechanism. The report should contain supporting technical information used to ensure low risk to resource quality such as: a) Impact assessment and mitigation report completed by an independent consultant as required by the NEMA and the NWA; b) All the relevant specialist reports supporting the proposed mitigation measures; i. Specialists Reports must address the level of modification /risk posed to resource quality i.e.: flow regime, water quality, geomorphological processes, habitat and biota of the watercourses and contain Present Ecological State and Ecological Importance and Sensitivity data for relevant watercourses. c) Environmental Management Plan (EMP) giving effect to all actions required to mitigate impacts (What, When, Who, Where and How); d) Best practices applicable to these activities, where applicable; e) Generic designs and method statements, where applicable; f) Norms and standards, where available; g) Monitoring programme that must include "present day" conditions to be used as base line values; h) Monitoring, auditing and reporting programme (reports must be sent on request to the region or Catchment Management Agency (CMA); and i) Internalised controls and auditing, where applicable.
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)	In accordance with Regulation GN509 of 2016, a 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 and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; b) In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or c) A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their 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; iv) Conduct river and storm water management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. 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.

Guidelines for Biodiversity Impact Assessments in KwaZulu-Natal (Ezemvelo KZN Wildlife 2009)	**Riverine (perennial / non-perennial) Sensitivity Mapping** According to the guideline, a 30 m buffer from the edge of a drainage line is considered applicable for the drainage features identified within the investigation area.
Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (OHSA)	The Occupational Health and Safety Act (OHSA; Act 85 of 1993) was administered by the Department of Labour and aim to provide: ➢ Health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; ➢ Protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; and ➢ Establish an advisory council for occupational health and safety, which must provide for matters connected therewith.

APPENDIX C: AIP CONTROL METHODS AND PHASES

1. CONTROL GUIDELINES AT SPECIES LEVEL

Methods to be used to control specific species during the implementation of the AIPCP are as follow (Coetzee, 2005):

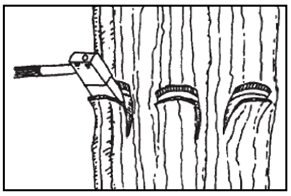
- Mechanical control which includes tree felling, ring barking and cut stump (refer to Table C1);
- Chemical control will entail using registered herbicides for a specific species, and one must adhere to the measurements on the product label. Avoid/Limit the use of chemical control methods within the watercourses and grassland, as this could contaminate water resources or have an adverse effect on indigenous flora; and
- A combination of chemical and mechanical control, where cut plants are treated with herbicide (Table C1).

Biological control or biocontrol methods involve the release of natural enemies that will reduce plant health and reduce population vigour to a level comparable to that of the natural vegetation (excluded from this report).

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 C1: 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	

Risk to Ecosystem	Infestation density & plant size targeted	Required Tools	Reference Photograph
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.			
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.	
Risk to Ecosystem	**Infestation density & plant size targeted**	**Required Tools**	**Reference Photograph**
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	

Risk to Ecosystem	Infestation density & plant size targeted	Required Tools	Reference Photograph
SLASHING			
<u>Low</u> 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. ***Costs are generally low for controlling annuals in this way, as no herbicide is required*.	
BRUSH-CUTTER			
Possible pollution caused by bar oil.	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[11].	Dense stands can be cleared. For felling large trees and can be used to cut logs and branches into shorter lengths. ***Common target species for felling include large specimens of Syringa, Pine, Gum and Wattle*.	A chainsaw	

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

Table C2: 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 / sponge 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 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	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.
	Scrape and Paint	Woody weeds	Knife or sharp blade Paintbrush, sponge, applicator bottle Herbicide	Scrape main or major stems of the plant. Apply herbicide immediately after scraping.
	Wick Wipe	Herbs, Bulbs and Rushes	Knapsack Vehicle-mounted tank Wick applicator Herbicide mix	Cover foliage thoroughly. Apply herbicide during active growth period.

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 C3 – C5 below specify the minimum required PPE for AIP clearing.

Table C3: 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	(With/without steel cap) long run. 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 spraying.
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.
Face mask	A face mask which covers the nose and mouth is essential when mixing herbicides and for foliar spraying.

Table C4: PPE for mechanised control.

Item	Specification
Chainsaw safety pants	Standard safety chainsaw and long 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 eye area, 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 C5: 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.

Initial Control Phase

Integrated Strategies to Control Alien Trees

Control of 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 listed in Table 5 in this report 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".

NB: The height of the cut stump must not exceed 15cm.

- **Methods for controlling trees:**
  - Cut stump treatment;
  - 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.

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.

Follow up treatment control must use the following methods:

- Chemical control methods: Only use registered herbicides to control any AIP species. Instruction on the herbicide labels must be followed carefully. Chemical control within watercourses to be avoided at all cost;
- Mechanical control methods; and
- Biological control methods that are available.

Control Methods for Dense Regrowth (Campbell, 2000)

After initial control operations, dense regrowth may arise, because of re-sprouting in the form of stump coppice, seedlings and root suckers. Below are the recommendations to combat 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

Control Methods for Low-medium Density Regrowth (Campbell, 2000)

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.

APPENDIX D: ALIEN AND INVASIVE PLANT CONTROL PLANNING

Principles of the AIPCP

To assist in achieving the objectives of the AIPCP, a set of principles were applied, which contributed to the formulation of action plans and specific management measures. The principles of the AIPCP are:

- Minimising impacts by limiting aspects of an action which could lead to environmental damage;
- Rectifying impacts through rehabilitation, restoration, etc. of the affected environment;
- Minimising impacts by optimising processes, structural elements and other design features;
- Provide ongoing monitoring and management of environmental impacts of a mine and documenting of any digressions/good performances; and
- The AIPCP, once approved for implementation by the relevant authorities, should be incorporated into the Environmental Management Plan (EMP) which is a legally binding document that all parties involved, as listed in Appendix C, must be informed about. AIPs can be very difficult to control and review of the AIPCP Must be done every two years in order to adapt the program as to ensure the AIPCP is up to date.

The following points are essential aspects to be avoided in order for an AIPCP to be successful (Coetzee, 2005):

- **Poor planning**: Occasional treatment by workers when time is available. AIP control is set out as a low priority and little to no consideration is given;
- **Impractical approach**: AIP control starting with densely infested AIP instead of lightly infested areas that are easier to control and more cost-effective;
- **Inflexible approach**: Not adapting methods of controlling AIP to changing weather or local conditions;
- **Improper use of control methods**: AIPs are not killed when treated, the herbicide that is used is incorrect and/or wrongly applied, as well as wrong application of control method in a season;
- **No control follow-up**: Areas that were treated are not revisited to treat any new growth or seedlings;
- **Absence of guidance**: Landowners are not always informed on how to get rid of AIP on their land. Workers that carry out the control methods do not always have the right training to do so and also received very little guidance; and
- **Not understanding the cost involved of control method**: Inexperience with AIP control methods usually result in inadequate financial planning.

Gathering of information (Campbell, 2000)

- The subject property/ AIP PA 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.

Planning all Aspects of the Control Program (Campbell, 2000)

- All required resources Must be listed for each PA e.g., equipment, herbicide, labour;
- Each area Must be evaluated and the correct registered herbicide for the AIP occurring in the specific area Must be used;
- Cost calculations Must be performed for each area and addressed according to priority; and
- Long-term AIP control funds Must be secured, as the success of the entire program will depend on it. Rehabilitation is a big factor and long-term commitment Must be secured, as neglecting to rehabilitate will increase the chance of AIP re-infestation.

During the planning phase, the points below Must be considered, and available funds Must be used optimally in order to effectively control AIPs:

- The following should be considered for the AIP control program to be successful:
  - Budget to estimate the cost of equipment and chemicals;
  - Transport and labour; and
  - AIP control programs are very expensive, and it is of utmost importance that cost, and planning estimates are done correctly, and that funding is used effectively.
- Goals and objectives for the project Must be clear so that the AIPCP can be shaped around other programs and help to achieve control of AIPs;
- The AIPCP Must be motivated in such a way as to keep it a long-term project, as it is of utmost importance that follow-up treatment is budgeted for and undertaken. This will ensure the success of the AIPCP within the PAs;
- The control plan Must be developed in such a way as to ensure that:
  - Annual input into the program is low; and
  - The level of impact of AIP on the environment is low;
- AIP control can be divided into phases, namely, initial control and follow-up control. The initial control is usually the most costly but, as the follow-up control is implemented, the cost of control is reduced until only a minimal cost is used at the maintenance level of control; and
- It is of utmost importance that the follow-up operations are budgeted and planned for, as neglecting to initiate and maintain a follow-up program will result in a denser infestation of AIPs after initial control. Follow-up operations Must also be done on a minimum of two to three follow-ups after initial control, especially during the first growing season, so as to control any coppice, saplings and seedlings that may be present. Follow-ups Must be done for a minimum period of five years to ensure that new infestation of AIPs do not occur and to ensure the success of the AIPCP.

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.

Record Keeping (Campbell, 2000)

- It is of utmost importance to keep records of all AIP control because it will set a baseline to compare to during the control phase;
- Records of labour days, herbicide volume and equipment used per site Must also be kept in order to ensure operations are kept within budget; and
- Sound record keeping will also ensure that the progress made with the control phase will be monitored. Feedback from the record-keeping can be used to update and amend the budget for the follow-up control operations to control the regrowth of AIP.

APPENDIX E: PROPOSED FIELD FORM FOR MEETING TARGETS AND TIMEFRAMES

Priority	Target Area	Specific Goal	Measurable Goal	Assignable Goal	Realistic Goal	Time-bound Goal
High	AIP tree stands within wetland habitats					
	Areas where historical construction rubble dumping took place and was never rehabilitated					
	Wetland and wetland buffers					
Medium	Open veld associated with terrace and support infrastructure areas					
Low	Open grassland					

APPENDIX F: EXAMPLE OF THE PROPOSED FIELD FORM FOR REPORT CONTENT

Date:					**Photo(s) of infestation:**
Name of recorder:					
MANAGEMENT UNIT DESCRIPTION AND INFORMATION					
Priority Area name:					
Priority Area number	**High 1**				
GPS location:					
AIP control present:	**YES**		**NO**		
AIP regrowth (Recruitment) present (where applicable):	**YES**		**NO**		
Description of Infestation:	(Species, Diversity, Abundance, Density, Extent, level of recruitment and trends.)				

Recommendations / Notes		
Overall Alien Plant Management Priority	High	The majority of the AIPs recorded at the culvert was present in relatively dense stands and threaten to disrupt the flow through the culvert if not managed. The clearance of species falling under NEMBA Category 1b are given a high priority despite being present in low quantities – by law required to be removed The AIP cover consists mainly of herbaceous species, thus manual and mechanical clearing is suitable.

ALIEN AND INVASIVE PLANTS: INSPECTION SHEET						
Check box	**Species Name**	**Common Name**	**NEMBA Category**	**CARA[12] Category**	**Estimated cover (High /Medium /Low)**	**Priority (High /Medium /Low)**
WOODY SPECIES						
	Tecoma stans	Yellow bells	1b	1		
HERBACEOUS SPECIES						
	Lantana camara	Lantana	1b	**1**		
	Xanthium strumarium	Large cocklebur	1b	1b		
	Solanum mauritianum	Bugweed	1b			
	Bidens pilosa	Common Blackjack	NL			
FORBS						
	Verbena bonariensis	Wild verbena, Tall verbena	1b	1b		
	Conyza bonariensis	Flax-leaf fleabean	NL			
Additional AIP species found on site						

[12] Category 2: Commercially used plants may be grown in demarcated areas, provided that there is a permit and steps are taken to prevent their spread.
Category X: Proposed weeds and invaders.
Category 3: Ornamentally used plants may no longer the planted. Existing plants may remain, except within the floodline of watercourses and wetlands, prevent the spread.

APPENDIX G: DECLARATION AND SPECIALISTS CV'S

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

Nelanie Cloete MSc Botany and Environmental Management (University of Johannesburg)

Nosipho Makaya MSc Environmental Science (University of Kwa

Nqobile Lushozi MSc (GeoInformatics) (Stellenbosch University)

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

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	1401	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc Environmental Management (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	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)		

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

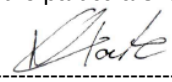
I, Stephen van Staden, declare that -

- 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, Nelanie Cloete, declare that -

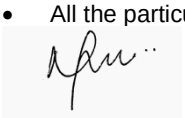
- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise 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, Nosipho Makaya, declare that -

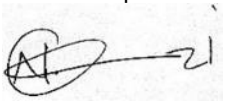
- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity 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, Nqobile Lushozi, declare that -

- I act as the independent 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

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

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF NELANIE CLOETE

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Botanical Science and Terrestrial Ecology
Joined SAS Environmental Group of Companies	2011

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 400503/14)
Member of the South African Association of Botanists (SAAB)
Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group
Member of the Grassland Society of South Africa (GSSA)
Member of the Botanical Society of South Africa (BotSoc)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Environmental Legal Compliance, Monitoring And Auditing	2021

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Eastern Cape, Free State
Africa - Democratic Republic of the Congo (DRC)

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Plant species and Landscape Plan

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
- Environmental Control Officer monitoring

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF NOSIPHO MAKAYA

PERSONAL DETAILS

Position in Company	Environmental Scientist
Joined SAS Environmental Group of Companies	July 2021

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Candidate Environmental Assessment Practitioner (EAP) of the Environmental Assessment Practitioner Association of South Africa (EAPASA) Registration Number: 2019/365

Member of the International Association for Impact Assessment of South Africa (IAIAsa), Member 4003

Member and Committee Member of the Institute of Waste Management Southern Africa (IWMSA), Member 10120040

EDUCATION

Qualifications

MSc Environmental Science (University of KwaZulu-Natal)	2018
BSc (Hons) Geography and Environmental Management (University of KwaZulu-Natal)	2015
BSoc Sc Geography and Environmental Management (University of KwaZulu-Natal)	2014

Short Courses

Mine Closure and Recent Case Law	2019
IWMSA Waste Legislation	2020
Wetland Back-2-Basics	2020
Environmental Legal And Compliance, Monitoring And Auditing	2021

AREAS OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental Authorisation Applications (Basic Assessments / Scoping and Environmental Impact Assessment / 24 G Rectification Application/ Exemption Environmental Applications
- Environmental and Water Use Monitoring and Audits
- Freshwater Resource Management and Monitoring as part of EMPR and Water Use Licence conditions
- Monitoring as part of EMPR and Environmental Authorisation Conditions and other Permits
- Environmental Management Programmes
- Environmental Feasibility Studies
- Site Selection

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF NQOBILE LUSHOZI

PERSONAL DETAILS

Position in Company	Freshwater Ecologist Wetland and Aquatic Ecology
Joined SAS Environmental Group of Companies	April 2019

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa
Member of the South African Wetland Society (SAWS)
Member of the South African Council for Natural Scientific Professions (SACNASP Reg No - 124679)

EDUCATION

Qualifications

MSc Geoinformatics (Cum laude) (Stellenbosch University)	2019
BSc (Hons) Environmental Sciences (University of KwaZulu-Natal)	2015
BSc Environmental Sciences (University of KwaZulu-Natal)	2014

Short courses

Tools for Wetland Assessment (Rhodes University)	2020
Grass Identification Course (Africa Land-Use Training)	2021

AREAS OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans

Aquatic Ecological Assessment and Water Quality Studies

- Toxicological Analysis
- Surface and groundwater quality Monitoring
- Screening Test
- Mass and salt balance determination