Wetland Rehabilitation Plan for the Lanseria Wastewater Treatment Works & Stormwater Infrastructure Project

Lanseria, City of Johannesburg Metropolitan Municipality, Gauteng, South Africa

July 2024 (Updated December 2024)

CLIENT

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

Report Name	**Wetland Rehabilitation Plan for the Lanseria Wastewater Treatment Works Project**	
Submitted to	ZITHOLELE CONSULTING	
Writer (Update)	**Divan van Rooyen** Can Sci Nat 151272	
Writer / Reviewer	**Andrew Husted** Pr Sci Nat 400213/11	
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2014 (as amended). We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principles of science.	

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DECLARATION

I, Andrew Husted, 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 Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Andrew Husted

Freshwater Ecologist

The Biodiversity Company

July 2024 / December 2024

I, Divan van Rooyen, 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;
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Divan van Rooyen

Freshwater Ecologist

The Biodiversity Company

December 2024

1 Introduction

The Biodiversity Company (TBC) was commissioned to compile a wetland rehabilitation and supporting monitoring plan for the proposed Lanseria Wastewater Treatment Works (WWTW) and additional stormwater infrastructure project in the City of Johannesburg Metropolitan Municipality, Gauteng, South Africa.

In addition, TBC was commissioned to compile an updated assessment of wetland systems associated with the access roads leading to the proposed Lanseria WWTW. Information pertaining to the delineation and functional description of these systems has been included in this assessment.

A wetland rehabilitation plan is required for the degraded wetlands in accordance with the requirements of the Department of Water & Sanitation (DWS) and in terms of the National Environmental Management Act (NEMA) and National Water Act (NWA) with regards to wetland protection and remediation.

1.1 Project Wetlands

The following is summarised from the wetland study completed by TBC (2017):

- A single wet season survey was conducted on the 23 November 2015. In addition to this, the proposed road and pipeline alternatives were assessed on 6 and 8 November 2016;
- Three wetland types were identified and delineated, these included valley bottom (channelled and unchanneled) and hillslope seepage systems. A riparian areas associated with the Jukskei River was also delineated;
- The ecological status of the wetlands was determined to be moderately modified (class C);
- The provincial authorities require buffers of 100 m and 50 m to be established for rivers/streams and wetlands in non-urban settings respectively. Buffer zones of 15 m and 18 m were determined (based on prescribed mitigation) for the construction and operational phases respectively;
- The proposed WWTW footprint area does encroach within the delineated wetland (and buffer) areas. Loss of wetland areas could not be avoided. As a result of this, the consequence of this was considered to be majorly negative due to the extent of lost wetland (and buffer) area. The significance of the remaining aspects (impacts sources) was determined to be minor without mitigation, with the significance being reduced to negligible for the majority of the aspects;
- A total wetland area of 0.76 ha will be lost as a result of the proposed WWTW which translates to a 3.7% wetland area loss. The approximate percentage wetland area loss for the larger wetland catchment area is 0.1% (Table 1-1);
- The prescribed rehabilitation measures were intended to maintain the current ecological status of the system, but if possible, to improve on the overall status which was determined to be moderate (class C); and
- A key focus for the plan was the rehabilitation of the valley bottom wetlands. The size of the valley bottom wetland which is proposed to be rehabilitated for the study is 16.2 ha, indicating a wetland compensation (offset) ratio of 21:1 (Table 1-1).

Table 1-1 The details of the size of lost wetland area and offset opportunities

Aspect	Measurement
Size valley bottom wetland	16.2 ha
Size of wetland area lost	0.76 ha
Compensation ratio (suggestive only)	21 : 1

No formal wetland offset strategy was compiled for the baseline studies, with only a rehabilitation plan and supporting measures being proposed for the project area. These rehabilitation objectives and supporting measures are deemed adequate to achieve the necessary compensation.

1.1.1 Access Roads

Following the site visit conducted on the 3rd of December 2024, which is considered a wet season survey, two (2) wetland types consisting of four (4) Hydrogeomorphic (HGM) units were identified along the access roads leading to the proposed project site. These include, one (1) Unchannelled valley-bottom (UVB) and three (3) seep wetlands (Figure 1-1 and Figure 1-2).

Functional assessments of wetlands have been conducted exclusively for those wetlands deemed to be at significant risk due to the proposed project and associated activities. It is crucial to acknowledge that these wetlands have experienced historical impacts from existing road infrastructure and agricultural practices, which have collectively influenced their functional capacity, current PES, and ecological importance and sensitivity (EIS). HGM unit 1 (UVB) achieved an "Intermediate" score for ecosystem services, whereas HGM units 2 and 3 (Seeps) were rated within the "Moderately-Low" range. Additionally, all HGM units were classified within the "D – Largely Modified" and "E – Seriously Modified" categories for PES. Due to the critical and unprotected status of the wetland vegetation, and their location within areas designated as Critical Biodiversity Areas or Ecological Support Areas, all HGM units were assigned a "Moderate" EIS classification (Table 1-2).

Table 1-2 Ecological characteristics and buffer requirements of the freshwater features located along the access roads leading to the WWTW project site

Aspect	Present Ecological State	Ecosystem Services	Ecological Importance and Sensitivity (EIS)
HGM 1 - UVB	D – Largely Modified	Intermediate	Moderate
HGM 2 - Seep	E – Seriously Modified	Moderately-Low	Moderate
HGM 3 – Seep	E – Seriously Modified	Moderately-Low	Moderate

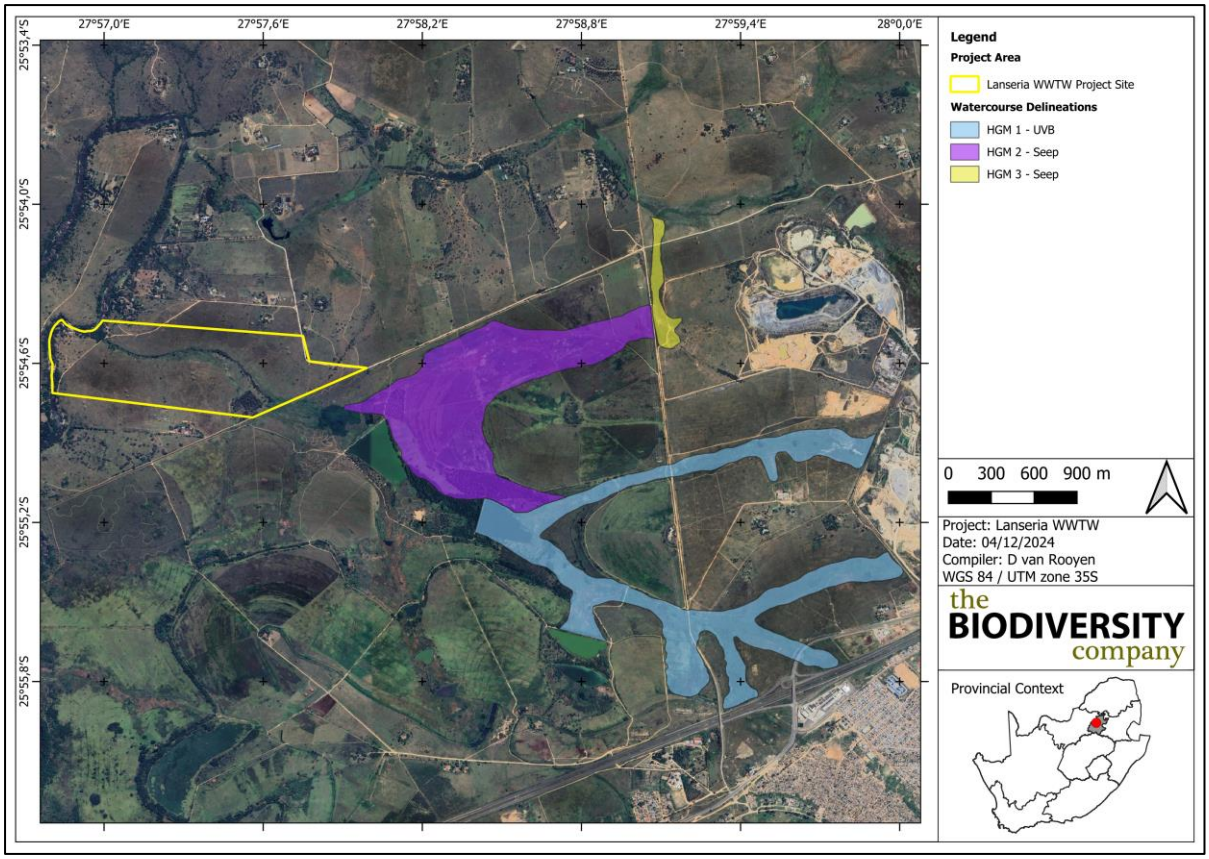

Figure 1-1 *Delineation of wetland features within the project area of influence*

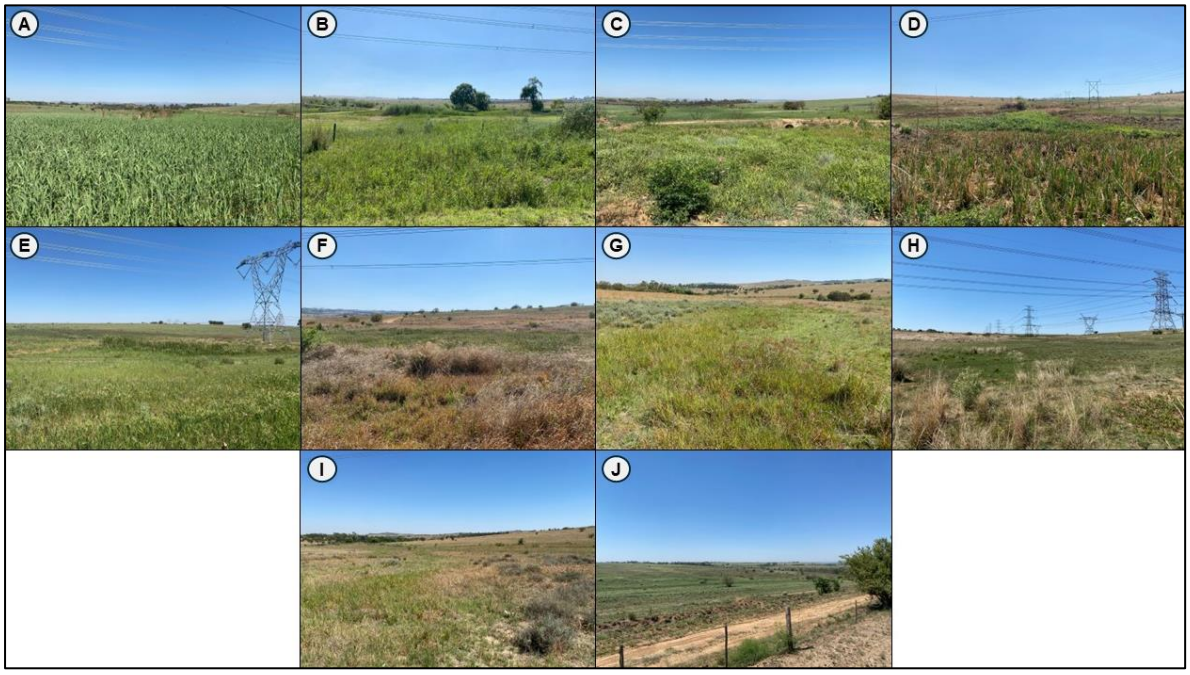

Figure 1-2 *Representative photographs of the different wet areas within the project area. A, B & C) unchannelled valley-bottom (HGM 1); D, E & J) Seep (HGM 2); F & G) Seep (HGM 3); and H) Seep (HGM 4)*

1.2 Terms of Reference

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- To inform and guide the rehabilitation of degraded areas; and
- Report compilation detailing the compiled rehabilitation plan.

2 Key Legislative Requirements

Section 24 of the Constitution of South Africa states that, '*everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development'*.

There are several legal stipulations that require wetlands to undergo rehabilitation. These stipulations are referred to in some capacity in the following Acts:

- National Environmental Management Act 107 of 1998 (NEMA);
- National Environmental Management: Biodiversity Act 10 of 2004 (NEM:BA);
- National Water Act 36 of 1998 (NWA); and
- Conservation of Agricultural Resources Act 43 of 1983 (CARA).

A key consideration is the requirement of 'duty of care' with regards to environmental remediation: stipulated in Section 28 of NEMA (National Environmental Management Act, Act 107 of 1998): '*Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot be reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment*.'

The National Water Act (No. 36 of 1998) stipulates requirements for rehabilitation of disturbed wetland areas: '*A person who lawfully impedes or diverts the flow of water in a wetland, or who alters the beds, banks or characteristics of a wetland must take necessary measures to stabilise the diversion structure and surrounding area through:*

- *rehabilitation of the riparian habitat using only indigenous shrubs and grasses;*
- *rehabilitation of disturbed and degraded riparian areas;*
- *restoring and upgrading the riparian habitat integrity to sustain a biodiverse riparian ecosystem;*
- *removal of alien vegetation, and*
- *conducting an annual habitat assessment*.'

These requirements have informed the rehabilitation plan which is intended to achieve the following:

- Allow for the trapping of sediment caused by adjacent deposition;
- To create diffuse streamflow across the wetland, ensuring prolonged saturation levels;
- The assimilation of toxicants, nitrates and phosphates; and
- Improve the ability of the systems to support biodiversity.

2.1 Rehabilitation Approach

A rehabilitation plan has only been compiled as a result in the direct loss of selected wetland areas. The rehabilitation plan will also include measures to address indirect impacts to the wetland areas that may occur because of the proposed project. Figure 2-1 presents the site development plan for the project. Efforts have been made (as detailed in the wetland report) to avoid direct impacts to wetlands and to further mitigate any unavoidable impacts. This strategy will present rehabilitation measures to facilitate the recovery of impacted systems.

Regarding the original' layout, a total wetland area of 0.76 ha will be lost as a result of the proposed WWTW. This loss translates to a 3.7% wetland area loss. The approximate percentage wetland area loss for the larger wetland catchment area is 0.1%. The details pertaining to the size of the wetland area and the calculated losses are presented in Table 2-1.

Table 2-1 The details of the size of lost wetland area resulting from the project

Aspect	Original Measurement	Revised Measurement
Size valley bottom wetland	16.2 ha	16.2 ha
Size hillslope wetlands	4.28 ha	4.28 ha
Total (combined) wetland size	20.48 ha	20.48 ha
Total size of project area	90.9 ha	90.9 ha
Size of wetland area lost	0.76 ha	0.3 ha
Percentage of total wetland area lost	3.7%	1.5%
Size of total wetland catchment area (approx.)	712 ha	712 ha
Percentage of wetland area lost for catchment	< 1%	< 0.5%

Table 2-2 below lists the rehabilitation actions that have been identified from the proposed layout, for which rehabilitation actions and objectives are provided. These actions are specific for the project components that will either result in a loss of wetland area (storm flow dam) or span the wetland area (bridges).

Table 2-2 The proposed rehabilitation actions and objectives to be considered

Crossing	Rehabilitation Action	Rehabilitation Objectives
Storm Flow Dam	• Demarcation of the footprint area • Removal of sandy colluvium • Stockpile, use or removal of soils from the site • Ensure permeability of the dam • Install energy dissipaters	• Reduce the extent of wetland loss • Prevent sedimentation of the watercourse. • Prevent contamination of the groundwater system. • Prevent the erosion and scouring of the watercourse at discharge
Pipe Bridge	• Crossing of the system at strategic areas • Foundations (ties) to be placed outside of the wetland area (within the buffer area) • Stabilising and support of wetland banks	• Avoidance of direct impacts to wetland areas • Maintain geomorphological integrity of the watercourse. • Maintain connectivity across the watercourse

2.2 Ecological Reserve

The Wetland Rehabilitation Plan was compiled to effectively manage the expectant project impacts to maintain, or preferably improve the ecological integrity and functioning of the wetland systems. The preliminary reserve determination and ecological categorisation that was undertaken for the Crocodile (West) Catchment, specifically the A21C quaternary catchment have been considered for the rehabilitation plan. The prescribed rehabilitation measures are intended to maintain the current ecological status of the system, but if possible, to improve on the overall status. The EcoClassification and preliminary reserve for the local system is presented in Table 2-3. The PES and EIS of the local wetland systems was determined to be moderate (Class C). The aim of the rehabilitation plan is to maintain this moderate ecological status, and not the Recommended Ecological Category (REC), of largely modified.

Table 2-3 The preliminary reserve based on present day flows

Water Resource	EWR Site	Catchment	PES	EIS	REC
Jukskei	2	A21C	E	Moderate	D

To maintain the current moderately modified state of the system, it is crucial that the implementation of the rehabilitation measures be concurrent with the development of the constructional phase of the project. The prescribed rehabilitation measures must be initiated at the onset of the project and continued throughout the construction of the WWTW. Aspects that have been considered for the rehabilitation plan include:

- Addressing key impacts associated with the project, with a focus on direct impacts to the wetland areas;
- The stabilisation of watercourse banks in order to maintain the geomorphological integrity of the systems;
- Re-vegetation of disturbed areas in order to prevent erosion;
- Preventative measures to address erosion, scouring and sedimentation of the watercourses; and
- The eradication of alien plant species from the project area.

A key focus for the plan is the rehabilitation of the valley bottom wetlands. The size of wetland area that will be lost as a direct result of the project is 0.76 ha. The size of the valley bottom wetland which is to be rehabilitated for the study is 16.2 ha, indicating a wetland compensation (offset) ratio of 21:1. The lost resulting from the updated layout is 0.3 ha, with a compensation ratio amounting to 54:1. The baseline study determined that the geomorphology and vegetation of the valley bottom wetland is largely modified. In order to compensate or offset the loss of hillslope wetland caused by the storm flow dam, the geomorphology and vegetation of the valley bottom wetland will be rehabilitated. The aim of the rehabilitation measures is to improve the ecological status of these components to moderately modified (Class C). The length of valley bottom wetland within Site 1 that will be rehabilitated for this project is approximately 1.3 km.

Table 2-4 The details of the size of lost wetland area and offset opportunities

Aspect	Original Measurement	Revised Measurement
Size valley bottom wetland	16.2 ha	16.2 ha
Size of wetland area lost	0.76 ha	0.3 ha
Compensation ratio	21 : 1	54 : 1

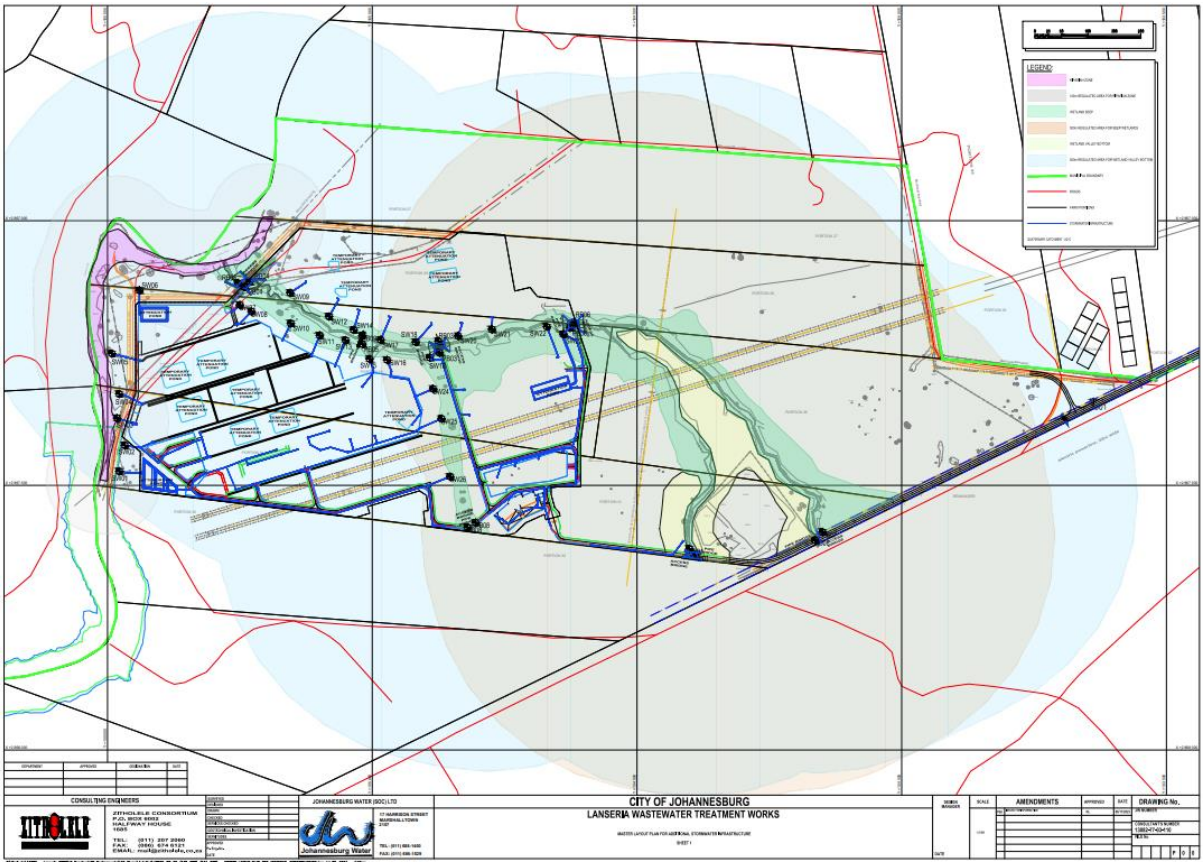

Figure 2-1 The site development plan

Table 2-5 The mitigation hierarchy requirements and accompanying comments

Category	Requirements	Comment
Avoid or Prevent	Refers to considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts.	The wetland assessment recommended buffer widths of 18 m for the development. Avoidance of direct impacts to the wetland has been achieved, with a further reduction in overall direct impacts to the systems.
Minimise	Refers to considering alternatives in the project location, sitting, scale, layout, technology and phasing that would minimise impacts.	The residual risks range predominantly from Minor Negative to Negligible, within one aspect rates as Moderate Negative.
Rehabilitation	Refers to rehabilitation of areas where impacts are unavoidable and measures are provided to return impacted areas to near-natural state or an agreed land use after mine closure.	It was recommended that a wetland rehabilitation and monitoring plan be implemented to address necessary rehabilitation initiatives within the watercourses onsite including erosion control, alien vegetation encroachment, Re-vegetation processes as well as improving functionality of the affected watercourses both during and post-construction.
Offset	Refers to measures over and above rehabilitation to compensate for the residual negative effects.	Onsite rehabilitation will be proposed to provide for suitable compensation, the overall ration to be achieved being 54:1.

2.3 Rehabilitation Measures

The recommended project components that will receive mitigation or rehabilitation measures are detailed in Table 2-6.

Table 2-6 The rehabilitation and measures prescribed for the expected impacts

Expected impact	Mitigation / rehab measure
Storm Flow Dam construction and operation	• Demarcation of the footprint area to avoid unnecessary wetland loss • Removal of sandy colluvium from the footprint • Stockpile, use or removal of soils from the site • Install energy dissipaters at the discharge area **Note:** *It is not feasible to create a bio-retention pond for the storm flow dam, which would typically consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil and plants. The dam has not been designed to accommodate any baseflows. The absence of a baseflow would result in no grasses / plants being sustained by a water source, essentially killing off vegetation. The loss of vegetation would nullify the purpose of such a pond in which contaminants and sedimentation are removed from stormwater runoff.*
Wetland crossings	• The bridge design must span the wetland area, with no piers or supports within the channel network. • Bridge ties to the watercourse banks must ensure stability, and that no erosion or scouring takes place at the tie in points. • Bridge access routes must incorporate coarse rock layers to increase the porosity and permeability of the sub-layers. • Pipes can be strategically positioned under the access routes to drain surface water, this will ensure the routes do not act as a barrier to water flow. • The height of the bridges should accommodate the 1:100yr flood events. • The bridge crossing must be aligned along the existing routes of disturbance i.e. where river bed and banks have already been modified.
Bank instability	• Gullies (or vulnerable banks) and banks that will be affected by the project must be stabilised. • Stacked gabion baskets used for bank stability should be tilted towards the soil they are protecting by a minimum of about 6 deg from vertical. • Boulders can be used to dissipate energy at the discharge locations. • Erosion control measures and soil stabilisers (geomats) should be incorporated to the design to minimise soil erosion. • The project should be monitored for any signs of geotechnical failure.
Removal of vegetation	• Stripping areas can be demarcated to avoid unnecessary removals (survey pegs). • Keep stripping areas to a minimum footprint area. • Vegetation should be stripped / removed in a phased manner. • Where possible, store vegetation for re-planting and rehab efforts. Impacted areas can be re-vegetated using sods from removed vegetation. • Sloped areas must be re-vegetated, either using removed vegetation or with a grass seed mix consisting of natural endemic species. • Mulch can be used to encourage re-vegetation efforts for re-growth.
Top soil and subsoil removal	• Only "local" soils must be used for the rehabilitation efforts, soils should not be imported from elsewhere. • Removed soils, top soil and subsoil must be stockpiled next to the excavation area separately. • Soil stockpiles should be low and relatively flat to reduce wind and water erosion potential. • Soil stockpiles should be prioritised for backfill and rehabilitation efforts to limit standing time. • Areas with minimal disturbance and negligible signs of compaction can be ripped (to re-vegetate naturally).
Soil compaction	• Ripping should be done to a maximum depth of 300 mm in two directions at right angles. • Ripping should be conducted during the drier period • After construction, compacted top soil should be ripped and vegetation re-planted or seeds dispersed
Sedimentation	• Silt traps should be set (downslope) within the wetlands during construction of the of the WwTW. • Signs of excess sediment within the system should be removed manually.
Alien vegetation	• Ensure that all vehicles and equipment are clear of alien plants prior to construction to avoid the spreading of these plants • Alien plants and saplings should be removed during the construction of the project. All wetland areas should be eradicated of alien invasive plants. • Mix a dye with any chemicals used for removal to note what has been treated • Monitor rehabilitated areas for the establishment and encroachment of alien plant species. Species must be removed appropriately i.e. mechanical methods.

Upgrade of access route	• Re-alignment of the access route should not infringe on watercourses and should remain outside the wetland buffers; • Ensure that the edges of the road are vegetated to prevent soil erosion; • Stormwater management should be installed along the access route to limit the potential for erosion
Potable Water Pipeline and boreholes	• The replacement of the pipeline should be undertaken in the dry season; • Once the pipeline is in place the pipeline route should be revegetated immediately
General	• Construction should be conducted during the dry season. • Make use of existing access routes, do not create new access routes into the wetlands. Temporary routes may be an alternative. • All vehicles and machinery should be fuelled and serviced offsite in a bunded location. • All construction and rehabilitation material should be placed beyond the respective buffer areas in demarcated areas considered to be already disturbed • Grit drying beds and drying beds should be lined or bunded to prevent seepage of pollutants into water/groundwater resources

2.4 Plant Clearing Methods

The following measures are recommended to prevent / minimize soils and vegetation disturbance during the construction and operational phases (Table 2-7) of the project. These measures will also reduce the probability that invasive alien plants will become established on site:

Table 2-7 Action measures for the construction and operational phase

Action	Frequency
The designated Environmental Control Officer (ECO) must provide permission prior to the clearing of any areas.	Daily / when required
Clearing of vegetation must be concurrent with the progress of the project. Avoid unnecessary clearings, and the clearing of large areas unless rehabilitation is to be implemented immediately.	Weekly
Brush from cleared areas should be used as much as possible in the event that organic matter is required for rehabilitation. No matter must be brought in from other areas.	Weekly
Exposed areas must be stabilized to prevent erosion. These areas must preferably be re-vegetated. In the event that re-vegetation is not feasible, exposed areas must be protected with packed brush, which can also serve as silt traps.	Weekly
The project area should be inspected monthly during the wet season, and bi-monthly during the dry season, focusing on disturbed areas to inspect for the establishment of alien vegetation.	Monthly / Bi-monthy

2.5 Alien Vegetation Removal

A total of eleven (11) Category 1b alien plant species were identified for the site (Table 2-8). These identified plant species must be removed from the project area, but more so from the wetland area. Both mechanical and chemical removal options are available, but it is preferred that mechanical removal first be implemented. Then based on the outcome and success of the mechanical control, the chemical control may then be considered. Chemical control must be overseen by a certified removal expert. Contractors using herbicides are required to have a permit according to Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947).

Table 2-8 Alien plant species recorded for the proposed Lanseria WWTW site

Scientific name	Common name	Form
Argemone ochroleuca	White-Flowered Poppy	Herb
Arundo donax	Spanish Reed	Reed
Campuloclinium macrocephalum	Pompom weed	Herb
Cirsium vulgare	Scotch Thistle	Herb
Datura stramonium	Jimson weed	Herb
Lantana camara		Shrub
Ligustrum lucidum	Chinese wax-leaved privet	Tree
Melia azedarach	Persian Lilac/Syringa	Tree

Opuntia ficus-indica	Sweet prickly pear	Tree
Robinia pseudoacacia	Black locust	Tree
Sesbania punicea	Red Sesbania	Shrub
Removal measures	Mechanical control: Removal (by hand) using a machete fork is recommended as it has not colonised the area extensively. Chemical control: Broadleaf herbicides such as Mamba or Roundup can be used in the event that this specie's growth accelerates. These herbicides are easily bought in hardware stores.	

2.6 Plant Species Plan

The existing land uses have imposed additional pressures on the wetland areas, resulting in the wetlands eroding. The valley bottom wetland in particular is characterised by a deep channel, with near vertical banks.

Erosion of the catchment is evident, with remediation efforts being undertaken for the gullies being formed. Rock piles either for or planned for gabion baskets were also identified indicating the remediation efforts.

Table 2-9 presents examples of listed plant species which should be sought and planted in order to address the identified risks, notably erosion and collapsing banks. These near vertical banks should be sloped, planted (or seeded) with the listed species. The length of valley bottom wetland within Site 1 should be rehabilitated for this project, this length if approximately 1.3 km.

Table 2-9 Listed plant species which should be considered for rehabilitation efforts

Wetland area	Risks	Objectives	Plant species	Recommendation
Banks	Erosion, bank collapse and steep banks	To slow water flows and provide soil stability	• *Cynodon dactylon,* • *Eragrostis gummiflua,* • *Aristida congesta subsp. congesta,* • *Aristida junciformis,* • *Eragrostis tef*	Slope banks to 1:5 and slight contouring to aid in plant establishment and slowing of water flows down the slopes. Seed should be sowed in a mix.
Channel	Erosion, soil dispersion and downstream impacts	Trapping of sediment, water filtration, improvement of plant diversity	• *Setaria sphacelata var. sericea,* • *Imperata cylindrica,* • *Sporobolus africanus,* • *Eragrostis capensis,* • *Digitaria eriantha*	Seed should be sowed in a mix and towards the end of the dry season.

2.7 Rehabilitation Action Items

The following action items are to be implemented for the rehabilitation of wetlands / watercourses to be affected by the additional stormwater infrastructure at the Lanseria WWTW, and the culverts along the access road, and the proposed re-alignments of the bridge.

2.7.1 Ripping compacted areas

The buffer areas that will be cleared and all other areas that may be degraded (by means of vehicles, laydown yards, ablution facilities etc.) must be ripped where compaction has taken place. According to the Department of Primary Industries and Regional Development (Agriculture and Food) (2017), ripping tines must penetrate to just below the compacted horizons (approximately 300 – 400 mm) with soil moisture being imperative to the success of ripping. Ripping must take place within 1-3 days after seeding, and also following a rain event to ensure a higher moisture content. To summarise;

- Rip all compacted areas outside of the wetland delineations that have been compacted;
- This must be done by means of a commercial ripper that has at least two rows of tines; and

- Ripping must take place between 1 and 3 days after seeding and following a rainfall event (seeding must therefore be carried out directly after a rainfall event).

2.7.2 Vegetation composition

Areas denuded by disturbances, site clean-up (soil scraping and washing) and landscaping activities must be re-vegetated. Re-vegetation must follow landscaping activities in a phased approach over two consecutive growing seasons. This approach ensures that the entire system is not denuded of vegetation all at once any that any challenges / short comings identified in the first phase to be rectified in the second phase. Several zones for re-vegetation have been identified and a species composition recommended. These re-vegetation zones essentially represent different water resources and also varying zones of saturation.

Rehabilitation must seek to re-establish a wetland vegetation comprised of short, dense hydromorphic grasses in the temporary to seasonal zone with slightly taller sedges becoming more prevalent in the permanent zones along the flow path. Avoid creating a monoculture, species diversity is the key to wetland health and the provision of important ecosystem services such as erosion control and water quality enhancement. To achieve this outcome the following approach is advocated:

- Attempts must be made to maximise the diversity of low hydromorphic grasses and sedges throughout;

- Re-vegetation must involve the use of both re-seeding and mechanical transplanting. Re-seeding must occur in both the flow path and banks to establish a vegetation base while mechanical transplanting of wetland plant sods must take place mainly within the flow path;

- As the saturation, nutrient and oxygen levels will vary markedly depending on the hydrological zonation (permanent, seasonal and temporary) care must be taken to sow or plant the appropriate plant species in each re-vegetation zone (flow path or bank). The species are generally common and adaptable species that show a tolerance to disturbed soil conditions;

- Only locally indigenous species that are adapted to local climatic conditions must be used. Perennial species must be prioritised for transplanting. Good quality planting material or seed must be readily available;

- Re-vegetation must commence immediately after landscaping and the preparation of the seedbed, preferably in early spring when conditions for germination and rootstock establishment are optimal. Planting must preferably be timed to take place 1-3 days following a significant rainfall event when soils are within 10% of the field capacity (maximum saturation level);

- Topsoil must be stored for later use and where necessary supplemented with imported topsoil. With correct storage and replacement of topsoil species diversity must improve rapidly as species present in the seedbank also germinate;

- Transplanted vegetation can be sourced from nurseries and / or sustainably harvested from local wetlands, with due authorisation. Most of the plants must be harvested from the areas that will be scraped during the site clean-up and landscaped and supplemented with plants from surrounding wetlands. Harvesting must target sedges, rushes and grasses;

- Harvesting would involve carefully digging up parent plants and separating the material into as many individual sods as possible. Parent plants must be large specimens with a high root biomass. These plants must be temporarily stored onsite and transplanted later. Try to minimise the time spent the harvested plants spend in nurseries between harvesting and replanting back in the wetland;

- Try to limit collection and disturbance to wetlands when collecting sods by sticking to the designated collection areas and utilising a single access path. Once complete the soil along the collection paths must be loosened;

- The sods must be planted to an approximate depth. This will vary depending on the size of the plant but will be around 200 mm on average. The recommended planting density depends on plant size (range from 1 plant / m^2 for large plants such as rushes to 8 pants / m^2 for small sedges and grasses) but is generally around 2–3 plants / m^2 for average sized plants. When transplanting sods attempt to retain as much of their roots and soil as possible and maintain saturation levels similar to where they were removed from;

- For larger sedges and rushes trim the foliage (about 100 to 150 mm) to reduce evaporative losses during transplanting. At least some live foliage must remain above ground after planting to drive water uptake and survival;

- Keep plants that are being prepared for later transplanting out of direct sunlight (fodder bags work well) and bag / re-plant as soon as possible. Uprooted plants left in the sun for a several hours will die. Conversely, those left in bags for several days will begin to rot; and

- Avoid the use of fertilizers or any other chemicals or soil enhancers during re- vegetation.

2.7.3 Re-vegetation / landscaping for vegetation establishment

Table 2-10 presents listed plant species which should be obtained and planted in order to address the identified risks, particularly associated with the management of stormwater. The prescribed plant species should be used to vegetate the embankments of the wetland area. These species can also be used to stabilise stormwater channels. After rehabilitation of the project area, and also the proposed re-shaping of the areas, it is likely that bare areas will need to be seeded. It is recommended that these plants be ordered in (from suppliers) and supplemented by a suitable (similar) seed mix. As per typical provincial requirements, only indigenous plant species are recommended. The four zones are described as follows:

- Zone A – Grass seed mix, seasonally wet;

- Zone B – *Typha sp* and *Phragmites sp*;

- Zone C – Vegetated islands / mounds; and

- Zone D – Grass seed mix, embankments.

Table 2-10 Listed plant species which could be considered for rehabilitation efforts

Zone (Plant species[1])			
A	**B**	**C**	**D**
Imperata cylindrica	*Typha capensis*	*Miscanthus capensis*	*Panicum maximum (Under trees)*
Leersia hexandra	*Phragmites australis*	*Pennisetum macrourum*	*Aristida junciformis (Dry)*
Leptochloa fusca	*Miscanthus junceus*	*Sporobolus africanus*	*Aristida congesta subsp. congesta*
Setaria megaphylla	*Miscanthus capensis*	*Setaria incrassata*	*Cenchrus ciliaris (Dry)*
Sporobolus africanus	*Leptochloa fusca*	*Monocymbium ceresiiforme*	*Setaria sphacelata var. sericea (Banks)*

[1] The seed mix should contain most of these plant species. It is not necessary to contain all of these listed species.

Setaria incrassata	*Cyperus articulatus*	*Miscanthus capensis*	*Pennisetum macrourum (Banks)*
Setaria sphacelata var. sericea	*Cyperus fastigiatus*	*Hemarthria altissima*	*Miscanthus capensis (Banks)*
Stiburus alopecuroides	*Imperata cylindrica*	*Paspalum dilatatum*	*Hemarthria altissima (Banks)*
Andropogon eucomus	*Setaria sphacelata var. sericea*	*Setaria megaphylla*	*Andropogon eucomus (Banks)*
Paspalum urvillei	*Sporobolus africanus*	*Cyperus marginatus*	*Paspalum urvillei (Banks)*
Paspalum dilatatum	*Eragrostis capensis*		*Paspalum dilatatum (Banks)*
Cyperus articulatus	*Digitaria eriantha*		*Cyperus marginatus (Banks)*
Cyperus congestus			*Cynodon dactylon,*
			Eragrostis tef
			Eragrostis gummiflua

All planting and seed-mix application must be carried out as far as is practicable during the period most likely to produce beneficial results but as soon as possible after the soil properties are estimated to be adequate. The seasonal period is from the beginning of April to the end of October.

2.7.4 Re-vegetate wetland areas

According to Russell (2009), areas characterised by a loss of soil resources must be revegetated by means of vegetation with vigorous growth, stolons or rhizomes that more or less resembles the natural vegetation in the area.

Phragmites australis, Cyperus dives. and *Typha capensis* are the dominant hydrophyte within the permanently saturated wetland zones. It is recommended that these plants be harvested throughout the wetland areas that are to remain in-tact to ultimately use to revegetate degraded areas. According to Russell (2009), the following is crucial when revegetating whole plants;

- The planting of whole plants must take place just before or at the beginning of the wet season;
- Whole plants must be dug up with as much of the root intact as possible;
- Roots must be dug up with the soil around it still intact and undisturbed;
- After the plants have been dug up/harvested, all plants must be stockpiled in damp or wet bags and be kept in the shade;
- The soil around the revegetated plants must be manually compacted after planting;
- Holes excavated for Re-vegetation must be approximately 300 to 500 mm deep;
- Soil must be stockpiled according to relevant horizons and backfilled in the same order prior to Re-vegetation (the first 300 mm must be stockpiled separately from the rest of the soil reserves).

2.7.5 Gully erosion

The systems must be inspected for more areas of headcut erosion. These headcuts, erosion gullies and channel that are incised or susceptible to erosion and that extent from the water resource area into the upper catchment area must be addressed. Figure 2-4 presents a guiding approach for a particular intervention for the development. The following is recommended for the decommissioning of incised channels:

- Dryland eroded channels can be backfilled with topsoil and sub-soils from the development area, together with other non-toxin materials and compacted to these channels (Figure 2-2). The following is recommended:

- Stockpile excavated material according to horizons (the top 300 mm separate from the rest of the material);
- First introduce the sub-soil into the channel and then gently compact the soil; and
- Then introduce the topsoil into the channel and then compact the soil gently.

- In the event the backfilling on channels is unsuccessful, then investigate the feasibly of hard-engineering structures such as weirs with aprons (Figure 2-3).

These measures must be informed by the stormwater management plan developed for the project, and a hydrologist must advise on the feasibility and suitability of the preferred option.

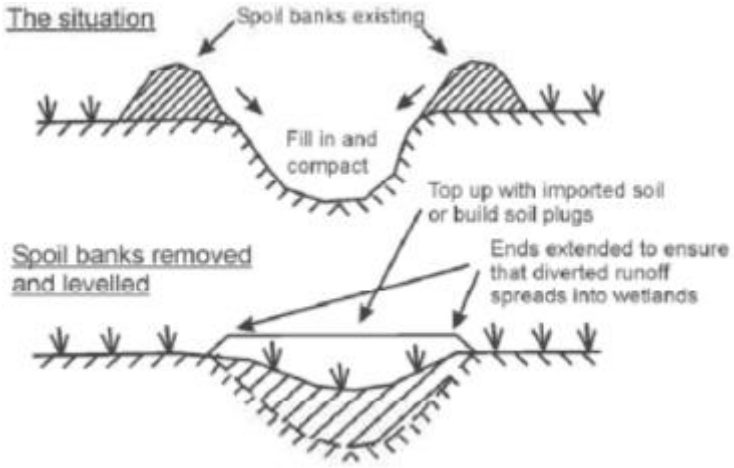

Figure 2-2 Back-filling of drains / gullies (Russell, 2009).

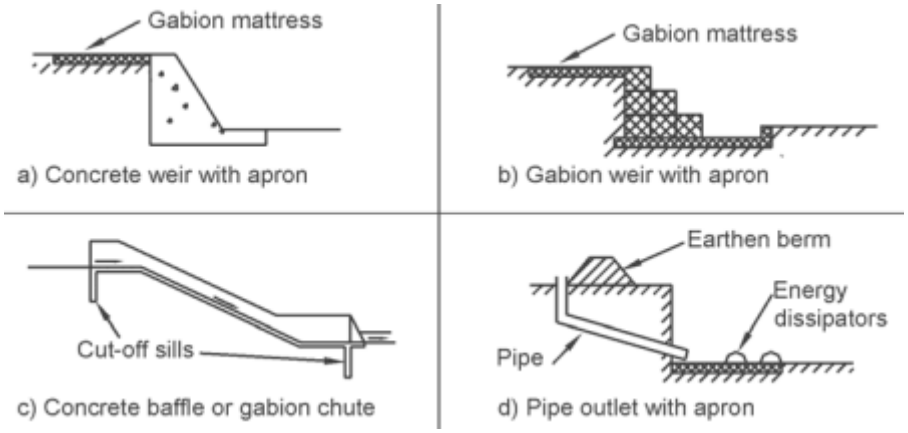

Figure 2-3 Side views of various structures to stabilize headcuts (Russell, 2009)

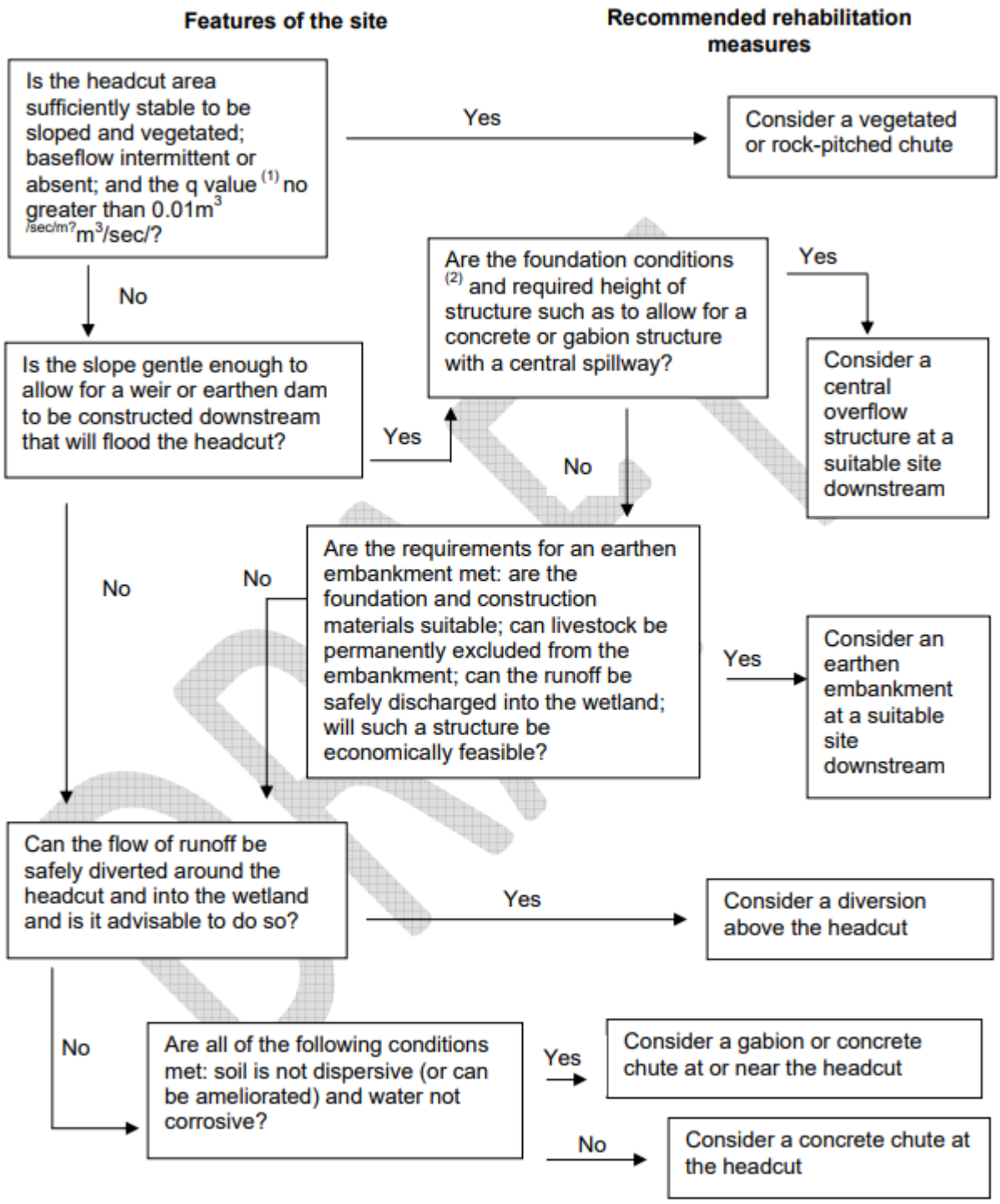

Figure 2-4 Decision tree for choosing a mechanism to stabilize active headcut erosion (Russell, 2009)

2.7.6 Backfill

During the period in which the excavated material is stockpiled, some of the material may be lost due to wind and water carrying lighter particles away. To compensate for the loss of this material, topsoil must be used to completely fill the excavated areas as well as degraded areas that have experienced a loss of soil reserves. It is worth noting that the topsoil material must not be mixed with the excavated material, but rather introduced to the surface. The surface of this topsoil area outside of the delineated wetland must be slightly compacted to compensate for subsidence of this material.

As part of the rehabilitation measures, the top 300 mm of the excavated soil resources must be stockpiled separately from that below 300 mm. The soil resources must be reintroduced back into the excavated pits/trenches according to the order excavated. In cases where stockpiled material has been lost, topsoil must be reintroduced into areas with insufficient material. It is imperative that weed free topsoil be used.

To summarise;

- Stockpile excavated material according to horizons (the top 300 mm separate from the rest of the material);
- Reintroduce the sub-soil into the excavated areas and then gently compact the soil; and
- Reintroduce the topsoil into the excavated area and then compact the soil gently

2.7.7 Bank stabilisation, reduce erosion risk

The clearance of sugarcane from the water resources must be used as an opportunity to inspect the resources for signs of erosion. These erosion risk areas must be identified and demarcated for interventions. These areas will likely need to be shaped and re-vegetated to provide bank / channel stability. The following is recommended for bank stabilisation:

- Shape the embankments manually using labour and a Bobcat excavator to create a slope / embankment that represents the natural topography of the catchment. The profile of the bank must be consistent with the slope of the catchment, avoid creating unnecessarily steep or raised slopes. These areas can then be re-vegetated following the same processed presented in previous sections; and
- In the event the abovementioned soft engineering approach does not succeed, then the suitability of gabion baskets and reno mattresses must be investigated.

2.7.8 Shaping

The natural slope or topography of the area that has been affected by the clearing needs to be restored in order to ensure that the flow of water and the growth of vegetation occurs naturally. The re-adjustment of the topography will also improve the general aesthetics of the area. The removal of all the piles within the project area such as vegetation, soil and old rubble is compulsory. The building rubble and general litter must be removed entirely from the area and disposed of at licensed facilities. The following are methods that can be used to reshape the slope of the area, and are also applicable to dryland areas:

- Sand Bags
    - Only biodegradable bags are to be used, this includes Geojute sacks or similar. No plastic bags may be utilised. The bags must be filled with a sand or rock mixture under no circumstances may any contaminants be put into the bags (i.e., cementitious material, soil with chemical spill or fuel etc.). This must be checked by the Environmental Compliance Officer (ECO).
- Terracing and Soil Stabilisation
    - For this process rows of straw, hay or bundles of cut vegetation may be used. The hay, straw or vegetation is dug into the soil in contours, in order to help slow surface wash and capture eroded soil. The spacing between rows would be dependent on slope and the specific area.
- Geojute Netting

- Netting or matting (biodegradable) can also be utilised on slopes to protect the soil from wind and water erosion. This assists with soil retention, weed control and vegetation establishment. Plants can be installed by making small incisions for planting. This would be an effective method in this area due to the high level of wind present. It is however important that this cannot be placed over existing vegetation growth and can only be used right after sloping have been performed.

- Geojute Rolls
  - Cylindrical rolls of Geojute fabric filled with sand (as described in the sandbag section) are effective on slopes and large cleared areas. This method is very effective in assisting with erosion control. Geojute rolls are kept in place with the use of pegs (alien invasive plant material can be utilised for this).

- Gabion Baskets and Reno Mattresses
  - These represent engineered solutions to steep slopes and banks; in this instance it would be relevant to the edges of the water resources. These methods are to be utilised in areas where drainage and flooding is a concern. Gabion baskets are 1m x 1m x 1m wire baskets that are filled with uniform sizes rocks. Reno mattresses are generally used to cover a larger area and is made of flat baskets. These two features are often used to enhance one another.

2.8 Landscape Management Plan

The following landscaping measures are derived from the DWS document titled “Specifications DWS 2410 Landscaping”. Only pertinent items have been considered and concise descriptions provided.

2.8.1 Contractor

A reputable Contractor must be appointed to undertake the specified work. This contractor must have a proven track record that displays gross competence.

2.8.2 Environmental Management

The Contractor shall make every effort to preserve the area, to minimise environmental disturbance and to inform employees as to the ecological sensitivity and importance of the area. The Contractor shall be responsible for any avoidable damages to the environment resulting from the actions of any employees. To minimize disturbances, the following must be considered:

2.8.3 Rehabilitation Workers

The Contractor shall be responsible for workers insofar as they shall be made aware of the seriousness of disregarding orders which relate to:

- Hunting, poisoning, trapping or disturbing fauna;
- Damaging of natural flora;
- Littering on the area;
- The use of supplied toilet facilities; and
- The use of the areas provided for eating.

Furthermore, no exotic plant material or domestic animal of any kind will be allowed to be brought onto the project area.

The Contractor shall also be responsible for ensuring the area worked on is free of erosion, pollution and/or any other unwanted materials. Nontoxic materials may not be dumped and buried in the spoil dumps. All other unwanted materials shall be collected and disposed of in a satisfactory manner.

All imported construction material shall also be checked for the importation of exotic seeds and/or any other foreign matter through these materials.

2.8.4 Marker Fences

All activities by the Contractor shall be contained within the fenced areas. The Contractor shall be liable for any damages which may result from trespassing outside these areas.

2.8.5 Surface Water

The ECO should report on Surface Water Management, and ensure Contractor complies with necessary findings regarding any surface water, be it from rain, excavations or any other source.

2.8.6 Erosion

During rehabilitation, the Contractor shall protect all areas susceptible to erosion by installing all necessary temporary and permanent drainage works and by taking such other measures as may be necessary to prevent the concentration of surface water and scouring of slopes, banks and other areas. All erosion, such as runnels, channels or sheet erosion, that develops during the project phase shall be backfilled and consolidated and the areas restored to their proper condition at the Contractor's expense. The Contractor shall not allow erosion to develop on a large scale before effecting repairs and all erosion damage shall be repaired as soon as possible and, in any case, not later than two months before the termination of the Period of Maintaining. All topsoil or other material accumulated inside drains shall be removed at the same time. Topsoil washed away shall be replaced.

2.8.7 Fire

The Contractor shall take adequate precautions to prevent and control veld fires of the area. The Contractor shall take all steps to ensure that the fire hazard on and near the project area is reduced to a minimum. The Contractor shall be held responsible for any damage to property adjoining the project area as a result of any fire caused by one of his employees.

The Contractor shall take immediate steps to extinguish any fire which breaks out, and shall comply with all statutory provisions which may be in force from time to time in relation to fire danger or to restrictions on the lighting of fires in the open. The Contractor shall have a supply of beaters to use in the extinguishing of bush fires to which this area is susceptible.

2.8.8 Trimming

Trimming shall consist of bringing the existing or previously shaped ground to an even surface with the final levels generally following the original surface. Where machine operations are not practicable trimming shall be done using hand tools.

Trimmed surfaces shall be left slightly rough to facilitate binding with topsoil or the natural establishment of vegetation. During trimming all stones with any dimension in excess of 30 mm in areas to be mowed by machine, all stones with dimensions in excess of 150 mm in other areas and all other excess material shall be removed to selected dumping sites.

2.8.9 Watering, Weeding, Cutting and Replanting

All grassed areas shall be maintained during the rehabilitation of the area by adequate watering at frequent and regular intervals in order to ensure proper germination of seeds and growth of grass until

an acceptable cover has been established and thereafter until the end of the rehabilitation phase. The amount and frequency of watering shall be at the discretion of the Contractor.

Weeds shall be controlled by means of extraction, cutting or other approved means.

The Contractor shall mow or cut all grassed areas to promote adequate coverage, until the end of the rehabilitation phase. All grass cuttings shall be collected and disposed of.

Any plants not immediately replanted are the responsibility of the Contractor and shall be kept under approved nursery conditions. All plants shall be maintained by regular watering and fertilizer applications, as well as by providing protection against wind, frost and direct sunlight until such time as they are to be replanted.

2.8.10 Monitoring

The following general aspects apply t onsite monitoring:

- Georeferenced photographic records of key areas before and after construction must be taken by the ECO and kept on record for future comparison with rehabilitated areas;
- The ECO must monitor and remedy any soil erosion or alien species establishment around rehabilitated areas on a monthly basis, and address it as per the recommendations mentioned above.
- Monitoring must take place on a monthly basis per area in order to establish if re-vegetation was successful and photographic records must be kept by the ECO;
- Should any shortfalls be identified the ECO must take action to address them accordingly; and
- Monitoring must be conducted for possible siltation, and stormwater issues by the ECO on a monthly basis.

3 Monitoring Plan

The monitoring plan (Table 3-1) has been designed to be achievable and realistic for the nature of the project. The plan will provide details as to the frequency of the monitoring efforts, the location of these efforts and what should be monitored. The primary focus for the monitoring plan is to evaluate the success of the rehabilitation efforts. Numerous monitoring frequencies have been proposed for this aspect of the project.

Rehabilitation: During rehabilitation, monitoring is essential to ensure that all recommended rehabilitation aspects are successfully applied. This monitoring must be undertaken by the (Environmental Control Officer) ECO appointed to oversee the rehabilitation process.

Post-rehabilitation: After completion of the rehabilitation phase wetland areas should be monitored to evaluate the success of the rehabilitation efforts. In the unlikely event of potential “risks” to the systems being identified, this inspection may allow for corrective measures to be applied. This monitoring must be undertaken by the appointed ECO.

Seasonal monitoring: The applicant must appoint an independent contractor to conduct seasonal (wet season) monitoring for a period of two years after the completion of the rehabilitation measures. The monitoring should be conducted during October or shortly after the first summer rains, and then towards the end of the growing season. The monitoring should inspect the following:

- Recovery of the vegetation layer;
- Extent of alien vegetation establishment;
- Hydrology and inundation of the systems;
- The formation of erosion gullies and sedimentation of the wetlands; and
- The removal of solid waste from the wetland and buffer areas.

Table 3-1 The proposed monitoring plan for the project

Variables	Methods	Monitoring Frequency	Indicators	Targets
Wetland (unit) monitoring	• Wetland Present Ecological State, Functioning & Ecological Importance & Sensitivity • Determine if habitat quality deterioration is occurring. • Determine if water quality deterioration is occurring.	• Bi-annual for 2-years as a minimum, thereafter to be determined by the wetland specialist in agreement with the relevant Department. • Quarterly for 2-years as a minimum, thereafter to be determined by the wetland specialist in agreement with the relevant Department.	• Wetland WET-Series • Monitor for presence erosion, alien vegetation, wetland rehabilitation succession, and sedimentation • Changes in water quality trends, spatial and temporal. Samples must include a reference site and a minimum of three monitoring sites.	Wetland unit Recommended Ecological Class Target Water Quality Requirements for aquatic ecosystems (DWAF, 1996)
Variables	**Methods**	**Monitoring Frequency**	**Indicator**	**Corrective Action**
Vegetation cover	• Monitor species and cover abundance; • Monitor indigenous vs alien plant encroachment; and • Fixed point photography	• After rehabilitation; and • Seasonal for the first two years.	• Establishment of primarily indigenous plants; and • Ground cover abundance is approximately 60% after the first year, and 80% after year two and 100% thereafter.	Replanting of indigenous grass species should be implemented if natural Re-vegetation is not successful after one year.
Erosion	• On-site inspection; • Fixed point photography; and • Compare to adjacent areas	• After rehabilitation; and • Seasonal for the first two year.	• Areas with no cover; • Erosion gullies; • Wetland outlet; and • Eroded wetland systems	• Short term: Rocks / boulders, and on-site debris; • Medium term: Replanting of indigenous vegetation; and • Long term: Rehab methods that may include gabion baskets, mattresses and should be discussed with specialists
Sedimentation	• On-site inspection; and • Fixed point photography	• After rehabilitation; and • Seasonal for the first two years.	• Excess sediment in wetlands	Sources of sedimentation should be noted and addressed If possible, excess sediment can be removed manually.
Invasive Plant Species	• Monitor invasive plant encroachment; • On-site inspection; and • Fixed point photography	• After rehabilitation and follow- up clearing; and • Seasonal for the first two years.	• Establishment of invasive plant species	Removal of invasive plants. Consult a botanist on what removal measures are best suited per species. Do not use chemicals for the removal process
Solid waste	• On-site inspection; and • Fixed point photography	• After rehabilitation and follow-up clearing; and • Monthly (by residents / representatives)	The presence of: • Litter; • Dumping material; and/or • Building rubble.	Removal of solid waste and disposal at a licensed facility.

4 References

Russell, W. 2009. WET-RehabMethods. National guidelines and methods for wetland rehabilitation.

Soil Classification Working Group. (1991). Soil Classification A Taxonomic system for South Africa. Pretoria: The Department of Agricultural Development.

Soil Classification Working Group. (2018). Soil Classification A Taxonomic system for South Africa. Pretoria: The Agricultural Research Council.

PROJECT: **Wetland Baseline & Risk Assessment for the proposed Lanseria Wastewater Treatment Works Project**

RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities (Version 2.1.1)

POTENTIALLY AFFECTED WATERCOURSE/S			FIELD-VERIFIED ASSESSMENT RESULTS				
Watercourse number	**Watercourse name**	**Watercourse type**	**PES**	**EI**	**ES**	**EIS**	**Wetland Importance**
(1)	Channelled valley-bottom	Wetland (incl. pans)	D			Moderate	Moderate
(2)	Riverine / Riparian	River / Natural channel	C			Moderate	Moderate
(3)	Seep	Wetland (incl. pans)	D			Moderate	Moderate

DETAILED PROJECT SPECIFICATIONS:
Include detailed project description, including all proposed control measures to prevent/minimise impacts on watercourses

The Biodiversity Company was commissioned to conduct a wetland baseline, risk and impact assessment for the proposed activities associated with the construction of a new Wastewater Treatment Works (WWTW).

•The contractors used for the construction should have spill kits available prior to construction to ensure that any fuel, oil or hazardous substance spills are cleaned-up and discarded correctly;
•All construction activities must be restricted to the development footprint area. This includes laydown and storage areas, ablutions, offices etc.;
•During construction activities, all rubble generated must be removed from the site;
•Construction vehicles and machinery must make use of existing access routes;
•All chemicals and toxicants to be used for the construction must be stored in a bunded area;
•All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
•All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
•Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
•All removed soil and material stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
•Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
•No dumping of construction material on site may take place;
•All waste generated on site during construction must be adequately managed. Separation and recycling of different waste materials should be supported;
•The first 300 mm of soil must be stockpiled separate from the soil excavated deeper than 300 mm;
•The proposed pipeline system must be divided up into 100 m intervals. Each interval’s soil must be stockpiled and filled back up (in the correct order) to avoid long periods of stockpiling;
•No heavy machinery must be allowed within the delineated wetland. All excavations must be carried out via manual labour instead of heavy machinery/vehicles; and
•Lighter vehicles (small trucks and other vehicles) required for the proposed activities should only be allowed to use existing roads (including dirt roads).

PROJECT: **Wetland Baseline & Risk Assessment for the proposed Lanseria Wastewater Treatment Works Project**

RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities - Version 2.1.1

Name of Assessor: Andrew Husted **Signature:**

SACNASP Registration Number: 400213/11

Date of assessment: Dec-24

Risk to be scored for all relevant phases of the project (**factoring in specified control measures**). MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance	Abiotic Habitat (Drivers)			Biota (Responses)											
						Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
CONSTRUCTION	Large Scale drainage pattern change. Isolated removal of embankment vegetation areas for selected roads; Operation of equipment and machinery; Excavation, leveling and installation of structures; stockpile and building material stockpile management; domestic and industrial waste; storage of chemicals, mixes and fuel; Routine operation and maintenance of the pipeline; Access road upgrade	Disturbance and degradation of wetland vegetation	Channelled valley-bottom	D	Moderate	3	3	3	3	3	6	2	2	10	3	30	80%	24	L	High
			Riverine / Riparian	C	Moderate	2	2	2	3	1	6	3	3	12	3	36	100%	36	M	High
			Seep	D	Moderate	2	2	1	1	1	4	2	3	9	3	27	100%	27	L	High
		Alteration of surface topography (excavations, reshaping and compacting)	Channelled valley-bottom	D	Moderate	3	2	3	3	2	6	2	2	10	3	30	80%	24	L	High
			Riverine / Riparian	C	Moderate	2	2	3	3	0	6	3	3	12	3	36	100%	36	M	High
			Seep	D	Moderate	2	2	1	2	1	4	3	2	9	3	27	100%	27	L	High
		Increased bare surfaces, runoff and potential for erosion	Channelled valley-bottom	D	Moderate	2	2	3	3	2	6	2	2	10	3	30	80%	24	L	High
			Riverine / Riparian	C	Moderate	2	1	1	2	1	4	3	3	10	3	30	100%	30	M	High
			Seep	D	Moderate	2	1	1	2	1	4	2	2	8	3	24	100%	24	L	High
		Introduction and spread of alien and invasive vegetation	Channelled valley-bottom	D	Moderate	2	2	2	3	2	6	2	3	11	3	33	80%	26.4	L	High
			Riverine / Riparian	C	Moderate	1	1	2	3	2	6	3	3	12	3	36	100%	36	M	High
			Seep	D	Moderate	1	1	1	2	1	4	2	2	8	3	24	100%	24	L	High
		Waste and ablution facilities	Channelled valley-bottom	D	Moderate	2	3	2	3	3	6	2	3	11	3	33	80%	26.4	L	High
			Riverine / Riparian	C	Moderate	1	2	1	2	1	4	3	3	10	3	30	100%	30	M	High
			Seep	D	Moderate	1	1	1	1	1	2	2	2	6	3	18	100%	18	L	High
		Increased sediment loads to downstream reaches	Channelled valley-bottom	D	Moderate	3	3	2	2	3	6	2	2	10	3	30	80%	24	L	High
			Riverine / Riparian	C	Moderate	3	2	2	2	1	6	3	3	12	3	36	100%	36	M	High
			Seep	D	Moderate	2	1	2	2	1	4	2	2	8	3	24	100%	24	L	High
		Contamination of wetlands with hydrocarbons due to leaks and spillages from machinery, equipment & vehicles as well as Contamination and eutrophication of wetland systems with human sewerage and litter	Channelled valley-bottom	D	Moderate	3	3	2	2	3	6	2	3	11	3	33	80%	26.4	L	High
			Riverine / Riparian	C	Moderate	1	2	1	2	2	4	3	3	10	3	30	100%	30	M	High
			Seep	D	Moderate	1	2	1	1	1	4	2	2	8	3	24	100%	24	L	High
		Storage of chemicals, mixes and fuel	Channelled valley-bottom	D	Moderate	3	3	1	2	2	6	2	3	11	3	33	80%	26.4	L	High
			Riverine / Riparian	C	Moderate	1	2	1	2	2	4	3	3	10	3	30	100%	30	M	High
			Seep	D	Moderate	1	2	1	1	1	4	2	2	8	3	24	100%	24	L	High
		Proliferation of alien and invasive species	Channelled valley-bottom	D	Moderate	3	2	2	3	2	6	2	3	11	3	33	80%	26.4	L	High
			Riverine / Riparian	C	Moderate	2	2	2	3	2	6	3	3	12	3	36	100%	36	M	High
			Seep	D	Moderate	2	1	2	2	1	4	2	2	8	3	24	100%	24	L	High
	Landscaping	Final Landscaping and reshaping	Channelled valley-bottom	D	Moderate	-2	-2	-2	-2	-2	-4	2	3	-9	3	-27	80%	-21.6	+	High
			Riverine / Riparian	C	Moderate	-3	-3	-3	-3	-3	-6	3	3	-12	3	-36	100%	-36	+	High
			Seep	D	Moderate	-2	-2	-2	-2	-2	-4	1	2	-7	3	-21	100%	-21	+	High
OPERATIONAL	Routine operation and maintenance of the structures	Alteration of surface drainage and runoff	Channelled valley-bottom	D	Moderate	2	1	2	1	1	4	1	2	7	3	21	80%	16.8	L	High
			Riverine / Riparian	C	Moderate	2	1	2	1	1	4	1	2	7	3	21	100%	21	L	High
			Seep	D	Moderate	1	1	2	1	1	4	1	2	7	3	21	100%	21	L	High
		Stormwater Management	Channelled valley-bottom	D	Moderate	2	1	2	2	1	4	1	2	7	3	21	80%	16.8	L	High
			Riverine / Riparian	C	Moderate	2	2	2	1	1	4	1	2	7	3	21	100%	21	L	High
			Seep	D	Moderate	1	1	1	1	1	2	1	2	5	3	15	100%	15	L	High
		Conducting Maintenance	Channelled valley-bottom	D	Moderate	1	2	2	1	1	4	1	2	7	3	21	80%	16.8	L	High
			Riverine / Riparian	C	Moderate	2	1	2	1	1	4	1	2	7	3	21	100%	21	L	High
			Seep	D	Moderate	1	1	1	1	1	2	1	2	5	3	15	100%	15	L	High
		Proliferation of alien and invasive species	Channelled valley-bottom	D	Moderate	2	2	2	2	2	4	1	2	7	3	21	80%	16.8	L	High
			Riverine / Riparian	C	Moderate	2	1	2	1	1	4	1	2	7	3	21	100%	21	L	High
			Seep	D	Moderate	1	1	1	1	1	2	1	2	5	3	15	60%	9	L	High

RISK RATING TABLES [for Risk Assessment Matrix (version 2.1.1): Section 21 (c) and (i) Water Use Authorisation]

TABLE 1 – IMPORTANCE OF AFFECTED WATERCOURSE/S

What is the overall importance of the watercourse/s, based on the criteria and guidelines provided below?*

(If no formal assessment of EI / EIS / Wetland Importance has been completed, assign rating according to criterion below that results in the highest score)

Low or Very Low EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, Low rating based on presence of: - no areas identified to be of conservation importance (i.e. OESA at most); and/or - only species/habitats of Least Concern on the IUCN Red List or on a regional/national Red List (including freshwater ecosystem types of Least Concern in terms of the NBA); and/or - only species which are common and widespread and/or habitats of low conservation interest; and/or - highly degraded habitat of extremely small size	**Low / Very low** = 2
Medium EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, Moderate rating based on presence of: - CESAs; and/or - species/habitats listed as VU or NT on the IUCN Red List or on a regional/national Red List (including VU/NT freshwater ecosystem types in terms of the NBA); and/or - functionality as an important ecological corridor or buffer area	**Moderate** = 3
High EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, High rating based on presence of: - CBA2; and/or - species or degraded habitats (in poor condition) listed as EN or CR on the IUCN Red List or on a regional/national Red List (including EN/CR freshwater ecosystem types in terms of the NBA)	**High** = 4
Very high EI / EIS / Wetland Importance rating; OR, If EI/EIS has not been determined, Very high rating based on presence of: -CBA1; and/or - FEPA; and/or - species or intact habitats (in fair or good condition) listed as EN or CR on the IUCN Red List or on a regional/national Red List (including EN/CR freshwater ecosystem types in terms of the NBA); and/or - KBA or IBA or Ramsar site	**Very high** = 5

* EI=Ecological Importance; EIS=Ecological Importance & Sensitivity; OESA=Other Ecological Support Areas; IUCN=International Union for Conservation of Nature; CESA=Critical Ecological Support Area; NBA=National Biodiversity Assessment; VU=Vulnerable; NT=Near Threatened; EN=Endangered; CR=Critically Endangered; CBA=Critical Biodiversity Area; FEPA=Freshwater Ecosystem Priority Area; KBA=Key Biodiversity Area; IBA=Important Bird Area.

TABLE 2- INTENSITY OF IMPACT

What is the intensity of the impact on the resource quality (hydrology, water quality, geomorphology, biota)?

Negative Impacts	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large detrioration in PES (by one class or more)	+4
Very high / critically harmful; critrical deterioration in PES (to E/F or F class)	+5
Positive Impacts	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection status	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5

NOTE: Positive Impacts must be given a negative Intensity Score

***PES of affected watercourses must be considered when scoring Impact Intensity**

TABLE 3 – SPATIAL SCALE (EXTENT) OF IMPACT

How big is the area that the activity is impacting on, **relative to the size of the impacted watercourses**?

Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5

TABLE 4 – DURATION OF IMPACT

How long does the activity impact on the resource quality?

Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5

TABLE 5 – LIKELIHOOD OF THE IMPACT

What is the probability that the activity will impact on the resource quality?

Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

TABLE 6: RISK RATING CLASSES

RATING	CLASS	MANAGEMENT DESCRIPTION

1 – 29	**(L) Low Risk OR (+) Positive (+ +) Highly positive**	Acceptable as is or or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 – 60	**(M) Moderate Risk**	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
61 – 100	**(H) High Risk**	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA

TABLE 7: CALCULATIONS AND MAXIMUM VALUES

Intensity = Maximum Intensity Score (negative value for positive impact) X 2	MAX = 10
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 20 (MIN = -20 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 100
Significance\Risk = Consequence X (Likelihood / 100)	MAX = 100

RISK ASSESSMENT MUST BE CONDUCTED BY A SACNASP REGISTERED PROFESSIONAL MEMBER AND THE ASSESSOR MUST:

1) CONSIDER ALL THE RELEVANT PHASES OF PROPOSED ACTIVITIES (CONSTRUCTION AND OPERATIONAL PHASES, AS A MINIMUM);

2) CONSIDER RISKS TO RESOURCE QUALITY WITH THE PROPOSED CONTROL MEASURES (AS SPECIFIED) ASSUMED TO BE IN PLACE;

3) CONSIDER THE PRESENT ECOLOGICAL STATUS (PES) AND ECOLOGICAL IMPORTANCE & SENSITIVITY (EIS) OF THE WATERCOURSE AS RECEPTOR OF RISKS POSED;

4) RATE POSITIVE IMPACTS/RISKS REDUCTION USING NEGATIVE IMPACT INTENSITY SCORES IN THE RISK ASSESSMENT MATRIX;

5) INDICATE CONFIDENCE LEVEL OF SCORES PROVIDED IN THE LAST COLUMN AS A CATEGORY (LOW / MEDIUM / HIGH).

ON THE EXCEL SPREADSHEETS, ROWS THAT ARE NOT NEEDED CAN BE DELETED AND ADDITIONAL ROWS CAN BE ADDED IF REQUIRED