Aquatic Biodiversity Specialist Assessment

Proposed maintenance plan for 'Adopt a Spot' land on RE/464, George, Western Cape.

Prepared for Cape EAPrac (Pty) Ltd

by

Dr. Jackie Dabrowski (*Pr.Sci.Nat. Aquatic Science*)

Confluent Environmental (Pty) Ltd

confluent
aquatic consulting & research

Tel: 083 256 3159
Email: jackie@confluent.co.za

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Jackie Dabrowski (Ph.D., Pr.Sci.Nat. *Aquatic Science*)
SACNASP Registration Number 115166
Co-director: Confluent Environmental (Pty) Ltd

Qualifications: BSc, BSc Honours (Entomology), MSc & PhD (Veterinary Science)

Expertise: > 13 years' experience working on aquatic ecosystems across South Africa, with a focus on the Southern Cape in the last 6 years. Includes research and consulting expertise, having published > 10 water-related research articles and compiled > 250 aquatic specialist reports. Research and consulting have been in a range of sectors including agriculture, urban developments, linear structures, renewable energy, conservation, and mining.

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1. INTRODUCTION

Confluent Environmental Pty (Ltd) was appointed by Cape EAPrac to provide aquatic specialist inputs for the Maintenance Management Plan (MMP) for a portion of RE/464 located west of the 1 on York residential development in George, Western Cape (Figure 1). The project area is approximately 2.3 km North of the N2 off-ramp to York St, George. The project area covered by this MMP is on municipal land, but the George Municipality has approved the proposed MMP as part of their 'Adopt a Spot' programme (Appendix 1). Implementation of the MMP will be undertaken by Ruwacon who are the developers of the 1 on York residential estate and the Homeowners Association (HOA) of 1 on York will assume responsibility once the initial work has been undertaken.

Many residential units in the estate, which is still under construction, are orientated towards the project area which is currently in a disturbed and degraded condition. The proposed MMP will provide several benefits including the provision of G7 material to the ongoing development (from an old quarry); a suitable location to dump and reshape topsoil excavated from the development site (into and around the old quarry); and habitat enhancement resulting from the control of alien vegetation and revegetation with indigenous species.

The project area is partially located in an area mapped as the Camphersdrift Wetland (Figure 1) and has a few aquatic features on site which are assessed in this report.

Historically the project area has been repeatedly subject to degrading activities including being used as a quarry, dumping ground for soil, waste materials and rubbish, vegetation clearing leading to dense stands of alien vegetation, and at least two municipal stormwater outflows which had no attenuation features at all and resulted in the formation of serious erosion gullies. The site would greatly benefit from maintenance and rehabilitation to mitigate these impacts. Furthermore, the upgrade of existing stormwater outflows which includes features such as a sizable stilling basin serve as a great improvement to the *status quo*.

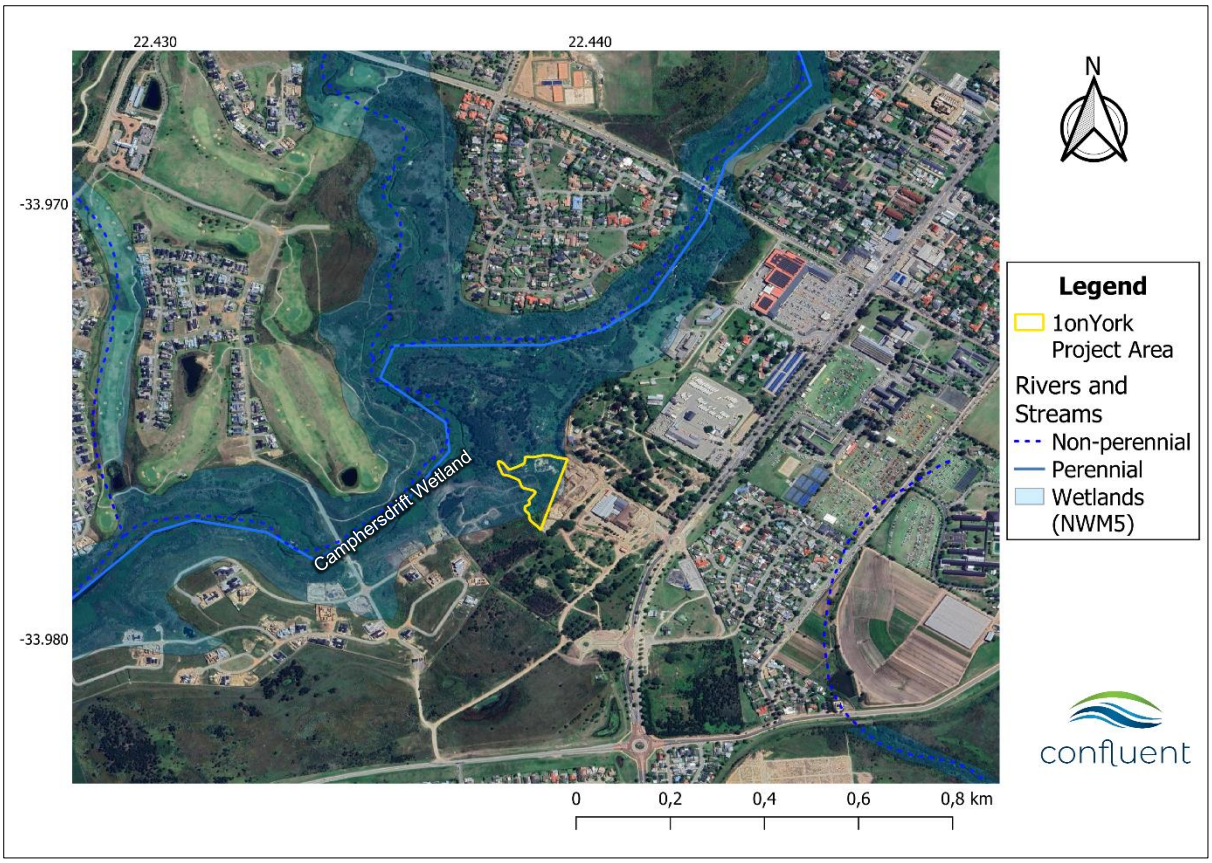


Figure 1. Project area (Adopt a Spot area west of 1 on York), George, Western Cape.

1.1 Proposed Maintenance Actions

From a broad perspective this MMP aims to remove waste materials, manage invasive alien vegetation and G7 gravel piles from the site, and improve disturbed areas through the placement and shaping of topsoil and revegetation with indigenous plants. Relevant features that form part of the MMP are mapped for the project area in Figure 2, with associated pictures shown in Figure 8.

Figure 2. Relevant features present at the site which form part of the MMP.

The project area will be accessed via an existing (although somewhat overgrown) track indicated in Figure 2. At least 3 large piles of rubble will be removed which contain tyres, building rubble, plastic and other debris. An excavator and tipper truck will remove two G7 gravel platforms and the material will be used in the 1 on York development. A large soil mound which has created steep slopes and gradients will be reduced in extent and shaped to reduce steep slopes. Any steep gradients which could exacerbate erosion or create instability will be trimmed and stabilised with vegetation. Topsoil from the 1 on York development will be used to reshape excavated areas to gentle slopes which will be revegetated with indigenous plants suitable to the site. Alien vegetation has mostly been controlled in an initial exercise but will be regularly followed up for maintenance of the site. Stormwater outflow points will be revegetated and protected if necessary to prevent erosion of gullies and soil loss.

1.2 Assumptions and Limitations

While the site had mostly been cleared of woody alien vegetation prior to assessment, some areas still had limited accessibility due to dense vegetation, unstable ground (dumped rubbish etc.) or steeply eroded channels. Although unlikely, pockets of indigenous vegetation worthy of protection may have been missed but should these be revealed during work on the site they should be protected.

For the same reasons explained above, additional piles of rubble or G7 may be present on the site that could be revealed whilst the site is being cleared. Any waste material exposed during this project should be removed from the site and the area rehabilitated following methods stipulated in this report.

1.3 Relevant Legislation

1.3.1 National Water Act

The project area is located approximately **170 m from the Camphersdrift Wetland**, which means that it lies within the 'Regulated Area of the Watercourse' which is defined as 500 m from a wetland in GN509 (2016) of the National Water Act (Act No. 36 of 1998). The proposed activities to maintain and rehabilitate the project area constitute Section 21 c) and i) water uses defined as:

Section 21 c): Impeding or diverting the flow of water in a watercourse; and

Section 21 i): Altering the bed, banks, course or characteristics of a watercourse.

Section 21 c) and i) water uses undertaken in the regulated area of a wetland must be assessed by a SACNASP-registered aquatic scientist using the Risk Assessment Matrix (RAM) to determine the level of risk posed by various actions to the Flow, Habitat, Water Quality and / or Geomorphology of the watercourse. Mitigation measures are recommended to reduce the risk of impacts to the watercourse. If the risks are considered 'Low' then the water use can be Generally Authorised (GA). If the risks are considered 'High' then a Water Use License (WUL) is applicable. The risk status is determined in the mitigated state, ie. Assuming full implementation of mitigation measures.

1.3.2 National Environmental Management Act

According to the National Environmental Management Act (NEMA; Act No. 107 of 1998) the actions proposed in this Maintenance Management Plan potentially trigger listed activities which are listed in Table 1.

Table 1. Listing notices and associated activities proposed for the project area in terms of NEMA.

Activity	Listing Notice	Applicability & Description of Proposal Related to the Listed Activity
19 (b)	*Listing Notice 1* *The **infilling or depositing of any material of more than 10 cubic metres** into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but **excluding where** such infilling, depositing, dredging, excavation, removal or moving -* *(a) will occur behind a development setback;* *(b) **is for maintenance purposes undertaken in accordance with a maintenance management plan**;* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or*	Excavation & movement of material (gravel, rubble, topsoil etc.) within & across a small non-perennial watercourse mapped to flow through the project area in a westerly direction into the Camphersdrift River. This drainage was confirmed as stormwater discharge (managed by existing outlet stilling basin) associated with a historical wetland long since transformed by existing development. The project area does not encroach on the Camphersdrift River itself. The maintenance activities covered by this MMP could impact artificial wetland created by mass earthworks such as the historical quarry.

	(e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	
12(iv)	*Listing Notice 3* *The **clearance of an area of 300m² or more of indigenous vegetation** except where such clearance of indigenous vegetation is undertaken in accordance with a maintenance management plan.* *(i) Within any **critically endangered or endangered ecosystem** listed in terms of section 52 of the NEM:BA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;* (ii) *Within **critical biodiversity areas** identified in bioregional plans;* *(iv) On land, where, at the time of the coming into effect of this Notice or thereafter such **land was zoned open space**, conservation or had an equivalent zoning.*	Although entirely transformed / disturbed by past quarrying, alien vegetation & dumping activities, the project site is located with a mapped critically endangered ecosystem, a terrestrial CBA and on land zoned as municipal open space. The clearance of vegetation is related to removal of stockpiled gravel and dumped rubble / waste, as well as the control of alien vegetation, in accordance with this EMMPr. This area to earmarked for rehabilitation (replacement of topsoil, stormwater & erosion control & replanting of indigenous vegetation) and maintenance thereof as part of this EMMPr and the 'Adopt-a-Spot' programme sanctioned by the George Municipality.

2. CATCHMENT CONTEXT

2.1 Catchment features

The project area is in quaternary catchment K30B adjacent to the Camfersdrift River and Wetland (Figure 3). The Camfersdrift River flows past the site in a south-westerly direction before reaching a confluence with the Gwaing River. The inherent erosion potential of soils (K-factor) at the site is mapped as Very High as observed on the site, two gullies have already eroded exacerbated by stormwater discharge and topography change due to quarrying, earthworks and dumping. The prevention of continued erosion through the controlled release of stormwater, reshaping of disturbed areas and sharp gradients is therefore important for the site (Table 2 and Figure 3).

Table 2. Summary of relevant catchment features for the proposed project area.

Feature	Description
Quaternary catchment	K30B
Mean Annual Runoff	213.78 mm
Mean Annual Precipitation	749.00 mm
Inherent erosion potential of soils (K-factor)	0.74, Very High
Rainfall intensity	Very High
Ecoregion Level II	20.02, Southeastern coastal belt
Geomorphological Zone	Upper Foothills
NFEPA area	Sub-quaternary reach 9115, FishFSA.
Mapped Vegetation Type	FFg5: Garden Route Granite Fynbos
Conservation	Critical Biodiversity Area 1 (Terrestrial; WCBSP (2017)

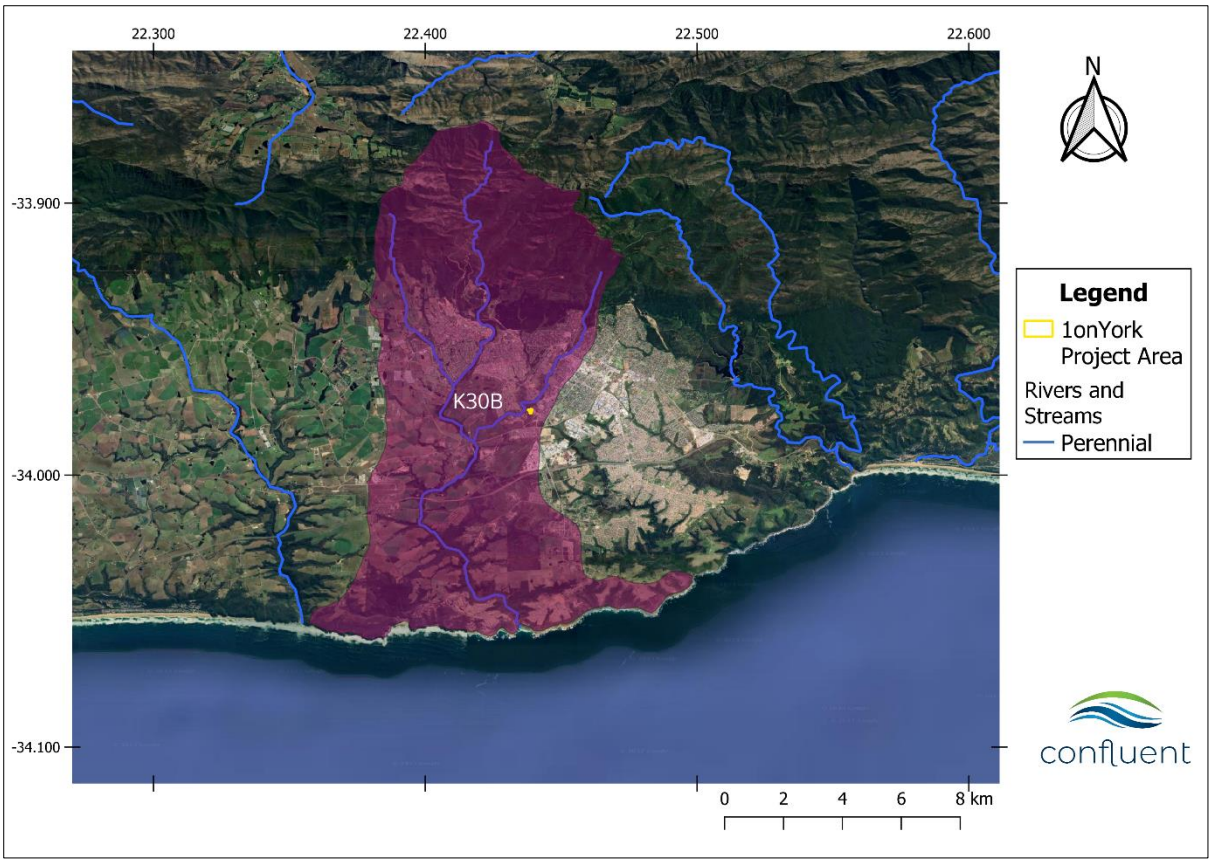


Figure 3. Location of the project area in quaternary catchment K30B.

Rainfall occurs year-round with minor seasonal peaks in spring (October) and autumn (March-April; Figure 4).

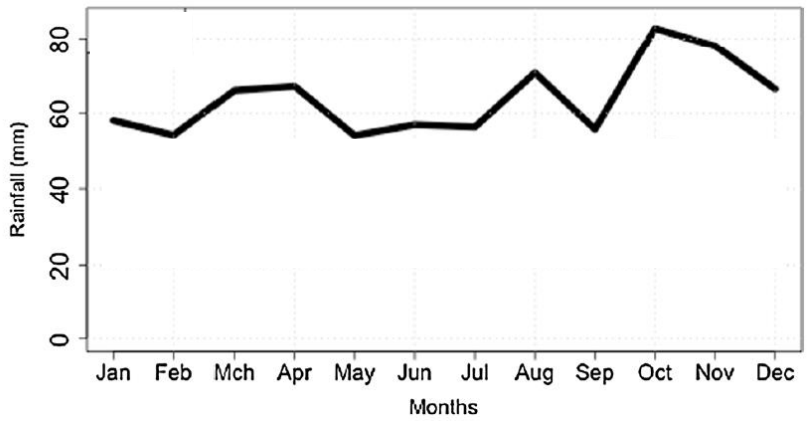


Figure 4. Area-averaged monthly rainfall for the coastal Southern Cape indicating peaks in Mar-Apr, Aug, and Oct. Data averaged between 1979 and 2011 (Engelbrecht *et al*., 2015).

The project area is located within the southeastern coastal belt (Ecoregion Level 2:20.02). The terrain is described as closed hills of moderate and high relief and moderately undulating plains. Altitude ranges between 0 – 1 300 m.a.m.s.l.

2.2 Vegetation

The vegetation type at the site is mapped as Garden Route Granite Fynbos, FFg5 which is classified as Critically Endangered according to the revised list of threatened ecosystems in need of protection (GN2747, 2002 of NEM:BA 2004). This vegetation type is described as

narrowly distributed with high rates of habitat loss in the past 28 years placing the ecosystem at risk of collapse. As the site is adjacent to the Camphersdrift Wetland there is a transitional zone between terrestrial and wetland dominated vegetation. The latter is very poorly mapped in George (and the southern Cape in general) but is best described as Cape Lowland Alluvial Vegetation which is classified as Endangered for the same reasons as above.

2.3 Conservation and Catchment Management

2.3.1 WCBSP

The Western Cape Biodiversity Spatial Plan (WCBSP; 2017) indicates the project area as a terrestrial Critical Biodiversity Area 1 (CBA1) and the Camphersdrift Wetland as an aquatic CBA1 (Figure 5). Relevant reasons for categorisation of the terrestrial CBA1 are listed as:

- Critically endangered vegetation variant - Wolwedans Grassy Fynbos (Vlok variant).
- Threatened SA vegetation type - Garden Route Granite Fynbos.
- Water resource protection area (Gwaing and southeastern coastal belt)

In addition to the above, reasons for the aquatic CBA1 in the Camphersdrift Wetland are listed as:

- FEPA river corridor (Fish support area).
- Water source protection: Gwaing River
- Watercourse protection: Southeastern coastal belt & Southern coastal belt
- Two wetland types - Eastern Fynbos Renosterveld Granite Fynbos Channelled Valley Bottom Wetland, Eastern Fynbos Renosterveld Granite Fynbos Floodplain Wetland

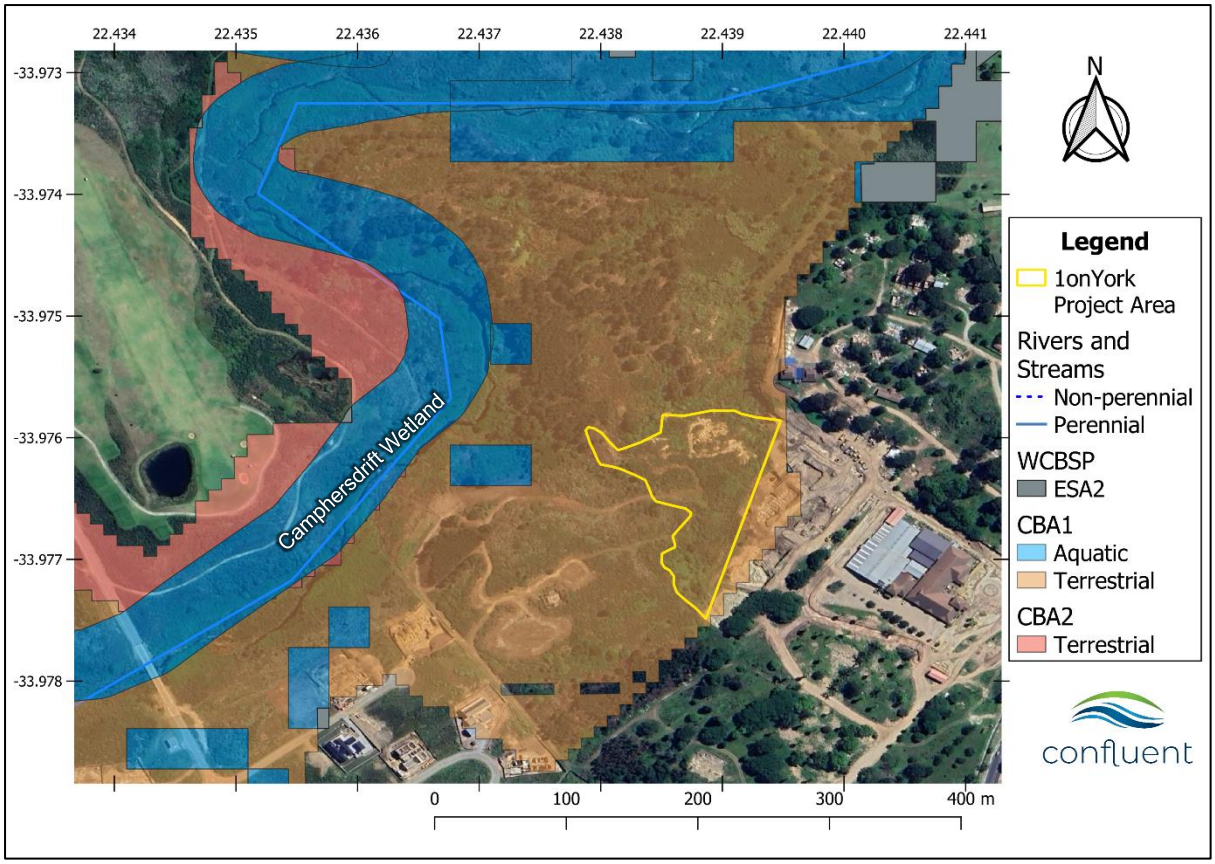


Figure 5. The project area with mapped conservation features of the Western Cape Biodiversity Spatial Plan (2017).

Necessary actions in relation to the WCBSP are to ensure that development on the site does not result in negative impacts to the ecological structure and function of the adjacent Camphersdrift Wetland. Actions proposed through this MMP are consistent with the management objectives of the WCBSP for CBA1 to rehabilitate degraded areas. Definitions and management objectives for CBA1 are provided (Table 3).

Table 3. Definitions and objectives for CBA1 in the Western Cape Biodiversity Spatial Plan (WCBSP, 2017).

WCBSP Category	Definition	Management Objective
Critical Biodiversity Area 1 (CBA1)	Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.	Maintain in a natural or near-natural state, with no further loss of natural habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.

2.3.2 NFEPA

According to the National Freshwater Ecosystem Priority Atlas (NFEPA; Nel *et al*., 2011) the sub-quaternary reach (SQR 9115), is classified as a Fish Support Areas, (FSA). The management objective for fish support areas is:

"Sub-quaternary catchments that are required to meet biodiversity targets for threatened and near threatened fish species indigenous to South Africa. Fish support areas also include SQRs

that are important for migration of threatened and near threatened fish species. River reaches in Fish Support Areas need to be maintained in a condition that supports the associated populations of threatened fish species."

Fish Support Areas are designated in SQRs with endangered fish species occur, but the condition of rivers is lower than an A or B ecological category.

Important fish species present in the SQR are 2 Western Cape endemics, *Galaxius zebratus* and *Sandelia capensis* (Cape kurper). The IUCN Red List classifies these fish as Data Deficient and Decreasing respectively. Both species occur in flowing rivers and streams and are unlikely to be in isolated or unchanneled wetlands. However, two invaluable and relevant ecosystem services provided by wetlands is the maintenance of base flows supported by interflow through soil during periods of low rainfall, and the removal of pollutants from urban areas which results in cleaner water delivered to flowing streams and rivers. It is important that these functions be preserved within the SQR, and stormwater is carefully managed to reduce high velocity inputs of polluted water.

2.4 Mapped Watercourses

Mapped watercourses include the Camphersdrift River that flows past the maintenance site to the West and one non-perennial flow path which crosses the project area in a westerly direction. The maintenance site also falls within the mapped area of the Camphersdrift Wetland (Figure 6).

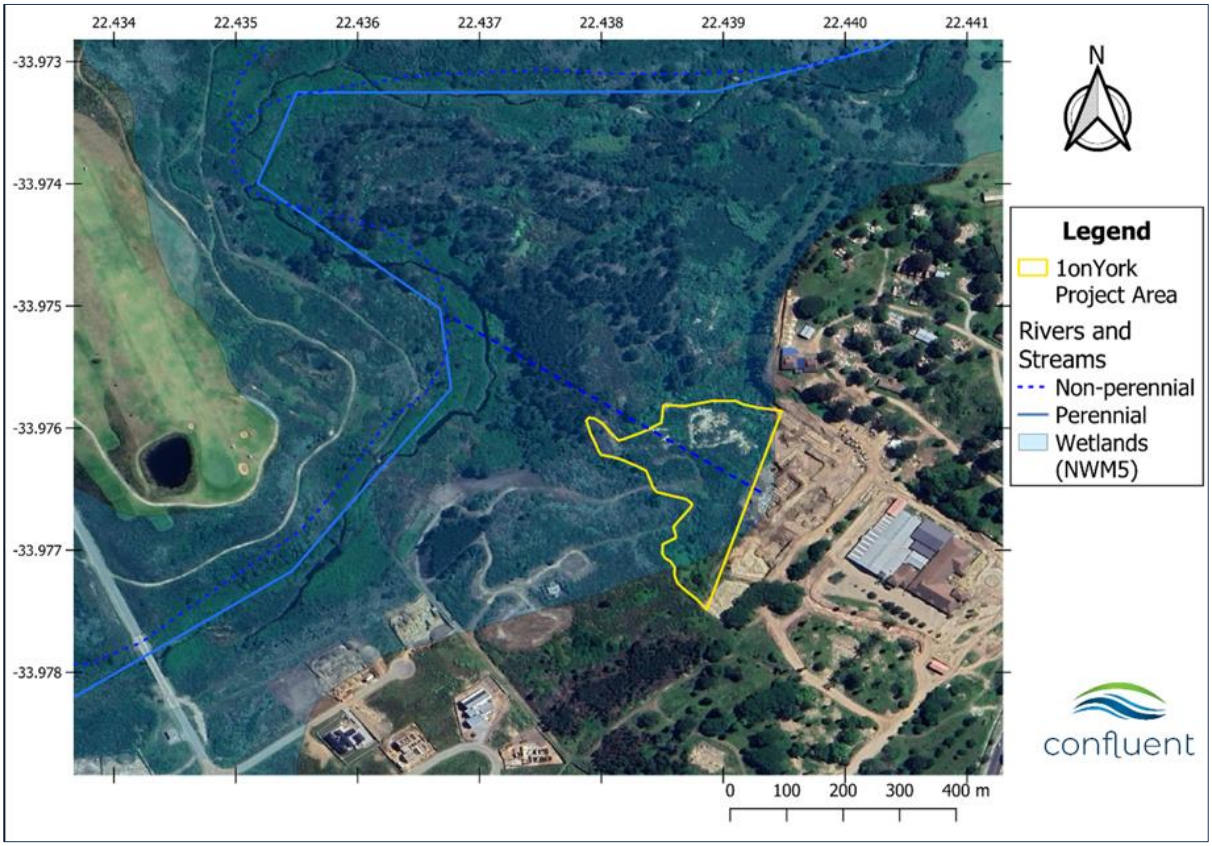


Figure 6. The maintenance site in relation to mapped watercourses and hydrological flow paths.

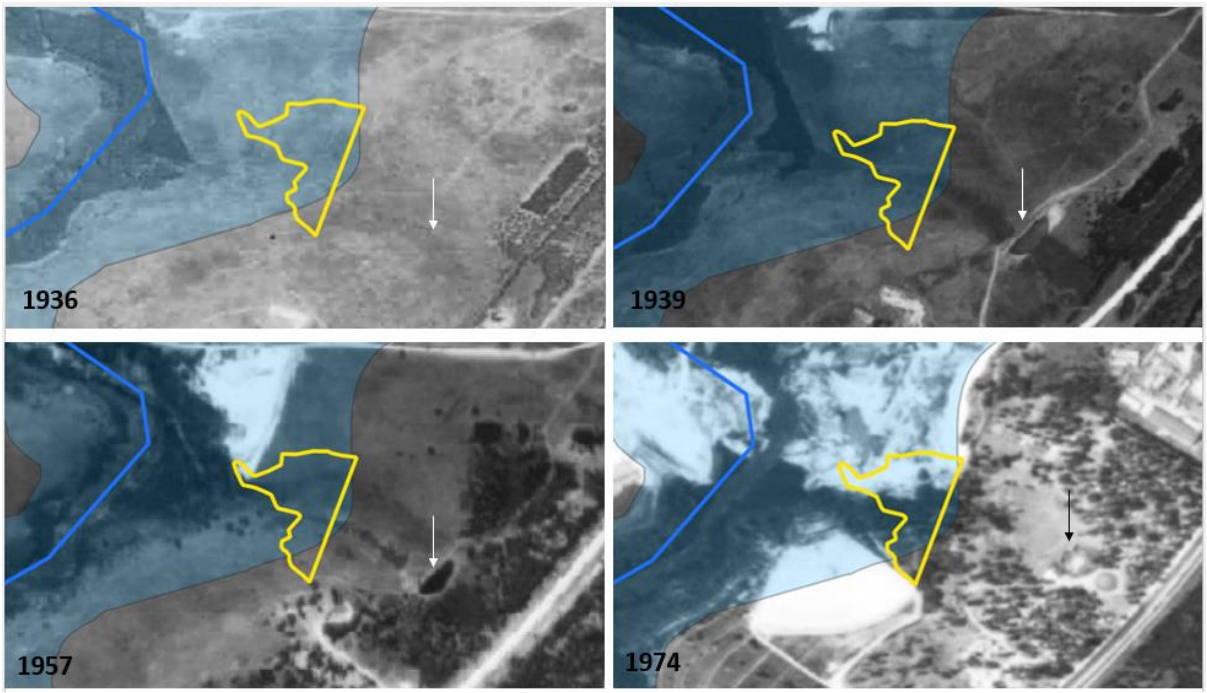
2.5 Historical assessment

Historical imagery is available from 1936 onwards. In 1936 the project area had no visible impacts affecting vegetation and no obvious signs of disturbance were evident. Three years later in 1939 a small dam had been built at the top of what appeared to be a wetland seep due to the darker vegetation along the slope which led to the Camphersdrift Wetland. This small wetland is aligned with the hydrological flow path indicated in Figure 6 and the associated dam was eventually infilled in and built over by the current gym and swimming pool complex.

Between the 1950s and 1980s various areas were extensively quarried including the northern portion of the project area. Parts of the quarried areas were gradually covered by vegetation as it established. Vegetation was mostly woody alien trees dominated by Black Wattle (*Acacia mearnsii).* From the 1950s onwards there is a densification and more extensive cover of vegetation associated with alien plant species which has been a persistent problem up to the present.

From the historical images a wetland, extending from a southwest direction through the site until it connects with the Camphersdrift wetland, can be observed from 1936 – 1957, identified by darkened areas of vegetation indicative of wetlands. From 1939 – 1957 a small dam was present in the upper reaches of the wetland that was proprobably for livestock farming (Figure 7).

Historically the project site and surrounding area has been quarried for several decades, possibly from 1939 up to 1976 (Figure 7). The quarrying took place on both sides of the Camphersdrift Wetland and accounts for the serious vertical edges currently present north of the project area. More recently in 2021 the mass clearance of woody vegetation across the site is evident with vehicle tracks and earth disturbances evident towards the end of that year (Figure 7).



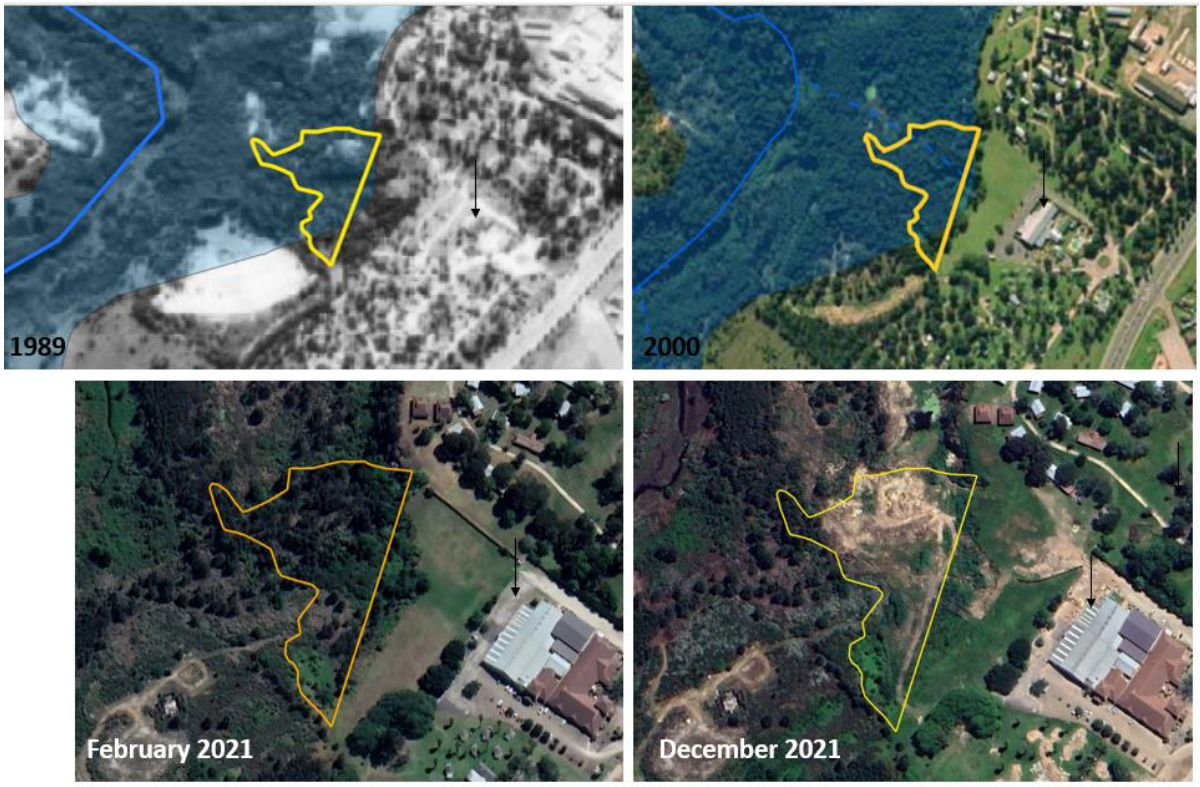


Figure 7: Historical photos showing the project area and notable changes between 1939 and 2021 (CD:NGI imagery; arrow indicates dam and historical wetland area below).

3. SITE ASSESSMENT

3.1 Site Condition

The site has been visited several times during the construction phase of the 1 on York development in 2023, but the detailed assessment for this MMP was on 13 September 2023.

Different aspects of the site are indicated in photos (Figure 8). Generally, the site is very degraded with only a few isolated indigenous vegetation remnants. A few patches of wetland vegetation consisting of hardy species resilient to disturbance occur at the site. To the north of the project area, where the deepest area of the quarry is located (outside of the site) is a significant area of wetland has formed which although artificial, provides reasonable habitat for wildlife and plants. Previous stormwater outflow points were unprotected and resulted in erosion cuts which have been colonised by high numbers of protected yellowwood trees and alien bottlebrushes (NEM:BA Category 1b). These trees are a direct reflection of the street trees planted along York Street where their seeds wash into the stormwater drain which effectively deposits them into the eroded gully. A new, protected stormwater outlet has been built for the 1 on York development which includes measures to mitigate high velocity flows including a stilling basin with gabion protection. An additional stormwater outlet is planned to the north of the site and will be constructed in a similar manner (Figure 2).

Rubble piles are not pictured, but present as mounds vegetated with alien and pioneer plant species. They are scattered across the site, and consist of rubble, rubbish, and tyres.

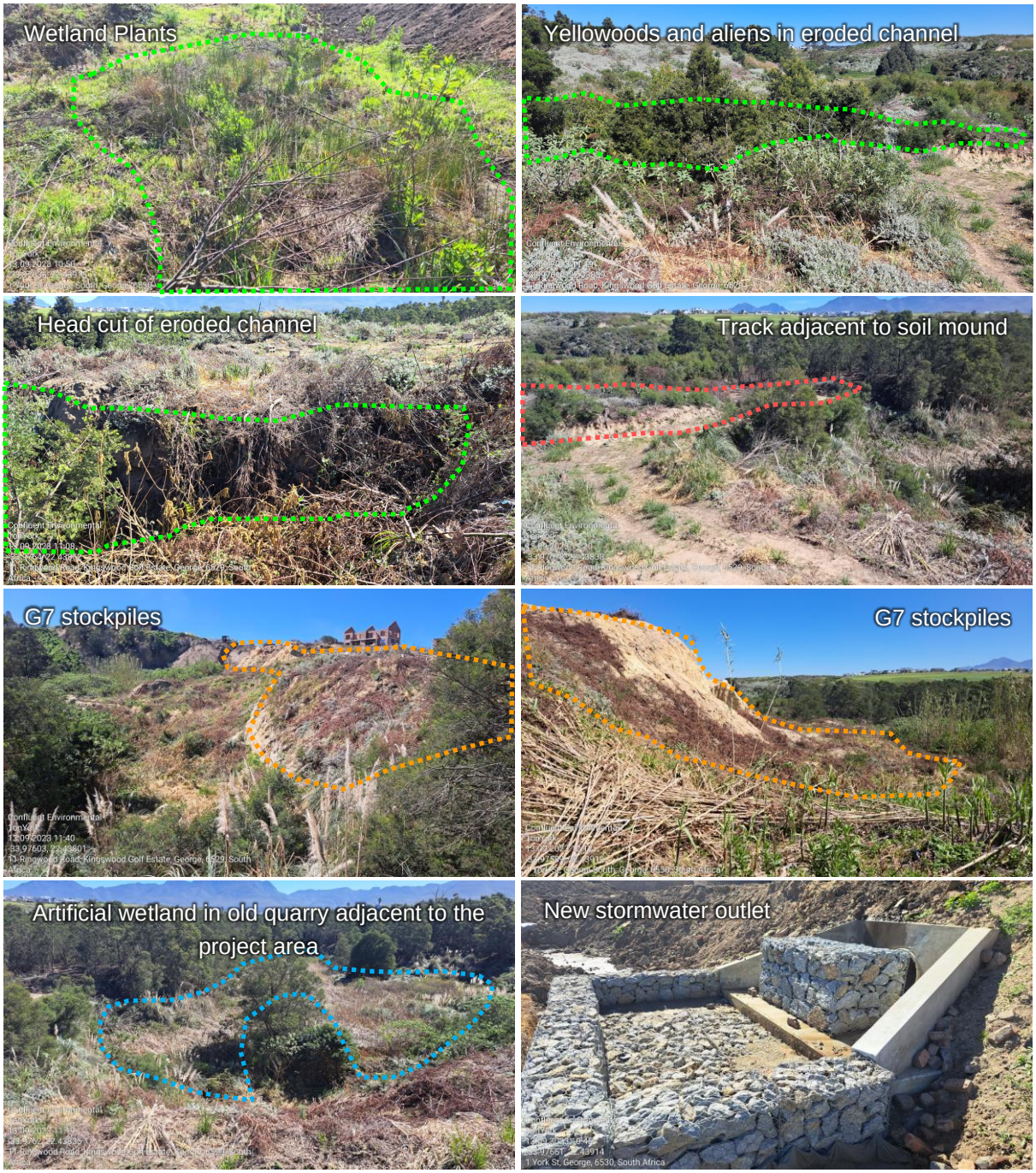


Figure 8. Relevant aspects of the project area, several of which correspond to points indicated in Figure 2.

3.2 Watercourse Delineation

Given the degree of disturbance that has occurred at the site over time, the delineation of watercourses was challenging. Factors that complicated this aspect include:

- Mass earthworks including infilling and excavations which can alter flow paths, drain wetlands, create new wetlands and infill wetlands.

- Stormwater outflow points which substantially increase flow volumes and velocities causing channel incision and draining of wetland habitat.
- Rubbish dumping which can smother and obscure wetland habitat.
- Historical construction of the gym and swimming pool complex over the old dam and wetland habitat which used to connect to the Camphersdrift Wetland (Figure 7).

Watercourses were delineated based on present and historical imagery of the site, as well as observations made during the site visit. Artificial wetlands created by the quarry and discharged stormwater have become functional ecosystems to an extent and have therefore been included and indicated as such. However, these areas are located beyond the project area. They provide the additional function of protecting the Camphersdrift Wetland from high velocity inflows of marginally polluted water originating from road runoff on York Street.

The delineation included a rough estimation of the extent of wetland habitat associated with the Camphersdrift Wetland as it is mapped by the National Wetland Map 5 layer as extending into the project area. However, this is not the case as shown in Figure 9. The wetland shown traversing the project area and originating on the slope which now forms part of the 1 on York development, is historical in nature. It no longer functionally exists due to infilling and construction in 2000 (Figure 7) and channel incision by the unprotected stormwater outlet. The latter has since been improved with construction of the protected outlet by 1 on York. The flow path indicated in Figure 9 corresponds with stormwater discharge and is what remains of the wetland. The current state of the watercourse can therefore be significantly improved with actions proposed by the developer and expanded upon in this MMP.

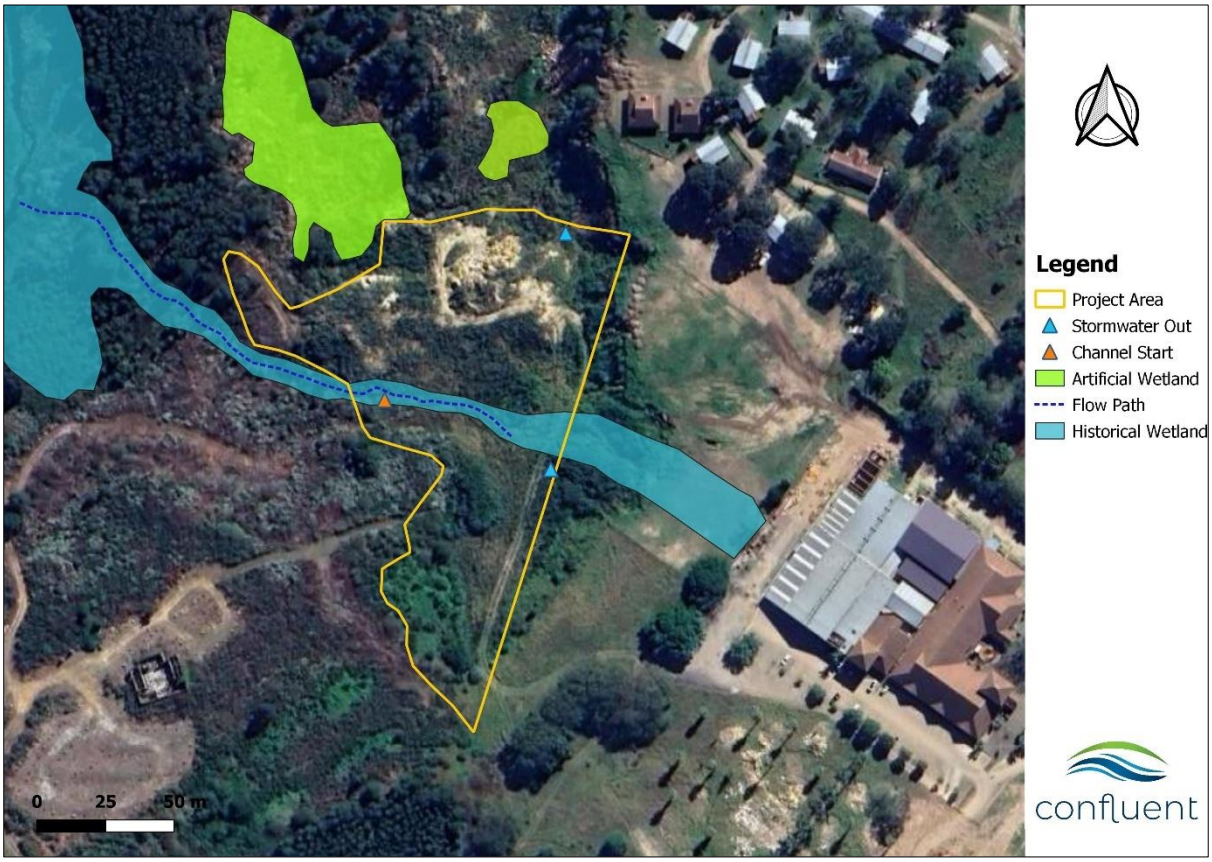


Figure 9. Delineated artificial wetlands and historical wetland across the project area which essentially ceased to exist due to various developments over time.

4. PROPOSED MAINTENANCE MANAGEMENT PLAN

4.1 Maintenance and Rehabilitation Aims

The overall aim is to recreate a landscape which is entirely vegetated by locally suitable indigenous plants with gentle gradients leading to a fairly unconfined valley-bottom wetland. The area should provide resources in the form of vegetative cover, food and water for local wildlife that occupy the Camphersdrift Wetland. Water originating from the site and surrounding areas should be of a high quality with measures in place that ensure delivery of clean water at a low flow velocity to the Camphersdrift Wetland.

4.2 Setback Lines and Buffer Areas

In addition to the delineated project area and historical wetland, a 10 m buffer zone was mapped for each of these features and is indicated in Figure 10. These two buffer zones serve different purposes. In the case of the Project Area, the 10 m line provides additional area within which beneficial activities can be undertaken provided they are covered by this MMP. For instance, if tyres associated with a rubble pile extend into the area beyond the Project Area, then these may also be cleared for up to 10 m distance from the Project Area. The 10 m buffer around the historical wetland indicates an area where limited disturbance should occur and revegetation should prioritise plant species which are considered temporary to seasonal wetland plants.

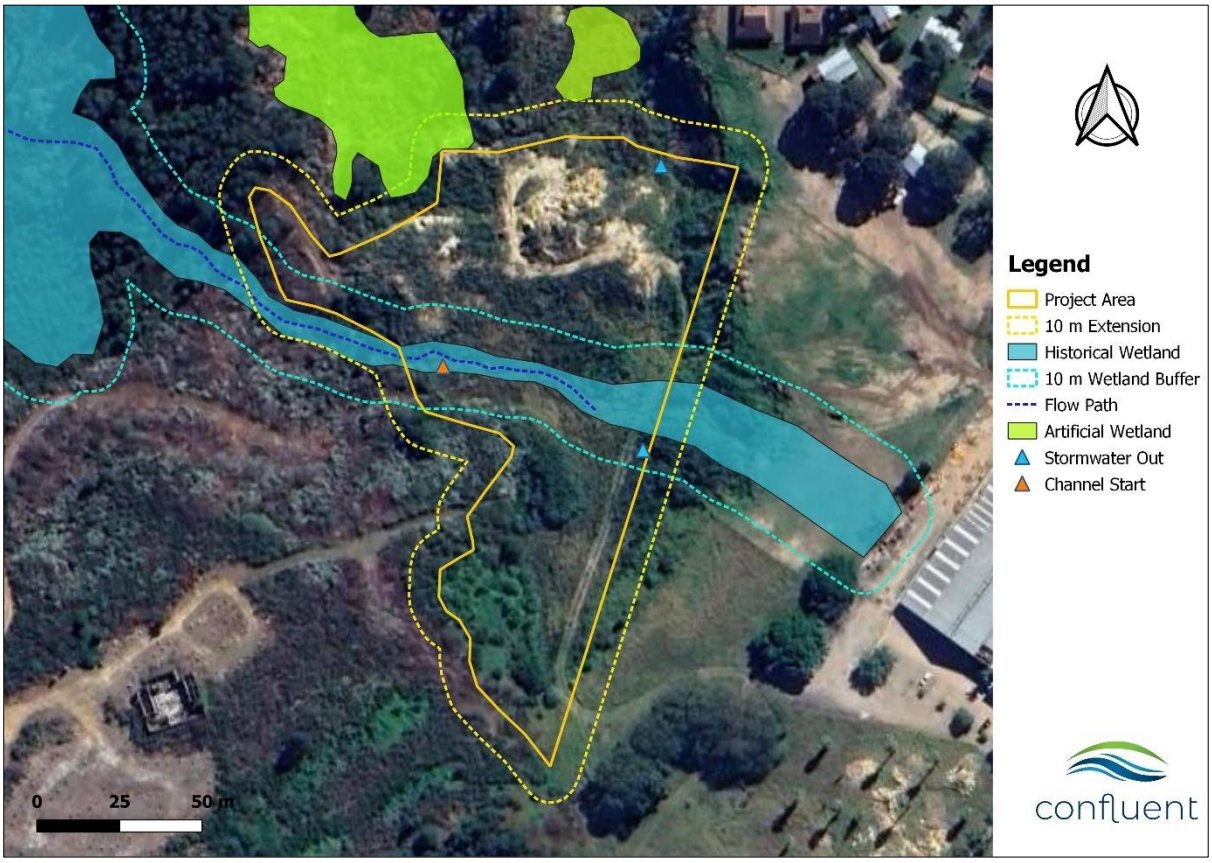


Figure 10. Historical wetland area indicating 10 m buffer either side, and 10 m extension area (if necessary) around the Project Area.

4.3 Plants for Revegetation

A list of indigenous plant species appropriate to the area, vegetation type and topography is provided in Table 4. This list includes plants that are fairly easy to obtain from local nurseries and that are relatively easy to grow with minimal effort provided they are planted well and cared for initially.

Table 4. List of suitable plant species for revegetation of disturbed areas post re-shaping or alien plant removal.

Species name	Common name	Wetland Buffer	Wetland	Other areas
Trees				
Buddleja salviifolia	Sagewood	✓		✓
Buddleja aligna	False olive	✓		✓
Ekebergia capensis	Cape ash	✓		✓
Halleria lucida	Tree fuchsia	✓		
Osteospermum moniliferum	Bitou	✓		✓
Shrubs				
Agathosma ovata	Boegoe	✓		
Anisodontea scabrosa	Sand mallow	✓		✓
Cyperus textilis	Mat sedge	✓	✓	
Helichrysum cymosum	Fume everlasting	✓	✓	
Helichrysum petiolare	Licorice plant	✓		✓
Hermannia flammea	Doll rose			✓
Hypoxis hemerocallidea	African potato			✓
Psoralea sp.	Fountainbush	✓	✓	
Watsonia galpinii	-	✓		✓
Watsonia pillansi cf. fourcadei	-	✓		✓
Selago corymbosa	Stiff bitterbush	✓		✓
Pelargonium fruticosum	None	✓		✓
Pelargnoium capitatum	Rose-scented pelargonium	✓		✓
Phylica axillaris or Phylica ericoides	Hardebos			✓
Podalyria myrtillifolia	Keurtjie	✓		✓
Polygala myrtifolia	September bush	✓		✓
Selago villicaulis	Purple turtle	✓		✓
Struthiola dodecandra	Soet gonna	✓		✓
Wachendorfia thyrsiflora	Marsh butterfly lily		✓	
Cliffortia strobilifera or Cliffortia graminea	Cape stock rose / vleibos	✓	✓	
Cliffortia odorata	Wild vine (can take over)		✓	
Aristea ecklonii	Blue stars	✓		✓
Juncus effusus	Soft rush		✓	
Zantedeschia aethiopica	White arum lily		✓	
Grasses				
Aristida junciformis	nGongoni grass	✓		✓
Cynodon dactylon	Kweek (can be invasive)	✓		✓
Eragrostis capensis	Hartjiesgras	✓		✓

Stenotaphrum secondatum	Buffalo grass	✓		✓
Groundcover				
Plectranthus fruticosus	Pink fly bush (shade-loving)	✓		✓
Juncus lomatophyllus	Creeping rush		✓	
Isolepis prolifera	Vlei gras		✓	

4.4 Earthworks Plan

Major earthworks will be undertaken using an excavator, tipper truck, grader and dozer where necessary. An annotated site map with a summary of the order of operations and relevant action points is provided in Figure 11.

A Note on Levels

It is critical that the site surveyor is present throughout earthworks. This is to ensure that ultimately the site drains gently towards the historical wetland and does not divert overland flow to new areas or the quarry. The latter would increase the risk of eroding new channels and would reduce success of rehabilitation of the historical wetland area. The site is not to be used as a dumping ground for topsoil, which must only be used where needed.

Pre-earthworks actions

- Historical wetland buffer must be marked off with temporary fencing apart from the road crossing which gives access to the remainder of the site, and the rubble pile in the wetland which must be removed. The buffer is a No-Go area for heavy vehicles to avoid compacting soil and creating further disturbance.
- Mark all indigenous vegetation with temporary fencing or danger tape and ensure all contractors know these are No-Go areas.
- Note carefully the Natural Ground Level (NGL) surrounding the historical wetland area. All soil shaping should aim to maintain this ground level. No unnecessary infilling, dumping of topsoil or excavation must take place beyond the areas discussed in this plan.

Access points

- Access should be via the existing track which is somewhat overgrown, but indicated in Figure 2 and Figure 11.
- Most points requiring earthworks are accessible from this existing track although short access tracks may be necessary to reach the rubble piles. These must be kept to the minimum footprint of disturbance.

Remove soil mound and reduce road height

- Site surveyor to monitor this process carefully to ensure that reducing the road height does not create a flow path from the surrounding site into the quarry. The aim to create gentler gradients and remove unnatural land forms.

- Refer to Location 1 in Figure 11 where a large mound of soil has been placed adjacent to the eroded gully which was a wetland, and still has wetland plants towards the lower end of the gully. Care must be taken to avoid disturbing Yellowwood trees.
- The road itself must be excavated down approximately 2 – 3 metres (further informed by the surveyor) as it has been built up with soil discarded from the adjacent quarry presumably. Work in the direction from West to East.

Excavate, removal and reshaping G7 piles

- Refer to Locations 2 and 4 in Figure 11. Pull material back from the edge of the artificial wetland towards the development. Material haulage to be via the existing track. Cease removal when the ground level matches that of the project area south of the G7 piles.
- Refer to Location 3. This point has a steep and eroding edge which must be trimmed back and reshaped to a more gentle gradient.

Construct new stormwater outlet

- Refer to Location 5. Design must sufficiently accommodate flows from the development and catchment area without causing erosion of the slopes below. A similar design to that already constructed on the site is suitable and has been planned for the site (Figure 8). But if more stormwater volumes are expected, it may be necessary to extend the stilling basin to an extent. This would be considered acceptable and indeed desirable as not natural wetland areas are affected and any measures that attenuate stormwater are considered beneficial.
- Conclude construction of the stormwater outlet prior to moving into new areas of the site rehabilitation as far as possible. The reason is to avoid crossing recently cleared ground repeatedly which could hamper rehabilitation efforts and increase soil compaction.
- The sloped area above the new stormwater outlet will need to be shaped back to a gentler gradient than the present. Once a suitable gradient has been attained then the slope should be stabilised with soil protection jute matting and seeded with grasses as indicated in Section 4.6. Ultimately a dense cover of indigenous shrubs would be important for stabilising the slope and preventing erosion or slips.

Remove rubble piles

- Refer to Locations 6,7 & 8. Remove all rubble, rubbish, tyres, and any other refuse that has been discarded at these locations. If any additional piles are identified within the project area, these should also be removed.

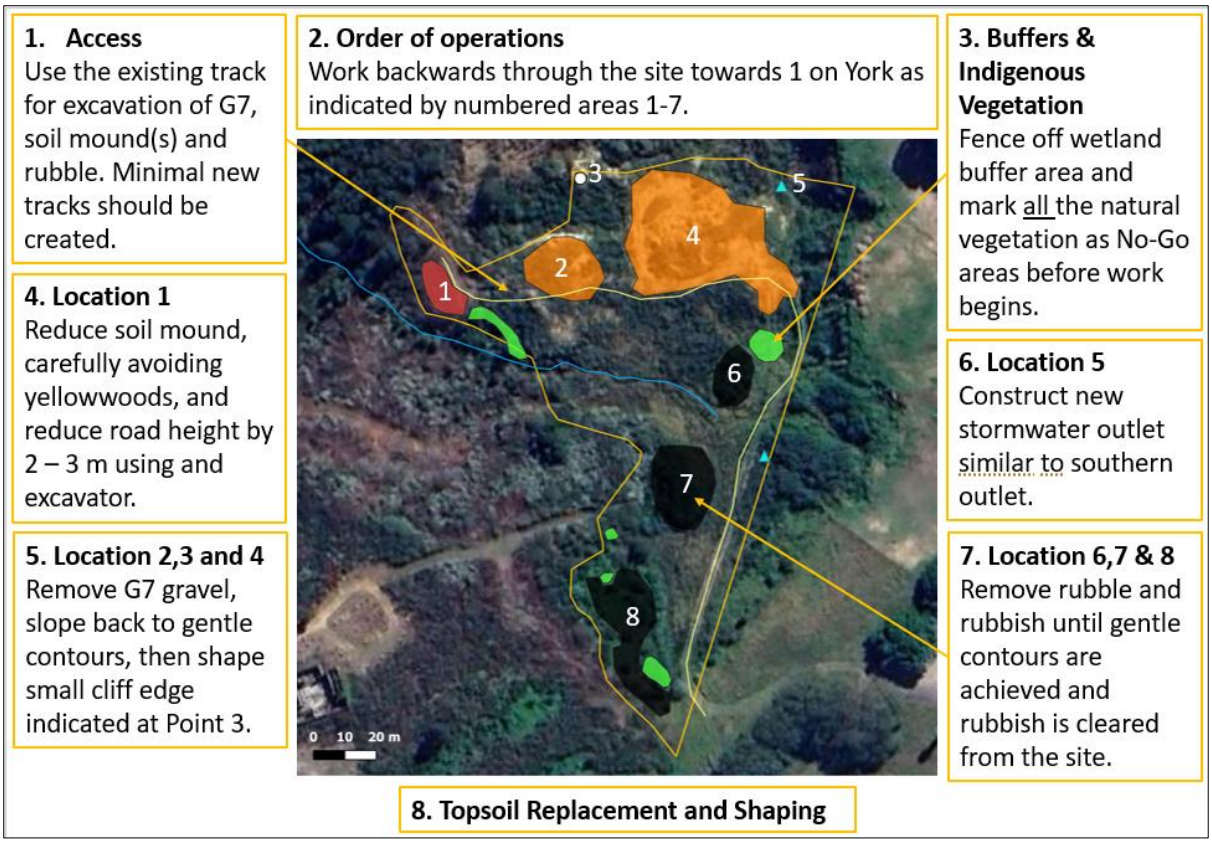


Figure 11. Annotated layout of the site indicating a basic overview of the actions to be undertaken.

4.5 Erosion Gully

The eroded gully formed by high velocity outflows of stormwater can be significantly improved through several actions. Firstly, reducing the volume and velocity of inflowing water will help to prevent further erosion and scour from occurring in the gully. As the stormwater outlet has already been formalised from its previous state as an unprotected piped outflow, this aspect has already been addressed. The gully location and a summary of proposed steps is provided in Figure 12. The gully is not in the original project area but is within the 10 m extension area. Inclusion of this feature for improvement will significantly improve the structure and function of the watercourse.

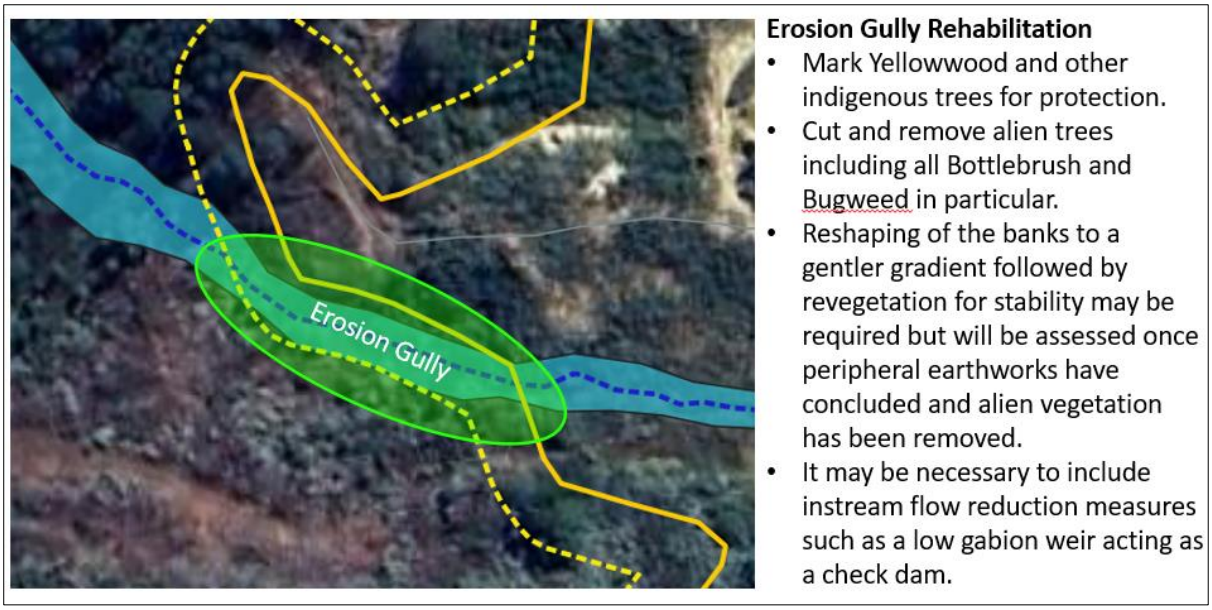


Figure 12. Approximate extent of the erosion gully to be addressed by the MMP. Summarised steps are provided with more detailed explanations in the text.

1. Many Yellowwood trees and a few other pockets of indigenous vegetation have established in the gully (Figure 15cf). Prior to any work, these must be identified for protection.
2. As it is likely this work will be undertaken during the breeding season, check all trees for obvious bird nests. If present, inform the site ECO and do not remove the tree. Remove all alien invasive vegetation from the incised channel and immediate banks by hand. Several alien species dominated by Bottlebrush and Bugweed are present in the channel and make an assessment of the extent of the gully and shape of the channel difficult to determine. Trees should be cut into manageable sizes using chainsaws and the stumps painted with a non-dispersive herbicide (cut and paint method) *during an extended period of dry weather*. All branches and woody material must be removed from the gully and the site.

The gully must be reassessed by the aquatic ecologist following:

- Removal of alien vegetation, and
- Surrounding earthworks at Location 1 (Figure 11)

It is likely that one or two small gabion weirs will be required flatten the channel slope and encourage instream sedimentation. This may be coupled with reshaping and revegetation of the incised banks depending on the location of indigenous vegetation and bank stability which will be determined by the aquatic ecologist. The gabion weirs would follow the principle illustrated in Figure 13. It is anticipated that gabion weirs would not be higher than 1 m above the stream bed and would need downstream protection in the form of a submerged gabion. Gabions are to be vegetated ‘green’ gabions.

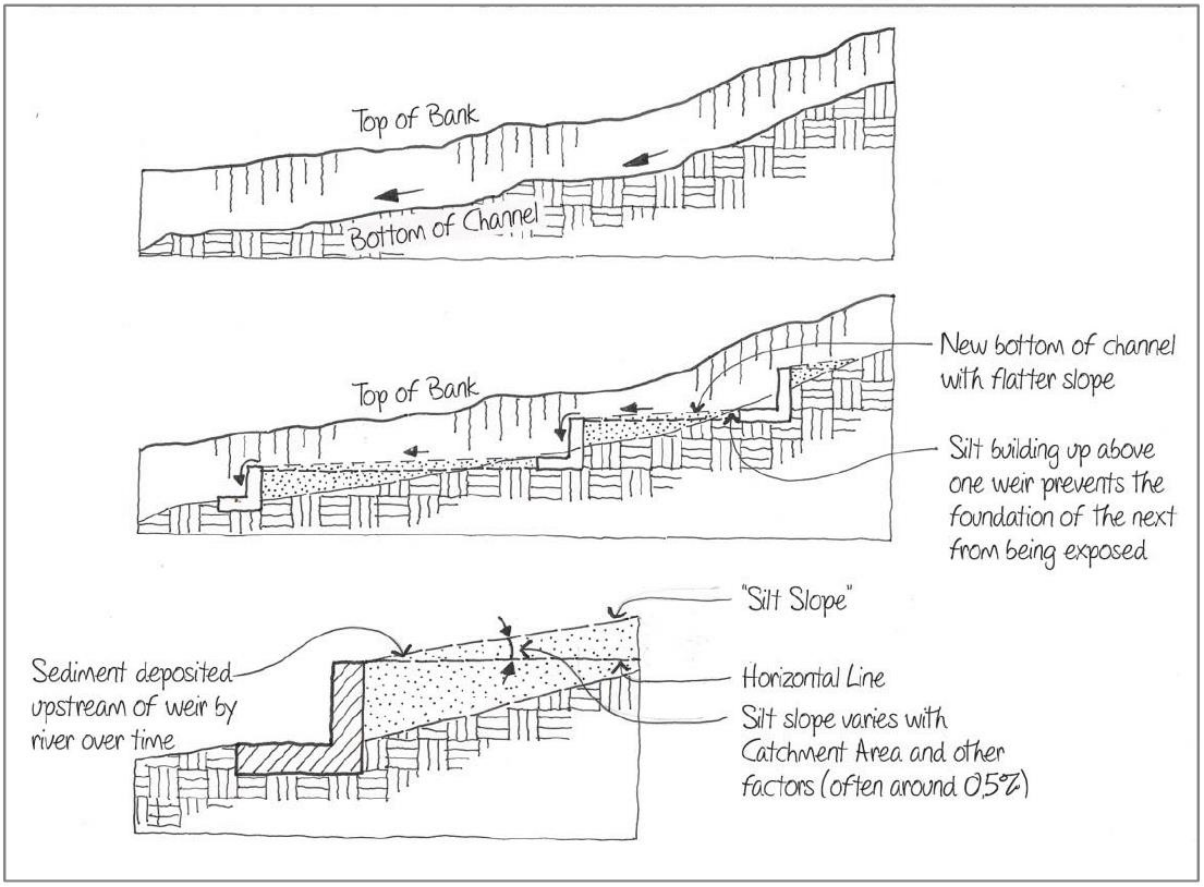


Figure 13. Indirect river incision control using a series of weirs which flatten the channel slope (Day *et al.*, 2016)

To protect the erosion gully from the effects of higher volume flows from the stormwater outlet, it is recommended that at least two soil berms be constructed in the approximate location indicated downstream of the stormwater outlet in Figure 14. The aim of the soil berms would is to retain small volumes of stormwater while allowing excess water to discharge more or less equally on either side of the berm when it reaches capacity. They will also encourage the establishment of wetland vegetation in the wetland area.

The berms must be constructed in a way that water would be evenly spread across the berm as opposed to concentrated in any area.

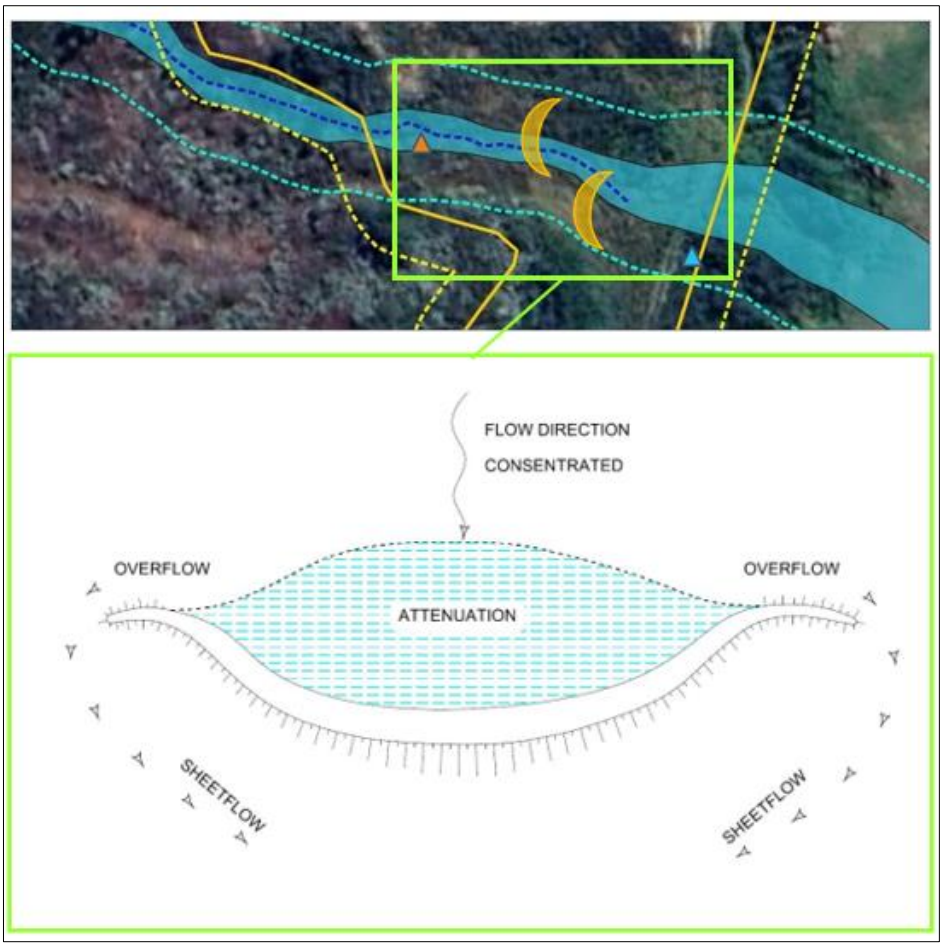


Figure 14. Sketched detail and approximate location of the conceptual soil berm to attenuate stormwater runoff from the site aimed at reducing high velocity and volume flows from reaching the eroded gully.

Figure 15. Photos of various aspects of the erosion gully showing the head cut and dense vegetation in the gully itself.

4.6 Soil Stabilisation and Revegetation

Any area disturbed following earthworks where topsoil has been replaced and reshaped must be rapidly revegetated using the plants listed in Table 4 of this MMP and following the guidelines in Figure 16 and Figure 17. This is to encourage stabilisation of the soil and minimise erosion. While every effort was made to list plants commonly available at local nurseries, it may be difficult to source all the plants on this list. Only plants that naturally occur in fynbos areas around George should be used. As far as possible this should exclude nursery cultivars and forest species as the site was originally covered in fynbos and a wetland. The

planting plan should follow the designated wetland, wetland buffer, and all other areas guideline.

Sloped areas may need protection from erosion while vegetation becomes established. And it may be necessary to first establish a rapid cover of a grass consisting of perennial indigenous grass *Cynodon dactylon* (kweek), and annual *Eragrostis teff* (available from agricultural co-op or most nurseries) with soil saver matting (jute mesh; Figure 16) pinned over the area for protection. Weed-free oats (*Avena sativa*) from a supplier like Agricol also provide rapid cover and are a non-invasive annual species which could be included in the mix. The aim is to provide mostly temporary cover and soil stabilisation while indigenous seedlings establish. The seed should be mixed in a 1:1:1 ratio and sown at a rate of 20 kg / ha. Seeds must be lightly raked so they are covered by 0.5-1cm of soil. Once cover has been established on sloped areas, this can be followed up with planting of more diverse species listed in Table 4.

Throughout this phase, alien plants are likely to germinate and must be continuously removed.

Detailed methods for the use of jute mesh and silt fencing are provided in Appendices 2 and 3.

Figure 16. Example of jute mesh also known as soil saver matting placed on a slope seeded with oats and further protected with silt fencing.

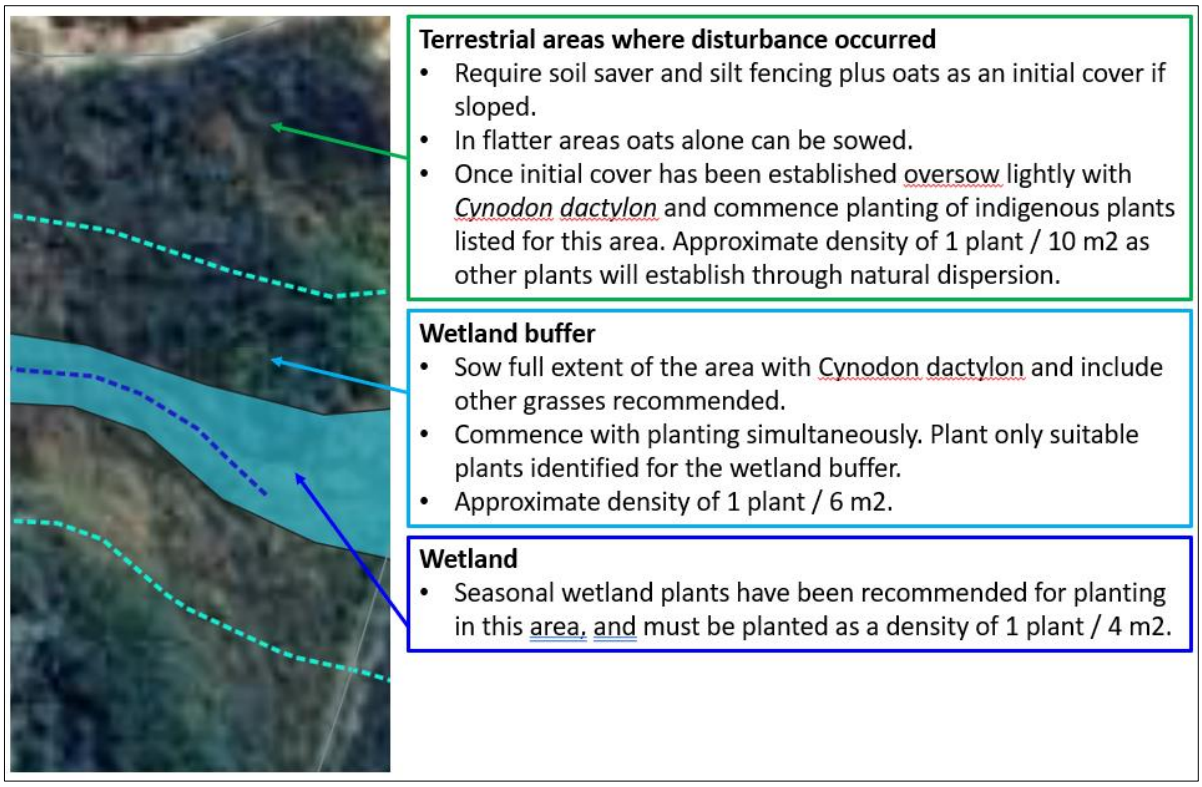


Figure 17. Areas identified in the MMP for different revegetation strategies. Plants listed for each different zone are provided in Table 4.

4.7 Alien Plant Management

Alien plant species identified at the site that will need continual management and maintenance are listed in Table 5 with corresponding invasive status categories in Table 6. An initial clearance of black wattles (*A. mearnsii*) was undertaken in June / July of 2023).

- Once earthworks at the site have concluded and revegetation is in progress, follow up control will be necessary. As most of the site will have been cleared and aliens have been controlled recently, this should be possible through regular hand-pulling of seedlings.
- A Tree Popper can be used to pull out trees which are too large for hand-pulling.
- In the demarcated wetland areas (natural and artificial, no herbicide may be used as an ongoing control measure. This is because amphibians and other aquatic organisms are highly sensitive to a range of commonly used herbicides.
- The large stand of Bottlebrushes and Bugweed in the erosion gully may initially be removed by sawing down trees into manageable pieces for removal, and painting the stems with a non-dispersive (gel-like) herbicide. Kaput is frequently used, but appears to spread to the soil substantially. Garlon 4 is therefore preferable, but must be carefully spot sprayed as soon as possible after cutting the trunk, or it will form a protective seal rendering the herbicide ineffective.
- Any dense stands of Rubus sp. (bramble) should first be brush cut and all visible stems immediately spot sprayed with Garlon 4.

Any application of herbicide can only be undertaken during an extended period of dry weather.

Table 5. Invasive alien plant species identified at the site.

Species Name	Common Name	Growth Form	NEMBA Category
Acacia mearnsii	Black wattle	Tree	2
Acacia melanoxylon	Australian blackwood	Tree	2
Callistemon rigidus	Stiff-leaved bottlebrush	Tree	1b
Cestrum laevigatum	Inkberry	Shrub/tree	1b
Cortaderia selloana	Pampas grass	Grass	1b
Paraserianthes lophantha	Australian albizia	Tree	1b
Rubus sp.	Bramble, Blackberry	Shrub	1b
Solanum aviculare	Kangaroo apple	Shrub/tree	Emergent invasive
Solanum elaeagnifolium	Silver-leaf bitter apple	Shrub	1b
Solanum mauritianum	Bugweed	Shrub	1b
Vinca major	Periwinkle	Herb	1b

Alien plant species identified in this plan are mostly in Category 1b (Table 6) which means that responsible land manager is legally obligated to remove these plants from the site.

Table 6. NEMBA categories for invasive alien plants in the project area.

Invasive Status (category)	Description
Category 1b (Prohibited)	Invasive species requiring compulsory control as part of an invasive species control program. Remove and destroy. Plants deemed to have such a high invasive potential that infestations can be placed under a government sponsored invasive species management program. No permits can be issued.
Category 2 (Permit required)	Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed in Category 2. No permits will be issued for these plants to exist in riparian zones (wetland and buffer area in this case).

4.8 Adaptive Management Opportunities

The long-term management of the Adopt-A-Spot area will be undertaken by the homeowner's association (HOA) of 1 on York. The agreement with the municipality to manage the site is renewable every 3 years, and it is anticipated that the HOA will renew the agreement for approximately a decade until minimal further interventions are required. It is recommended that with each renewal, the site be critically assessed to determine whether recommendations in this report are still applicable, and to seek opportunities to further enhance the biodiversity and ecological integrity of the site.

5. RISK MATRIX

Methods used to complete the risk matrix are provided in Appendix 4. Completion of the risk matrix is required when work is undertaken within the regulated area of the watercourse as defined in GN509 of 2016 as 500 m from a wetland. Affected watercourses in this case are

the historical wetland delineated across the project area, and the Camphersdrift Wetland further downslope which is approximately 100 m away.

For all intents and purposes the wetland which crossed the project area has ceased to exist due to historical infilling, stormwater and construction. The actions in this maintenance plan aim to rehabilitate the structure and function of the wetland as far as possible within the project area. The Camphersdrift Wetland is separated from the site by dense vegetation and in some cases by topography due to the historical quarrying. From this perspective there are not many impacts to a watercourse that require mitigation and can be assessed in the Risk Matrix. Consideration has however been given to a few aspects of the work where mitigation measures are provided to reduce risk to aquatic ecosystems.

Construction and Operational Phase impacts are considered and are presented in Table 7. The outcome of the Risk Matrix was a ‘Low Risk’ and a range of mitigation / control measures have been provided that must be implemented to maintain this risk rating. On the basis of the Low-Risk outcome, a General Authorisation in terms of the National Water Act would be applicable for the MMP at this site.

Table 7.Risk Matrix for proposed maintenance and rehabilitation actions at RE/464.

Risk Matrix completed by Jackie Dabrowski SACNASP registration number 115166.

Impacts assume full implementation of mitigation measures.

					Severity															
No.	**Phases**	**Activity**	**Aspect**	**Impact**	**Flow Regime**	**Water Quality**	**Habitat**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**	**Frequency of activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance**	**Risk Rating**	**Confidence level**	**Control Measures**	**PES AND EIS OF WATERCOURSE**
		Heavy construction vehicles accessing the site for earthworks	Widespread disturbance to soil and vegetation	Erosion and sedimentation in watercourses.	0	2	1	3	1,5	2	2	5,5	1	2	5	1	9	49,5	Low	70	• Pre-construction, temporary fencing must be erected along No-Go areas as indicated in Fig. 11. • Signage indicating No-go areas must be placed on fencing. • Contractor to have stock of erosion control materials on site. This includes hay bales, shade cloth, jute mesh and wooden stakes. • Check ahead for rainfall. Do not continue work during rainfall, and ensure the site is prepared to minimise erosion and sediment-laden runoff in advance of rainfall. • Site topography is likely to change substantially throughout the construction phase. Between the ECO and the contractor, erosion control materials must be place where sediment-laden water could enter any watercourse or flow path. • All contractors must be briefed that vehicles, workers and materials may not encroach into No-Go areas. • Access road for the project area must primarily use the existing track indicated in Fig. 11. Side tracks to access and excavate rubble or other materials may be created but must exclude the wetland buffer as far as possible, and create a minimal footprint of disturbance. • All material stores should be kept on flat areas and bunded to prevent material loss during rainfall.	

	CONSTRUCTION PHASE			Harm or mortality to (mainly terrestrial) animals but posibly amphibians.	0	0	0	2	0,5	1	2	3,5	1	2	5	1	9	31,5	Low	80	• Team of 3 - 5 workers to move ahead of area to be excavated creating a disturbance by stomping, clapping and jumping to drive out any small animals. A catcher should be on standby with a wooden box, towel and gloves to catch any small mammals or rodents that are flushed. This action must be explained and supervised by the ECO. • Any animals caught should be relocated to a similar habitat at the site where earthworks are not planned.	
1			Vehicle leaks or fuel spillage	Pollution of watercourses or aquatic habitat	0	1	0	0	0,25	1	1	2,25	1	2	5	1	9	20,3		80	• Vehicles must be checked for leaks prior to working on the site on a daily basis. Vehicles leaking fuel may not acess the site until leaks are repaired. • Vehicle refueling must take place at least 50 m away from the project area.	PES: Not Applicable EIS: Not Applicable
		Management and removal of waste materials from the site.	Location of discarded material	Degradation to water quality and habitat due to waste materials	0	1	1	0	0,5	1	1	2,5	1	3	5	2	11	27,5	Low	80	• All excavated materials and rubble must be removed from the project area and disposed of at either the landfill site, or used in the construction site (e.g. G7). • All dead alien trees and slash must be removed from the site and discarded appropriately. • No waste materials are to be discarded in the pojrect area or the natural environment adjacent. • Any waste materials, woody debris or rubble found in the erosion gully must be removed from the project area.	
	OPERATIONAL PHASE	Discharge of stormwater from two outlets	High velocity flows	May exacerbate erosion and channel incision at both locations	2	1	2	2	1,75	2	1	4,75	1	3	5	1	10	47,5	Low	70	• Erosion due to stormwater runoff must be monitoried at the site, especially post-rainfall on a continuous basis until vegetation has established. • Areas downstream of stormwater discharge points to be densely vegetated with 100% cover. If erosion occurs despite this, then additional measures will be required. • It may be necessary to consruct an enlarged stilling basin, or alternatively a series of small check dams to reduce flow velocities. • Vegetated rock gabions partly buried would be recommended in both cases provided these structures are retained int he project area.	

		Alien vegetation management	Regrowth and establishment of alien plant species	Loss of regenerating and established indigenous vegetation due to gradual invasion by alien plants	0	0	2	1	0,75	2	2	4,75	1	2	5	1	9	42,8	Low	70	• All areas disturbed during the construction phase (earthworks) must be inspected and cleared of alien vegetation 6 months and 12 months following construction. • No pesticides to be used in any wetland or buffer areas. Alien plants must be removed by hand / hand tools only. • Where indigenous vegetation struggles to establish adequate cover in disturbed areas sow seeds of indigenous grasses such as *Cynodon dactylon* and plant additional plants indicated in the list provided.	

6. CONCLUSIONS

The project area that has been identified and formally adopted for maintenance and rehabilitation has been degraded in several ways over time. The site has had a history of mass earthworks through quarrying, dumping of waste and materials, alien vegetation invasion and unprotected discharge of high velocity stormwater.

Assessment of historical aerial photos showed that a wetland was present on the site which has disappeared due to infilling, construction of a gym and swimming pool complex, and alien vegetation establishment. The original course of the wetland is well aligned with the present upgraded stormwater outlet and an incised and eroded gully which connects to the Camphersdrift Wetland. This wetland was delineated based on historical imagery as opposed to any recognisable features on site and it may be possible to recreate the feature to some extent. Particularly as it is aligned with the stormwater outflow.

A stepwise plan was provided to guide earthworks to remove G7 and soil piles as well as dumped rubbish at the site. As far as possible, access to the site should be via the existing track indicated in this report, with limited deviation to minimise disturbance.

A comprehensive list of indigenous plants is provided for the wetland area, buffer, and terrestrial areas which includes a large variety of different growth forms. These species must be used for revegetation of disturbed areas post placement of topsoil and reshaping.

It is important that the Natural Ground Level is not infilled to any extent with topsoil unless for the purpose reshaping a steep edge and providing a substrate for revegetation. The site cannot become a dumping ground for excess topsoil as this will further alter the topography and possibly result in new flow paths and erosion.

A Risk Matrix was compiled which determined the risk of proposed maintenance actions to the watercourse as Low. Given that the watercourse on site has all but ceased to exist, the proposed actions are aimed at improving the overall condition in the long term. The proposed Maintenance Management Plan can therefore be Generally Authorised and implementation is supported.

7. APPENDICES

7.1 Adopt a Spot Confirmation

GEORGE
THE CITY FOR ALL REASONS

Mr Dawie Adonis
Director: Community Services
E-mail: dadonis@george.gov.za
Tel: +27 (0)44 801 2900

1 Koppie Road
Langenhoven Park
Bloemfontien
9301

04/07/2023

RE: ADOPT A SPOT APPLICATION ERF 464

Dear Sir/ Madam

Please note that your adopt a spot application with an interest to adopt a portion of erf 464 for the purpose of rehabilitating the area which is directly west of erf 28876 was reviewed by the committee on the 23 May 2023. Your application met adopt a spot criterion and was recommended as alien clearing and rehabilitation would be beneficial for the public and the municipality.

The committee recommends that the agreement of the adopted spot should be with the master Homeowner's Association and not the developer. If the committee's recommendation is in order, you can write back to this office and resubmit the application.

Regards

Dawie Adonis
DIRECTOR: COMMUNITY SERVICES

71 York Street, George 044 801 9111 gmun@george.gov.za www.george.gov.za

7.2 Silt Fence Methods

Proper installation of soil erosion control fences is necessary for them to be effective. Silt fences must be installed along contours to intercept perpendicular flow. Images demonstrating the installation of erosion control fences are shown in Figure 18.The following guidelines must be followed:

- Geotextile / shade cloth fences must be installed perpendicular to the direction of water flow and along a line of uniform elevation or contour. In other words they should not waiver up and down the slope, but should be in a straight line across the slope. If this guideline is not followed, water will flow along the fence to the lowest point creating stress and potential collapse at this point;
- Use synthetic UV resistant geotextile fabric able to withstand at least 6 months of sun exposure. The material must be able to allow water to move through it, so materials like bidim are *not suitable*, but shadecloth can be used if necessary;
- Silt fences can be staked using wooden stakes. Metal droppers are preferable but will be stolen. The stakes should be arranged in straight lines across the area to be rehabilitated, at most 3m apart and firmly driven into the ground. A steel wire along the top of the stakes and also along the ground must then be secured and to which the geotextile is fastened, top and bottom;
- A 250 to 350 cm wide and 10 cm deep trench must be dug upslope of the location of the fence and the bottom half of the geotextile then laid into the trench;
- The trench must be backfilled and the soil compacted over the geotextile;
- The height of the silt fence should be between 20 and 30 cm;
- The distance between silt fences should be 8-10m. This results in 4 silt fences at the site, with the lowest one following the line of the lowest uncleared vegetation;
- Geotextile should be in a continuous roll to avoid joins which weaken the structure. Where joins are unavoidable both fabric ends should be wound around stakes to prevent it from unravelling;
- Terminal ends of the silt fence should run slightly uphill to prevent runoff from going around the ends of the fences.
- Silt fences will be removed once vegetation has established on exposed areas.

Figure 18. Installation of the soil erosion control fence. A: Installing the standards and wires and preparing the trench. B: Fitting the geotextile, tying it on with wire. C: Filling in the trench over the geotextile. D: Applying a mulch against the completed fence (Photos courtesy Ken Coetzee).

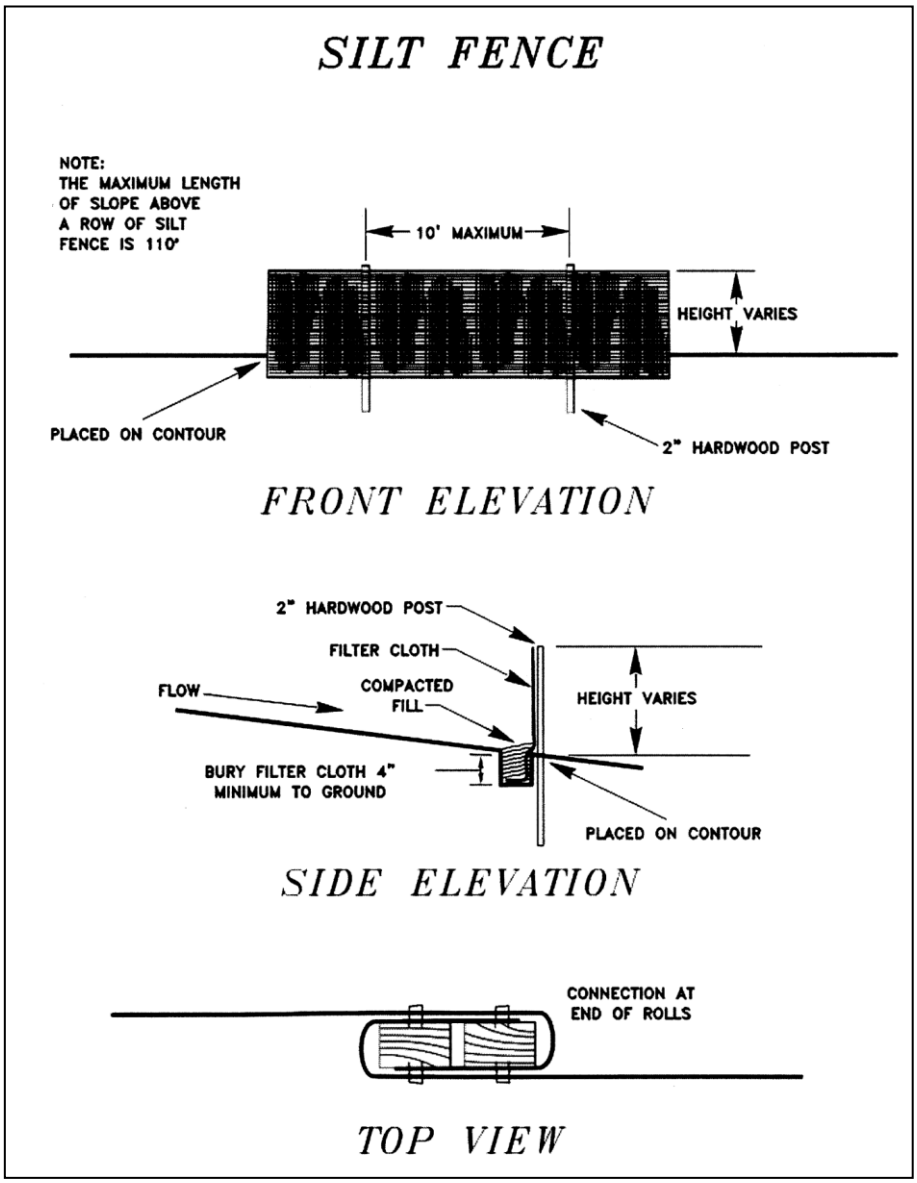


Figure 19. Example of methods recommended to install silt fencing (Measurements in inches; Source: Department of Environmental Protection, West Virginia)

7.3 Jute Mesh Methods

Between the silt fences, soil may be vulnerable to erosion on sloping ground and must be stabilised. A combination of temporary vegetation cover and soil matting is recommended. The following steps must be taken.

- Lightly rake over the soil to create a uniform surface.
- Seed the areas between silt fences with a light cover of weed-free **oats** purchased from a registered supplier (e.g. Agricol). Oats are an annual, non-invasive plant that will rapidly provide cover and stabilise the soil. The seeding rate should be 20 kg / ha. Seed should be scattered as uniformly as possible to prevent clumping, and the silt fences should be avoided as seed will probably collect along these lines anyway.
- The seeded area must be covered in a **light mulch (1-2cm deep**). This can consist of shredded woody material but must not be wood chips. Suppliers such as Grow Green Organics can be contacted for options.
- Cover the seeded and mulched slopes with a rolled erosion control product (such as jute, coir or straw matting). Only use a natural (vs. man-made), bio-degradable product.

The role of the erosion control matting is not to provide long-term protection for slopes from erosion, but to protect the soil surface until vegetation can establish and become the permanent stabilising feature. The slope should be seeded and mulched, and then covered with erosion control matting which will remain in place until the vegetation has established. Matting should be overlapped by about 10cm and secured using wooden stakes along the edges. Terminal ends of the matting can also be staked or buried in an anchor trench.

Figure 20. Example of how Soilsaver is fitted to the soil surface (Photo courtesy Ken Coetzee). Note holes to accommodate indigenous vegetation.

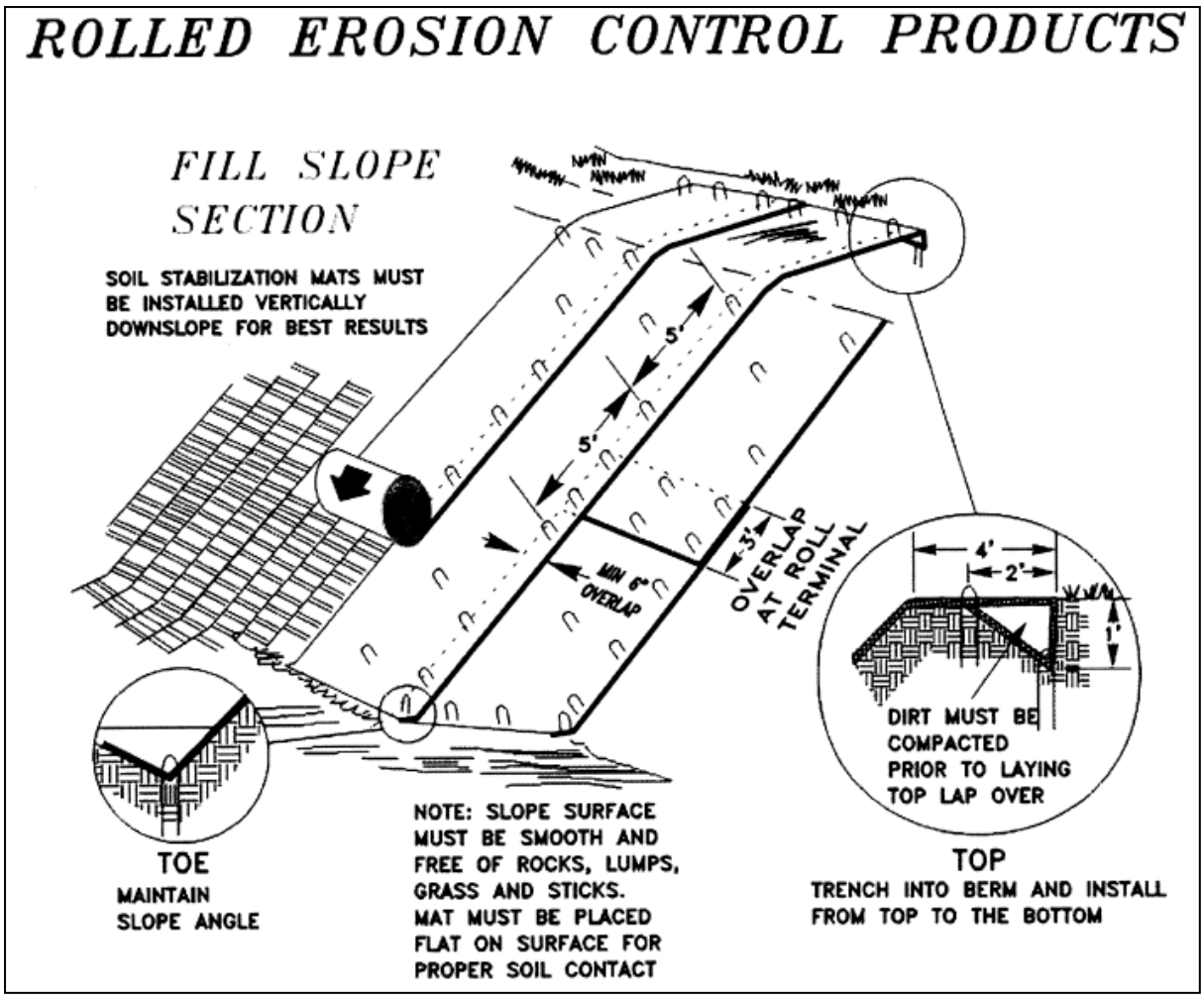


Figure 21. Example of methods recommended to install erosion control matting on sloping areas such as the dam wall embankment that require revegetation (Source: Department of Environmental Protection, West Virginia)

7.4 Risk Matrix Methods

The risk assessment matrix (Based on DWS 2016 publication: Section 21 c) and i) water use Risk Assessment Protocol) was implemented to assess risks for each activity associated with maintenance plan.

The first stage of the risk assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are as follows:

- An activity is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An aspect is an ‘element of an organizations activities, products and services which can interact with the environment’. The interaction of an aspect with the environment may result in an impact.
- Environmental impacts are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity.

- Resources are components of the biophysical environment and include the flow regime, water quality, habitat and biota of the affected watercourse.
- Severity refers to the degree of change to the status of each of the receptor. An overall severity score is calculated as the average of all scores receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- Spatial extent refers to the geographical scale of the impact (Table 9).
- Duration refers to the length of time over which the stressor will cause a change in the resource or receptor (Table 10)
- Frequency of activity refers to how often the proposed activity will take place (Table 11)
- Frequency of impact refers to the frequency with which a stressor (aspect) will impact on the resource (Table 12).

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary.

In accordance with the method stipulated in the risk assessment key, all impacts for flow regime, water quality, habitat and biota were scored as a 5 (i.e. average Severity score of 5) as all activities occurred within the delineated boundary of the wetland.

Table 8. Scores used to rate the impact of the aspect on resource quality (flow regime, water quality, geomorphology, biota and habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland.	

Table 9. Scores used to rate the spatial scale that the aspect is impacting on.

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table 10. Scores used to rate the duration of the aspects impact on resource quality

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5

Table 11. Scores used to rate the frequency of the activity

Annually or less	1
Bi-annually	2
Monthly	3
Weekly	4
Daily	5

Table 12. Scores used to rate the frequency of the activity's impact on resource quality

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table 13. Scores used to rate the extent to which the activity is governed by legislation

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5

Table 14. Scores used to rate the ability to identify and react to impacts of the activity on resource quality, people and property.

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table 15. Rating classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	(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.
170 – 300	(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.

Table 16. Calculations used to determine the risk of the activity to water resource quality

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence x Likelihood

8. REFERENCES

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