



Annexure 5

Riparian Assessment

RIPARIAN VEGETATION COMPONENT OF THE BAVIAANSKLOOF MEGA RESERVE ENVIRONMENTAL WATER REQUIREMENT DETERMINATION

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1. INTRODUCTION

The Riparian Vegetation Response Assessment Index (VEGRAI) is the model used to determine the Ecological Category for the riparian vegetation component within the EcoStatus approach. It has been designed for undertaking qualitative assessments of the response of riparian vegetation to impacts such that qualitative ratings translate into quantitative and defensible results (Kleynhans *et al.* 2007). The metrics within the VEGRAI model describe the status of the riparian vegetation in its current state as well as in its reference state and compares the differences between these two states as a measure of vegetation response to an impact regime (Kleynhans *et al.* 2007).

2. BACKGROUND TO THE STUDY AREA

The Baviaanskloof Wilderness Area makes up the vast majority of the Study Area. This area has complex vegetation as it is situated where the following seven biomes converge: Fynbos, Albany Thicket, Succulent Karoo, Nama Karoo, Grassland, Savanna and Azonal Vegetation (Vlok 1989; Mucina & Rutherford 2006). This creates complicated vegetation patterns in the landscape and there is a fair amount of mixing between the biomes that result in fairly unique plant assemblages many of which are not captured in the national vegetation map of Mucina & Rutherford (2006).

The majority of the upper mountain slopes are covered in the following Fynbos Biome Vegetation Units: Kouga Sandstone Fynbos and Kouga Grassy Sandstone Fynbos and also Baviaanskloof Shale Renosterveld. The Albany Thicket Biome is represented by Groot Thicket that is restricted to the lower lying valleys. The Azonal Vegetation Biome is represented by Albany Alluvial Vegetation that is restricted to the Baviaanskloof River valley. The National Vegetation Map does not reflect the fragments of other biomes that also occur in the study area such as Grassland, Savanna, Nama Karoo and Succulent Karoo. Fragments of true grassland can be found on the lower rounded plateaus at the base of the mountains. Savanna is found in the valley bottoms. Nama Karoo fragments occur in the Groot catchment area and Succulent Karoo on the flats around Steytlerville

A vegetation map produced for the Baviaanskloof Mega Reserve (Euston-Brown 2006) more accurately depicts the diverse nature of the vegetation in the study area. This map classified 10 biomes into 59 different vegetation types. The fynbos of the lower slopes of most mountains supports a fynbos community that tolerates very arid conditions. As a result of this the vegetation cover is relatively low compared with wetter climates, and this also reduces the mountain's ability to absorb and drain water to the rivers. Higher up on the Kouga Baviaanskloof Mountains a more typical kind of fynbos occurs, and this is where most of the water flowing into the rivers is trapped by infiltrating the bedrock.

The various kinds of riparian vegetation communities that can be found in the study area are diverse and rich in species from a wide range of plant biomes. The riparian vegetation in the study area is largely understudied and is also quite unique. The land-use outside of the Wilderness Area tends to be largely similar, i.e. large tracts of natural areas covered in the natural vegetation. The inaccessible and undisturbed nature of the mountainous terrain has allowed the natural vegetation to persist. However, certain areas of flatter more fertile soils in the lower river valleys have been largely transformed for intensive agriculture (e.g. citrus in the Gamtoos Valley and orchards in the Langkloof Valley). Certain parts were previously farmed but were expropriated over 50 years ago for the construction of the Kouga Dam and its catchment management necessities.

The entire Baviaanskloof Valley was previously on private land and a fair amount of grazing of the natural veld occurred. This has reduced the cover of vegetation on some slopes and also initiated erosion of some slopes. Most areas within the reserve have recovered well or are in the process of recovering. However, on private land the grazing pressure on the veld has continued and land degradation, desertification and erosion is occurring in drier and hotter micro-sites within the study area, especially areas previously covered with thicket vegetation. This vegetation is quite limited in the extent of area it covers, but adjacent to rivers it plays an important role in buffering the impacts of droughts, floods and browsing by herbivorous animals (Vlok & Euston-Brown 2002). Furthermore this vegetation is sometimes able to resist burning in wildfires that burn adjacent fynbos and grasslands in the mountains above it. These fires can also render slopes to be more prone to erosion in flooding events, and the intact thicket represents a powerful buffer that may protect rivers from sediment runoff and rock slides that might occur in post fire flooding events.

3. STUDY AIMS

The aim of the current study is to provide an assessment of the riparian vegetation of the Baviaanskloof-, Groot-, Geelhoutbos-, Gamtoos-, Kouga- and Wit Rivers based on the EcoStatus methodology. The following objectives were identified in order to complete the assessment:

- Collect data on the riparian vegetation communities of the relevant rivers
- Provide input into the site suitability of each EWR site
- Establish a reference condition for the riparian vegetation for the relevant rivers
- Determine the Present Ecological State of the vegetation for the relevant rivers
- Provide input into the Ecological Importance and sensitivity analysis
- Provide input into the assessment of the reasons for the PES
- Provide input into the assessment of the trajectory of change in the PES
- Provide input into the verification of the modeled EWR estimates
- Provide input in terms of management and mitigation measures
- Provide input in terms of the river health monitoring programme for the study area

4. METHODOLOGY

4.1. Data collection

Data was collected in the field between 20 and 24 October 2008. Data was entered onto the standard data sheet forms that are provided with the manual for the VEGRAI model (Kleynhans et al. 2007). At each site the causeway or river crossing was regarded as the middle of the site and the riparian vegetation was surveyed approximately 75 m up- and downstream of the causeway. Species that could not be identified were collected, pressed and dried and identified as far as possible in the Compton Herbarium, Kirstenbosch in Cape Town. Further information on data collection can be obtained in the VEGRAI manual (Kleynhans et al. 2007).

4.2. Site suitability

Confidence in the suitability of each EWR sites for providing clues in the verification of the modeled EWR estimates are ranked from 0 (no confidence) to 5 (high confidence). Results of this assessment are also provided in the main report.

4.3. Information availability

The availability of information is rated from 0 to 4. 0 to 2 indicates that the level of information is adequate for a Rapid Ecological Reserve Determination, while 3 indicates that it is adequate for an Intermediate Ecological Reserve Determination and 4 that it is adequate for a Comprehensive Ecological Reserve Determination. Confidence ratings assigned indicate the level of confidence in the available information. A confidence rating of 5 is high whereas a score of 0 indicates no confidence. Results of this assessment are also provided in the main report.

4.4. Reference conditions

The reference conditions refer to the status of the riparian vegetation before human induced disturbances altered the river and its associated riparian vegetation. There are many variables that need to be considered when reconstructing the reference state such as condition of the catchment, past and present land use in the catchment, historical information on droughts and floods in the catchment. In general there are very few rivers left in the country that can be said to be in a condition similar to the reference condition. If these are present they are usually found in upper mountainous areas in Wilderness or natural areas such as this study area that have been protected for conservation of biodiversity. Larger rivers lower in the catchment tend to be highly disturbed as a result of human induced changes in the catchment that has altered the volume and quality of water in the river, and this may have impacted on the riparian vegetation. It is extremely difficult to reconstruct the reference condition without a thorough knowledge of the history of land use in the catchment area above any particular river site. To further complicate this there are more subtle changes such as climate change and the invasion of alien plants in the catchment that also need to be considered. Another important aspect to consider when reconstructing the reference condition is the natural disturbance regime to which the riparian vegetation is adapted. Thus one needs to estimate the extent to which natural disturbances at a river site have been altered by human activities at the site and in the catchment area. The manual of Kleynhans *et al.* (2007) provides clear guidelines as to how to reconstruct the reference condition. In summary the extent to which the riparian vegetation may have changed in each zone is assessed as a result of the impacts of vegetation removal, changes in water quality and quantity and exotic invasion. The impacts are assessed for different aspects of the vegetation such as cover, abundance, population structure, recruitment and species composition.

4.5. Present Ecological State assessment

The PES is determined by following the manual of Kleynhans *et al.* (2007). In summary each zone at a river site is assessed for the change from the reference state in the cover, abundance, population structure, recruitment and species composition of the riparian vegetation. This is recorded on the field data sheets that are provided with the manual (Kleynhans *et al.* 2007).

4.6. Ecological Importance and Sensitivity assessment

The EIS is determined through a process that involves an Excel based model that incorporates fish, invertebrate and riparian vegetation information related to the riverine habitat. Results of this assessment are also provided in the main report.

4.7. Interpretation of flow & non-flow related impacts and trajectory of change

By unpacking the EC and the metric groups it is determined whether the observed changes in the EC is due to flow or non-flow related impacts. The major reason for the changes in EC is further unpacked to determine which of the metrics are most responsible for the change. From this it is then possible to make recommendations regarding the maintenance or possible improvement of the EC i.e. the trajectory of change. Results of this assessment are also provided in the main report.

4.8. Verification of the modeled EWR estimates

In order to determine whether or not the modeled EWR estimates will be sufficient to maintain the Present Ecological State category determined for each river, the cross-section profiles and hydraulic tables containing hydrological data transformed into hydraulic components (depth and velocity) for each EWR site, is assessed. This assessment is mainly based on the requirements of indicator taxa. Results of this assessment are also presented in the main report.

5. RESULTS AND DISCUSSION

5.1. Site suitability

Eight sites were assessed during the survey conducted from 20 to 24 October 2008. The site suitability was assessed according to the advantages and disadvantages of each site for providing clues in the verification of the modeled EWR estimates. The confidence in each of these assessments was also ranked from 0 (no confidence) to 5 (high confidence). An assessment of the site suitability for all sites is therefore provided below (Table 1).

Table 1: EWR site suitability assessment in terms of riparian vegetation

Site	Conf. Level	Advantages	Disadvantages
BAV1	5	Easy access to the site from the road. Presence of diverse riparian vegetation in distinct zones	Proximity of road increases likelihood of human interference – wood collection/grazing. On private land. Water abstraction by farmers upstream not gauged
BAV3	5	Easy access to the site from the road. Presence of diverse riparian vegetation in distinct zones. In reserve	Previous manipulation of river channel to prevent flooding of road. Water abstraction by farmers upstream not gauged
GEE1	5	In protected kloof, diverse riparian vegetation in distinct zones, few exotics present, close to pristine. In reserve	Disturbance of upper zone by recreational infrastructure and road
WIT1	5	Easy access to the site from the road. Presence of diverse riparian vegetation in distinct zones. In reserve	Proximity of road increases likelihood of human interference although this is limited, eroding dirt road may have impact
GRO1	4	Easy access to the site from the road. Presence of diverse riparian vegetation in distinct zones.	Proximity of road increases likelihood of human interference

Site	Conf. Level	Advantages	Disadvantages
GAM1	4	Easy access to the site from the road.	Heavily disturbed by agriculture, Kouga dam upstream
KOU1	4	Easy access to the site from the road.	Heavily disturbed by overgrazing and alien invasions in catchment and riparian zone, dam upstream
KOU2	4	Easy access to the site from the road.	Heavily disturbed by overgrazing and alien invasions in catchment and riparian zone. Weirs & dam upstream

5.2. Information availability

The availability of information was rated from 0 to 4. The confidence levels assigned indicate the level of confidence in the available information. A confidence rating of 5 is high whereas a score of 0 indicates no confidence (Table 2).

Table 2: Assessment of the information availability for each EWR site

Site	Confidence Level	Information availability					Comments
		0	1	2	3	4	
BAV1	5					4	Botanical specialist knowledge of area, catchment intact (MSc thesis by Douglas Euston-Brown. 1995. Environmental and dynamic determinants of vegetation distribution in the Kouga and Baviaanskloof Mountains, Eastern Cape.)
BAV2	5					4	Botanical specialist knowledge of area, catchment intact (MSc thesis by Douglas Euston-Brown. 1995. Environmental and dynamic determinants of vegetation distribution in the Kouga and Baviaanskloof Mountains, Eastern Cape.)
GEE1	5					4	Botanical specialist knowledge of area, catchment intact very little disturbance (MSc thesis by Douglas Euston-Brown. 1995. Environmental and dynamic determinants of vegetation distribution in the Kouga and Baviaanskloof Mountains, Eastern Cape.)
WIT1	5					4	Botanical specialist knowledge of area, catchment intact, very little disturbance (MSc thesis by Douglas Euston-Brown. 1995. Environmental and dynamic determinants of vegetation distribution in the Kouga and Baviaanskloof Mountains, Eastern Cape.)
GRO1	4					4	Catchment degraded in Karoo, less knowledge of catchment history
GAM1	4					4	Catchment degraded in Karoo, Kouga dam reduces flow, intensive agriculture in upper zone, less knowledge
KOU1	4					4	Degraded catchment by alien invasive, dams & weirs, less knowledge available
KOU2	4					4	Degraded catchment by alien invasive, dams & weirs, less knowledge available

5.3. Reference conditions

The following reference conditions were determined for each EWR site (Table 3 to Table 10).

Table 3: Reference state at BAV1

Zones	Impacts	Response Metrics	Description of PRESENT STATE	Description of REFERENCE STATE
Marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Reed dominated with variety of herbaceous plants, few trees rooted here, but under canopy of <i>Salix mucronata</i> and <i>Ficus sur</i> , relatively loose boulder bed substrate. Spreading of watercress.	Tree dominated and reed dominated, with wider and higher cover of herbaceous and grass & reed species. More shaded, possibly included <i>Afrocarpus falcatus</i> forest that has been cut for timber. Would have been more stable with less scouring, as these events tend to happen more frequently now. The un-impacted system was better equipped to tolerate/absorb and benefit from flooding events
Lower	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Dominated by tall <i>Ficus sur</i> , under story disturbed by overgrazing by livestock including cattle & donkeys. Invasion of kikuyu.	Dominated by tall <i>Afrocarpus falcatus</i> & <i>Ficus sur</i> . More stable banks and stream channels and backwater pools. More shaded than present.
Upper	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Very narrow on steep rocky slopes with subtropical thicket species on the slopes including <i>Portulacaria afra</i>	Very narrow on steep rocky slopes with subtropical thicket species on the slopes including <i>Portulacaria afra</i>

Table 4: Reference state at BAV3

Zones	Impacts	Response Metrics	Description of PRESENT STATE	Description of REFERENCE STATE
Marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Banks dominated by <i>Cyperus textilis</i> about 5 m wide either side. Also sub-adult <i>Salix mucronata</i> and few <i>Acacia karoo</i> . Historical use by game & currently by game reduces vegetation cover. Reduced quantity of water by overgrazing in catchment may have reduced extent of lower zone. Increased sediment load may have favoured dominance and spread of <i>Cyperus textilis</i> .	Less <i>Cyperus</i> , more short reeds, more grazing lawns, more diverse channels with backwater pools, open dominated and short reed dominated. Possibly with higher tree cover in form of <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> .
Lower	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Fine sand and cobble bed with some dry channels. Previously disturbed. Dominated by <i>Acacia karoo</i> . Grasses are <i>Panicum maximum</i> and <i>Cynodon dactylon</i> . <i>Plumbago auriculata</i> & <i>Lycium africanum</i> are also abundant. Historically exposed to heavy use by cattle, now by kudu, rhinoceros and other game. Special habitat on stable cobble beds with a karroid type shrubland with rare <i>Amphiglossa callunoides</i>	More diverse structure with more trees and patches of thicket, grazing lawns, shrubs & succulents. Use by a wider diversity of game including elephants.
Upper	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Upper zone is difficult to detect/determine and if present is quite similar to lower zone	Probably was more distinct on more stable banks tree dominated with tall <i>Ficus sur</i> and <i>Afrocarpus falcatus</i> and <i>Celtis africana</i> .

Table 5: Reference site for GEE1

Zones	Impacts	Response Metrics	Description of PRESENT STATE	Description of REFERENCE STATE
Marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Narrow, 1-3 m wide either side of stream which is 1-5 m wide. Dominated by <i>Todea barbara</i> and <i>Pycerus polystachyos</i> . Reeds and ferns are short less than 1 m tall.	Narrow, 1-3 m wide either side of stream which is 1-5 m wide. Dominated by <i>Todea barbara</i> and <i>Pycerus polystachyos</i> . Reeds and ferns are short less than 1 m tall.
Lower	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Narrow with low cover of herbaceous plants, and including some sedges and ferns in seepage areas. Dominated by tall (10-20 m) <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> trees.	Narrow with low cover of herbaceous plants, and including some sedges and ferns in seepage areas. Dominated by tall (10-20 m) <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> trees.
Upper	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	In a narrow kloof, where the slope angle gets steeper still dominated by <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> . This site includes a wide diversity of trees from both subtropical and afro-montane/temperate forest.	In a narrow kloof, where the slope angle gets steeper still dominated by <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> . This site includes a wide diversity of trees from both subtropical and afro-montane/temperate forest.

Table 6: Reference state for WIT1

Zones	Impacts	Response Metrics	Description of PRESENT STATE	Description of REFERENCE STATE
Marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Pristine condition - no impacts. Narrow marginal zone 1-3 m wide. Dominated by reeds, sedges and grasses and herbaceous plants. Well shaded by trees. Ferns & aquatic plants. Presence of tree root systems providing habitat instream, especially <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> . However, access road into baviaanskloof in this catchment is poorly maintained and is eroding in some parts of the catchment. This may be decreasing the quantity (increase in surface runoff) and quality (increased sediment load, car pollution (oil etc), and increased presence and use by people (tourism) of water.	Pristine condition - no impacts. Narrow marginal zone 1-3 m wide. Dominated by reeds, sedges and grasses. Well shaded by trees
Lower	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Pristine condition - no impacts. Well shaded by forest trees 10-15 m tall. Very diverse woody bushes and trees (about 20) and herbs, shrubs and grasses (about 25 species). Presence of fynbos indicating more temperate climate, but dominated by subtropical elements such as <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> .	Pristine condition - no impacts. Well shaded by forest trees 10-15 m tall. Very diverse woody bushes and trees (about 20) and herbs, shrubs and grasses (about 25 species). Presence of fynbos indicating more temperate climate, but dominated by subtropical elements such as <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> .
Upper	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Pristine condition - no impacts. Well shaded by forest trees 10-15 m tall. Very diverse woody bushes and trees and herbs, shrubs and grasses. Presence of fynbos indicating more temperate climate, but dominated by subtropical elements such as <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> . The North Facing slopes above this are very steep and covered in a mix of fynbos and subtropical thicket with <i>Portulacaria afro</i> present. However, the south-facing slope is more a fynbos woodland. Prickly pear (<i>Opuntia</i>) is present in low numbers of juveniles.	Pristine condition - no impacts.

Table 7: Reference state for GRO1

Zones	Impacts	Response Metrics	Description of PRESENT STATE	Description of REFERENCE STATE
Marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Dominated by reeds, mostly <i>Cyperus textilis</i> . One small patch of <i>Typha capensis</i>	Probably more open dominated with less <i>Cyperus</i> and more diverse short reeds with grazing lawns on more stable banks, and more diverse channel structure with more back water pools etc.
Lower	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Dominated by <i>Acacia karoo</i> & <i>Rhus pyroides</i> . Quite open with large hillocks of loose sand and silt. Heavily overgrazed by cattle	Was more diverse with more grass cover and more stable banks and possibly more open.
Upper	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Upper zone quite indistinct and patchy restricted to more sheltered sites and protected banks. Tree dominated	More well established and with higher diversity of tree and thicket species. More exposed to and tolerant of elephant browsing.

Table 8: Reference state for GAM1

Zones	Impacts	Response Metrics	Description of PRESENT STATE	Description of REFERENCE STATE
Marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Dense reeds of <i>Cyperus textilis</i> & <i>Phragmites australis</i> 50 to 100 m wide on both sides. Few <i>Rhus pyroides</i> , <i>Salix mucronata</i> , <i>Acacia karoo</i> & <i>Acacia caffra</i> . Wide diversity of weeds. Vegetation removal from quarrying cobble, reduced flow as a result of dams, debris of alien logs in floods do damage to riparian vegetation	Probably more open state with tall reeds less abundant. Kouga Dam has reduced the impact of scouring floods. Overgrazing in Groot catchment increased sediment load and silt build-up that is trapped and favoured by these tall reeds. Also eutrofication from agriculture has promoted higher abundance and cover of tall reeds. More back water pools and different channels and thus higher diversity of riparian and wetland species. May also have been shaded by tall trees such as <i>Ficus sur</i> and <i>Afrocarpus falcatus</i> especially in more sheltered sites that are less exposed to the force of flooding events. The natural vegetation cover in the catchment would have absorbed the impact and severity of floods but this function has been severely degraded by overgrazing so that now the sediment load and high run-off has changed the structure and diversity of this zone.
Lower	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	This zone is quite limited and highly disturbed. Dominated by <i>Acacia karoo</i> .	Probably more open state with tall reeds less abundant. Kouga Dam has reduced the impact of scouring floods. Overgrazing in Groot catchment increased sediment load and silt build-up that is trapped and favoured by these tall reeds. Also eutrofication from agriculture has promoted higher abundance and cover of tall reeds. Would have been a more distinct zone with herbivore pressure shaping and limiting extent and cover of bushes and trees and also tall reeds. Would have supported more grasses and other shorter reeds that would have been grazed by many different animals. More diverse and species rich with more complex structure of both vegetation and riverbed. More back water pools. More stable banks
Upper	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population structure	This zone tends to be cultivated so few examples are intact	More spinescent bushes and tall trees. With more <i>Afrocarpus falcatus</i> and <i>Gymnosporia buxifolia</i> and <i>Rhus pyroides</i> . Footpaths for game including elephant, hippos, crocodiles. Quite distinct riparian zone with high cover of a wider diversity of bushes and trees

Table 9: Reference state for KOU1

Zones	Impacts	Response Metrics	Description of PRESENT STATE	Description of REFERENCE STATE
Marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Low presence of reeds and herbs with mostly open sand banks. Open dominated. Clearing of Black wattle	Higher cover of hardy indigenous bushes such as <i>Rhus pyroides</i> . More backwater pools, more stable embankments with higher cover and stability of non-woody vegetation
Lower	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Partly cleared of black wattle, open & exposed sand banks & boulder beds with few backwater pools. The clearing and flooding events have reduced the vegetation to an open state	Higher cover of hardy indigenous bushes such as <i>Rhus pyroides</i> . More backwater pools, more stable embankments with higher cover and stability of non-woody vegetation
Upper	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Infested with black wattle, partly cleared, very little indigenous woody vegetation left on site. The aliens reduce water quantity by transpiration. Increased sediment load and cattle overgrazing and solid waste has impacted on water quality	Open fire swept topography would have limited the development of a distinct upper Zone. It would have been a fairly narrow and limited band of vegetation with resprouting and hardy bushes

Table 10: Reference state for KOU2

Zones	Impacts	Response Metrics	Description of PRESENT STATE	Description of REFERENCE STATE
Marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Open dominated, rocky boulder beds, some <i>Cyperus textilis</i> and some backwater pools with sedges such as <i>Isolepis prolifer</i> , <i>Juncus capensis</i> , <i>Pycerus polystachyos</i> . Few <i>Salix mucronata</i> recently scoured. Black wattle (<i>Acacia meamsii</i>) invasion and clearing has reduced indigenous cover especially in floods	Less open, more backwater pools with higher reed cover, wider zone than present, possibly used to support palmiet in parts but these have been scoured out
Lower	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Mostly open boulder bed with few <i>Salix mucronata</i> . Dominated by <i>Acacia meamsii</i> , large debris dumps of black wattle trunks that do untold damage to riparian vegetation in floods	More stable banks, taller and more well established <i>Salix mucronata</i>
Upper	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition Recruitment Population Structure	Fairly open with partly cleared <i>Acacia meamsii</i> that has displaced much indigenous vegetation.	More distinct zone with wider diversity of trees and bushes

5.4. Present Ecological State assessment

The PES for the Baviaanskloof, Geelhoutbos, Wit, Groot, Gamtoos and Kouga Rivers is determined by applying the VEGRAI protocol to the data collected during the field survey (October 2008) for each EWR site. The following section presents results from the VEGRAI model (Kleynhans *et al.* 2007) for the different metric groups assessed for the Baviaanskloof, Geelhoutbos, Wit, Groot, and Kouga Rivers. The results are presented as follows for each EWR site:

- Marginal zone metrics
- Lower zone metrics
- Upper zone metrics
- Ecological Category determination

a) UPPER BAVIAANSKLOOF RIVER (BAV1)

Table 11: Marginal zone for BAV1

IMPACT RATINGS							
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	2.0	2.0	4.0	Scouring, trampling			
EXOTIC INVASION	3.0		4.0	10 exotic spp, watercress & kikuyu invading			
WATER QUANTITY	2.0	2.0	4.0	abstraction from farmers, catchment vegetation degradation results in reduced infiltration and increase in surface			
WATER QUALITY	2.0	2.0	4.0	scouring, overgrazing increases sediment load, farming practices herbicides and fertiliser increases nutrient status			
AVERAGE			4.0				
RESPONSE METRIC RATINGS							
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	2.0	4.0			
	ABUNDANCE	Y	2.0	4.0			
	POPULATION STRUCTURE	Y	2.6	4.0			
	RECRUITMENT	Y	1.8	4.0			
	SPECIES COMPOSITION	Y	0.3	4.0			
			1.7	4.0			
NON-WOODY	COVER	Y	2.0	3.0			
	ABUNDANCE	Y	2.0	3.0			
	SPECIES COMPOSITION	y	0.1	3.0			
			1.4	3.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	y	2.0	75.0	1.7	1.29	4.0	important for stabilising banks and shade & organic matter into stream
NON-WOODY	y	1.0	100.0	1.4	1.36	3.0	non-woody mor NB in marginal zone
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL					30.3		
					2.65	3.5	

Table 12: Lower zone of BAV1

		IMPACT RATINGS:					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	2.0	2.0	4.0	little evidence of removal other than low removal from wood cutting and scouring			
EXOTIC INVASION	1.0		4.0	present but not yet abundant or having negative impact on indigenous			
WATER QUANTITY	1.0	1.0	4.0	catchment in relatively good condition, water abstraction by farmers limited			
WATER QUALITY	2.0	2.0	4.0	fairly limited extent and low intensity of farming practices upstream, few people living in upstream catchment			
AVERAGE			4.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	2.0	4.0	may be slightly less from wood cutting and scouring floods		
	ABUNDANCE	Y	2.0	4.0	may be slightly less from wood cutting and scouring floods		
	POPULATION STRUCTURE	Y	0.8	4.0	low impact		
	RECRUITMENT	Y	1.3	4.0	low impact		
	SPECIES COMPOSITION	y	0.4	4.0	low impact		
NON-WOODY	COVER	Y	2.0	3.0	scouring floods & overgrazing, reduction in extent of non woody vegetation		
	ABUNDANCE	Y	2.0	3.0	scouring floods & overgrazing, reduction in extent of non woody vegetation		
	SPECIES COMPOSITION	y	0.0	4.0	low impact		
				1.3	3.3		
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	y	1.0	100.0	1.3	1.30	4.0	important for stabilising banks and shade & organic matter into stream
NON-WOODY	y	2.0	60.0	1.3	0.80	3.3	less abundant, more open in this zone
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE					26.3		
						2.10	3.7

Table 13: Upper zone for BAV1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	1.0	1.0	4.0	little evidence of removal other than low removal from wood cutting and scouring			
EXOTIC INVASION	1.0		4.0	present but not yet abundant or having negative impact on indigenous			
WATER QUANTITY	1.0	1.0	4.0	catchment in relatively good condition, water abstraction by farmers limited			
WATER QUALITY	1.0	1.0	4.0	fairly limited extent and low intensity of farming practices upstream, few people living in upstream catchment			
AVERAGE			4.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	2.0	4.0	may be slightly less from wood cutting and scouring floods		
	ABUNDANCE	Y	2.0	4.0	may be slightly less from wood cutting and scouring floods		
	POPULATION STRUCTURE	Y	2.8	4.0	low impact		
	RECRUITMENT	Y	1.9	4.0	low impact		
	SPECIES COMPOSITION	Y	0.2	4.0	low impact		
			1.8	4.0			
NON-WOODY	COVER	Y	3.0	4.0	scouring floods & overgrazing, reduction in extent of non woody vegetation		
	ABUNDANCE	Y	3.0	4.0	scouring floods & overgrazing, reduction in extent of non woody vegetation		
	SPECIES COMPOSITION	Y	0.5	4.0	low impact		
			2.2	4.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	75.0	1.8	1.33	4.0	trees & succulents & thicket vegetation stabilise banks, provide shade, and create habitat. Permanent feature
NON-WOODY	Y	2.0	25.0	2.2	0.54	4.0	more ephemeral & low influence of river in this zone
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE					1.87	4.0	
			37.5				

Table 14: Riparian zone EC for BAV1

LEVEL 4 ASSESSMENT							
RIPARIAN VEGETATION EC METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	WEIGHT	NOTES: (give reasons for each assessment)	
MARGINAL	69.7	34.9	3.5	1.0	100.0	marginal zone provides moisture to sustain trees in lower zone shade and fig tree roots create habitat and stability	
LOWER ZONE	73.7	29.5	4.0	2.0	80.0		
UPPER ZONE	62.5	6.3	4.0	3.0	20.0		
					3.0	200.0	
LEVEL 4 VEGRAI (%)				70.6			
VEGRAI EC				C			
AVERAGE CONFIDENCE				3.8			

b) LOWER BAVIAANSKLOOF RIVER (BAV3)

Table 15: Marginal zone for BAV3

IMPACT RATINGS								
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)				
REMOVAL	1.0	1.0	4.0	roads, tracks, livestock, game, firewood, channelling of riverbed				
EXOTIC INVASION	1.0		5.0	few aliens in low abundance in lower zone				
WATER QUANTITY	1.0	1.0	4.0	weirs & farm dams, overgrazing in catchment reduced infiltration and less flow				
WATER QUALITY	1.0	1.0	4.0	nutrification, sediment load increase				
AVERAGE			4.3					
RESPONSE METRIC RATINGS								
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)			
WOODY	COVER	Y	1.0	4.0	road, cattle, game,			
	ABUNDANCE	Y	1.0	4.0	road, cattle, game,			
	POPULATION STRUCTURE	Y	<u>3.1</u>	5.0				
	RECRUITMENT	Y	<u>2.8</u>	5.0				
	SPECIES COMPOSITION	Y	<u>1.0</u>	5.0				
			1.8	4.6				
NON-WOODY	COVER	Y	1.0	4.0				
	ABUNDANCE	Y	1.0	4.0				
	SPECIES COMPOSITION	Y	<u>0.3</u>	5.0				
			0.8	4.3				
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)	
WOODY	Y	2.0	50.0	1.8	0.88	4.6		
NON-WOODY	Y	1.0	100.0	0.8	0.76	4.3		
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL					21.9	1.64	4.5	

Table 16: Lower zone for BAV3

IMPACT RATINGS:							
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	1.0	1.0	4.0				
EXOTIC INVASION	1.0		5.0				
WATER QUANTITY	1.0	1.0	4.0				
WATER QUALITY	1.0	1.0	4.0				
AVERAGE			4.3				
RESPONSE METRIC RATINGS							
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	1.0	4.0			
	ABUNDANCE	Y	1.0	4.0			
	POPULATION STRUCTURE	Y	2.0	4.0			
	RECRUITMENT	Y	2.1	4.0			
	SPECIES COMPOSITION	Y	1.3	4.0			
			1.5	4.0			
NON-WOODY	COVER	Y	1.0	4.0			
	ABUNDANCE	Y	1.0	4.0			
	SPECIES COMPOSITION	Y	0.2	4.0			
			0.7	4.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	1.5	1.47	4.0	acacia karoo
NON-WOODY	Y	2.0	75.0	0.7	0.56	4.0	grasses
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE					23.2		

Table 17: Upper zone of BAV3

IMPACT RATINGS							
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	0.0	0.0	5.0				
EXOTIC INVASION	0.0		5.0				
WATER QUANTITY	0.0	0.0	5.0				
WATER QUALITY	0.0	0.0	5.0				
AVERAGE			5.0				
RESPONSE METRIC RATINGS							
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	1.0	4.0			
	ABUNDANCE	Y	1.0	4.0			
	POPULATION STRUCTURE	Y	2.0	4.0			
	RECRUITMENT	Y	2.1	4.0			
	SPECIES COMPOSITION	Y	1.6	4.0			
			1.5	4.0			
NON-WOODY	COVER	Y	1.0	4.0			
	ABUNDANCE	Y	1.0	4.0			
	SPECIES COMPOSITION	Y	0.9	4.0			
			1.0	4.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	1.5	1.54	4.0	tree dominated
NON-WOODY	Y	2.0	50.0	1.0	0.49	4.0	
					2.03	4.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE			27.0				

Table 18: Riparian zone EC for BAV3

LEVEL 4 ASSESSMENT						
RIPARIAN VEGETATION EC METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	WEIGHT	NOTES: (give reasons for each assessment)
MARGINAL	78.1	27.2	4.5	2.0	80.0	
LOWER ZONE	76.8	33.4	4.0	1.0	100.0	
UPPER ZONE	73.0	15.9	4.0	3.0	50.0	
	3.0				230.0	
LEVEL 4 VEGRAI (%)				76.5		
VEGRAI EC				C		
AVERAGE CONFIDENCE				4.2		

c) GEELHOUTBOS RIVER (GEE1)

Table 19: Marginal zone for GEE1

		IMPACT RATINGS								
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)						
REMOVAL	1.0	1.0	5.0	weir may reduce flow and extent of marginal zone						
EXOTIC INVASION	1.0		5.0	watercress low abundance						
WATER QUANTITY	1.0	1.0	5.0	weir may reduce flow and extent of marginal zone						
WATER QUALITY	0.0	0.0	5.0	no impact, catchment intact, possible low impact from tourist use/swimming in streams/pools						
AVERAGE			5.0							
		RESPONSE METRIC RATINGS								
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)					
WOODY	COVER	Y	1.0	5.0	near pristine, pathway & recreation					
	ABUNDANCE	Y	1.0	5.0	near pristine, pathway & recreation					
	POPULATION STRUCTURE	Y	0.7	5.0						
	RECRUITMENT	Y	0.0	5.0						
	SPECIES COMPOSITION	Y	0.0	5.0						
			0.5	5.0						
NON-WOODY	COVER	Y	0.0	5.0	near pristine, pathway & recreation					
	ABUNDANCE	Y	0.0	5.0	near pristine, pathway & recreation					
	SPECIES COMPOSITION	Y	0.0	5.0	near pristine, pathway & recreation					
			0.0	5.0						
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)			
WOODY	Y	1.0	100.0	0.5	0.54	5.0	shade & leaf litter			
NON-WOODY	Y	2.0	90.0	0.0	0.00	5.0				
					0.55	5.0				
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL			5.7							

Table 20: Lower zone for GEE1

IMPACT RATINGS:							
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	1.0	1.0	5.0	weir may reduce extent			
EXOTIC INVASION	0.0		5.0	no exotics here			
WATER QUANTITY	1.0	1.0	5.0	weir may reduce extent			
WATER QUALITY	0.0	0.0	5.0	not in this zone			
AVERAGE			5.0				
RESPONSE METRIC RATINGS							
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	0.0	5.0			
	ABUNDANCE	Y	0.0	5.0			
	POPULATION STRUCTURE	Y	0.2	5.0			
	RECRUITMENT	Y	0.2	5.0			
	SPECIES COMPOSITION	Y	0.0	5.0			
			0.1	5.0			
NON-WOODY	COVER	Y	0.0	5.0			
	ABUNDANCE	Y	0.0	5.0			
	SPECIES COMPOSITION	Y	0.0	5.0			
			0.0	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	0.1	0.09	5.0	
NON-WOODY	Y	2.0	50.0	0.0	0.00	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE					1.2		

Table 21: Upper zone for GEE1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	1.0	1.0	5.0				
EXOTIC INVASION	0.0		5.0				
WATER QUANTITY	1.0	1.0	5.0				
WATER QUALITY	0.0	0.0	5.0				
AVERAGE			5.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	0.0	5.0			
	ABUNDANCE	Y	0.0	5.0			
	POPULATION STRUCTURE	Y	0.0	5.0			
	RECRUITMENT	Y	0.3	5.0			
	SPECIES COMPOSITION	Y	0.0	5.0			
			0.1	5.0			
NON-WOODY	COVER	Y	0.0	5.0			
	ABUNDANCE	Y	0.0	5.0			
	SPECIES COMPOSITION	Y	0.0	5.0			
			0.0	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	0.1	0.07	5.0	
NON-WOODY	Y	2.0	20.0	0.0	0.00	5.0	
					0.07	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE			1.1				

Table 22: Riparian zone EC for GEE1

LEVEL 4 ASSESSMENT						
RIPARIAN VEGETATION EC METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	WEIGHT	NOTES: (give reasons for each assessment)
MARGINAL	94.3	34.3	5.0	2.0	80.0	
LOWER ZONE	98.8	44.9	5.0	1.0	100.0	
UPPER ZONE	98.9	18.0	5.0	3.0	40.0	
	3.0				220.0	
LEVEL 4 VEGRAI (%)				97.2		
VEGRAI EC				A		
AVERAGE CONFIDENCE				5.0		

d) WIT RIVER (WIT1)

Table 23: Marginal zone for WIT1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	1.0	1.0	5.0	Infrastructure (dirt road & slipway crossing stream.			
EXOTIC INVASION	0.0		5.0	none seen			
WATER QUANTITY	1.0	1.0	4.0	increased surface runoff as a result of road through catchment small visible impact. Alien invasives in catchment			
WATER QUALITY	1.0	1.0	4.0	potential impact of car pollution and increased sediment load in storm events as a result of road & increase in			
AVERAGE			4.5				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	1.0	5.0	very low impact		
	ABUNDANCE	Y	1.0	5.0	very low impact		
	POPULATION STRUCTURE	Y	0.0	5.0	very low impact		
	RECRUITMENT	Y	0.0	5.0	very low impact		
	SPECIES COMPOSITION	Y	0.0	5.0	very low impact		
			0.4	5.0			
NON-WOODY	COVER	Y	1.0	4.0	very low impact		
	ABUNDANCE	Y	1.0	4.0	very low impact		
	SPECIES COMPOSITION	Y	0.0	4.0	very low impact		
			0.7	4.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	0.4	0.40	5.0	dominated by old forest trees shaded by forest, and organic input from that creates habitat for non-woody species
NON-WOODY	Y	2.0	90.0	0.7	0.60	4.0	
					1.00	4.5	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL			10.5				

Table 24: Lower zone for WIT1

		IMPACT RATINGS:					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	1.0	1.0	5.0	infrastructure (formal dirt road & slipway crossings)			
EXOTIC INVASION	0.0		5.0	none recorded			
WATER QUANTITY	0.0	0.0	5.0	lower zone less impacted as high flows are few			
WATER QUALITY	0.0	0.0	5.0	lower zone less impacted as high flows are few			
AVERAGE			5.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	0.0	4.0	no impact		
	ABUNDANCE	Y	0.0	4.0	no impact		
	POPULATION STRUCTURE	Y	0.0	4.0			
	RECRUITMENT	Y	0.0	4.0			
	SPECIES COMPOSITION	Y	0.0	4.0			
NON-WOODY	COVER	Y	0.0	4.0			
	ABUNDANCE	Y	0.0	4.0			
	SPECIES COMPOSITION	Y	0.0	4.0			
			0.0	4.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	0.0	0.00	4.0	Dominated by tall trees
NON-WOODY	Y	2.0	90.0	0.0	0.00	4.0	high cover & very diverse
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE					0.0		

Table 25: Upper zone for WIT1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	1.0	1.0	5.0	road infrastructure			
EXOTIC INVASION	1.0		5.0	prickly pear, small isolated clump of small plants			
WATER QUANTITY	0.0	0.0	5.0				
WATER QUALITY	0.0	0.0	5.0				
AVERAGE			5.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	0.0	5.0			
	ABUNDANCE	Y	0.0	5.0			
	POPULATION STRUCTURE	Y	0.0	5.0			
	RECRUITMENT	Y	0.0	5.0			
	SPECIES COMPOSITION	Y	0.0	5.0			
			0.0	5.0			
NON-WOODY	COVER	Y	0.0	5.0			
	ABUNDANCE	Y	0.0	5.0			
	SPECIES COMPOSITION	Y	0.0	3.3			
			0.0	3.3			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	0.0	0.00	5.0	tall & diverse trees
NON-WOODY	Y	2.0	95.0	0.0	0.00	3.3	presence of fynbos elements, grasses & herbaceous plants
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE					0.0		
					0.00	4.2	

able 26: Riparian zone EC for WIT1

LEVEL 4 ASSESSMENT						
RIPARIAN VEGETATION EC METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	WEIGHT	NOTES: (give reasons for each assessment)
MARGINAL	89.5	44.7	4.5	1.0	100.0	suseptible to scouring events
LOWER ZONE	100.0	37.5	4.2	2.0	75.0	stabilised by trees rooting system and forest floor vegetation
UPPER ZONE	100.0	12.5	4.2	3.0	25.0	
					3.0	200.0
LEVEL 4 VEGRAI (%)				94.7		
VEGRAI EC				A		
AVERAGE CONFIDENCE				4.3		

e) GROOT RIVER (GRO1)

Table 27: Marginal zone for GRO1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	4.0	2.0	5.0	road and stock farming			
EXOTIC INVASION	1.0		5.0	few exotics low cover, Arundo donax			
WATER QUANTITY	2.0	2.0	5.0	irrigation farming - water abstraction, land degradation from overgrazing reduced infiltration, Beervlei dam			
WATER QUALITY	3.0	3.0	5.0	irrigation, steytleville town - sewerage, roads, rubbish dumping, increased sediment load and eutrication			
AVERAGE			5.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	1.0	5.0			
	ABUNDANCE	Y	1.0	5.0			
	POPULATION STRUCTURE	Y	1.1	5.0			
	RECRUITMENT	Y	1.4	5.0			
	SPECIES COMPOSITION	Y	1.1	5.0			
			1.1	5.0			
NON-WOODY	COVER	Y	2.0	5.0			
	ABUNDANCE	Y	2.0	5.0			
	SPECIES COMPOSITION	Y	0.0	5.0			
			1.3	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	2.0	50.0	1.1	0.57	5.0	
NON-WOODY	Y	1.0	100.0	1.3	1.33	5.0	
					1.90	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL			25.3				

Table 28: Lower zone for GRO1

		IMPACT RATINGS:					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	4.0	2.0	4.0	grazing, road, causeway, firewood,			
EXOTIC INVASION	2.0		4.0	Arundo donax, Rubus cuneifolius, Cynodon dactylon, Nicotiana glauca			
WATER QUANTITY	2.0	2.0	4.0	farm dams & overgrazing & land degradation in karoo reduced flow			
WATER QUALITY	3.0	3.0	4.0	stock farming, dumping & small town in catchment			
AVERAGE			4.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	1.0	4.0			
	ABUNDANCE	Y	1.0	4.0			
	POPULATION STRUCTURE	Y	1.8	4.0			
	RECRUITMENT	Y	1.1	4.0			
	SPECIES COMPOSITION	Y	1.8	4.0			
			1.4	4.0			
NON-WOODY	COVER	Y	3.0	4.0			
	ABUNDANCE	Y	3.0	4.0			
	SPECIES COMPOSITION	Y	1.1	4.0			
			2.4	4.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	1.4	1.35	4.0	
NON-WOODY	Y	2.0	80.0	2.4	1.88	4.0	
					3.23	4.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE			35.9				

Table 29: Upper zone for GRO1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	4.0	2.0	4.0	cattle use, firewood			
EXOTIC INVASION	1.0		4.0				
WATER QUANTITY	2.0	2.0	4.0				
WATER QUALITY	3.0	3.0	4.0				
AVERAGE			4.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	1.0	4.0			
	ABUNDANCE	Y	1.0	4.0			
	POPULATION STRUCTURE	Y	0.0	4.0			
	RECRUITMENT	Y	0.0	4.0			
	SPECIES COMPOSITION	Y	2.2	4.0			
			0.8	4.0			
NON-WOODY	COVER	Y	3.0	4.0			
	ABUNDANCE	Y	3.0	4.0			
	SPECIES COMPOSITION	Y	0.3	4.0			
			2.1	4.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	0.8	0.84	4.0	
NON-WOODY	Y	2.0	50.0	2.1	1.05	4.0	
					1.90	4.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE			25.3				

Table 30: Riparian zone EC for GRO1

LEVEL 4 ASSESSMENT						
RIPARIAN VEGETATION EC METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	WEIGHT	NOTES: (give reasons for each assessment)
MARGINAL	74.7	31.1	5.0	1.0	100.0	
LOWER ZONE	64.1	21.4	4.0	2.0	80.0	
UPPER ZONE	74.7	18.7	4.0	3.0	60.0	
	3.0				240.0	
LEVEL 4 VEGRAI (%)				71.2		
VEGRAI EC				C		
AVERAGE CONFIDENCE				4.5		

f) GAMTOOS RIVER (GAM1)

Table 31: Marginal zone for GAM1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	3.0	2.0	5.0	quarrying coble, scouring floods, reduced flow, alien debris in floods			
EXOTIC INVASION	4.0		5.0	many invasive species, vulnerable open habitat			
WATER QUANTITY	2.0	2.0	4.0	beervlei & Kouga dam & extraction; overgrazed catchment mor runoff reduced infiltration results in water loss			
WATER QUALITY	3.0	3.0	4.0	increased sediment load, sewerage discharge, fertilisers and pesticides, less shading increased temperature			
AVERAGE			4.5				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	3.0	5.0	reduced in scouring floods		
	ABUNDANCE	Y	3.0	5.0	reduced in scouring floods		
	POPULATION STRUCTURE	Y	2.3	5.0	altered		
	RECRUITMENT	Y	1.1	5.0	altered		
	SPECIES COMPOSITION	Y	2.4	5.0	species loss		
			2.4	5.0			
NON-WOODY	COVER	Y	3.0	5.0	altered system		
	ABUNDANCE	Y	3.0	5.0	reduced in scouring floods		
	SPECIES COMPOSITION	Y	0.7	5.0	specis loss		
			2.2	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	2.0	50.0	2.4	1.18	5.0	
NON-WOODY	Y	1.0	100.0	2.2	2.25	5.0	
					3.43	5.0	
CHANGE (% IN VEGETATION COMPONENTS:OVERALL			45.7				

Table 32: Lower zone for GAM1

		IMPACT RATINGS:					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	4.0	3.0	5.0				
EXOTIC INVASION	2.0		5.0				
WATER QUANTITY	3.0	3.0	5.0				
WATER QUALITY	3.0	3.0	5.0				
AVERAGE			5.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	3.0	5.0			
	ABUNDANCE	Y	3.0	5.0			
	POPULATION STRUCTURE	Y	1.5	5.0			
	RECRUITMENT	Y	1.5	5.0			
	SPECIES COMPOSITION	Y	1.3	5.0			
			2.0	5.0			
NON-WOODY	COVER	Y	2.0	5.0			
	ABUNDANCE	Y	2.0	5.0			
	SPECIES COMPOSITION	Y	1.7	5.0			
			1.9	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	2.0	2.05	5.0	
NON-WOODY	Y	2.0	90.0	1.9	1.72	5.0	
					3.77	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE			39.7				

Table 33: Upper zone for GAM1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	5.0	5.0	5.0				
EXOTIC INVASION	4.0		5.0				
WATER QUANTITY	4.0	4.0	5.0				
WATER QUALITY	4.0	4.0	5.0				
AVERAGE			5.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	5.0	5.0			
	ABUNDANCE	Y	5.0	5.0			
	POPULATION STRUCTURE	Y	4.4	5.0			
	RECRUITMENT	Y	3.1	5.0			
	SPECIES COMPOSITION	Y	1.7	5.0			
			3.8	5.0			
NON-WOODY	COVER	Y	3.0	5.0			
	ABUNDANCE	Y	3.0	5.0			
	SPECIES COMPOSITION	Y	3.0	5.0			
			3.0	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	3.8	3.83	5.0	
NON-WOODY	Y	2.0	50.0	3.0	1.50	5.0	
					5.33	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE			71.1				

Table 34: Riparian zone EC for GAM1

LEVEL 4 ASSESSMENT						
RIPARIAN VEGETATION EC METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	WEIGHT	NOTES: (give reasons for each assessment)
MARGINAL	54.3	20.1	5.0	1.0	100.0	
LOWER ZONE	60.3	20.1	5.0	2.0	90.0	
UPPER ZONE	28.9	8.6	5.0	3.0	80.0	
	3.0				270.0	
LEVEL 4 VEGRAI (%)				48.8		
VEGRAI EC				D		
AVERAGE CONFIDENCE				5.0		

g) UPPER KOUGA RIVER (KOU1)

Table 35: Marginal zone for KOU1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	3.0	3.0	4.0	cattle, scouring floods when dam broke, unstable banks			
EXOTIC INVASION	5.0		5.0	Acacia mearnsii, clearing attempts but still dominant			
WATER QUANTITY	2.0	2.0	4.0	transpiration by aliens, poor catchment management, dam, irrigation, abstraction			
WATER QUALITY	3.0	2.0	4.0	sewerage spill in upper catchment, sediment load, fertiliser, pesticides			
AVERAGE			4.3				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	5.0	5.0	black wattle invasion & clearing & scouring events in floods		
	ABUNDANCE	Y	5.0	5.0	black wattle invasion & clearing & scouring events in floods		
	POPULATION STRUCTURE	Y	5.0	5.0			
	RECRUITMENT	Y	5.0	5.0			
	SPECIES COMPOSITION	Y	2.7	5.0			
			4.5	5.0			
NON-WOODY	COVER	Y	3.0	5.0			
	ABUNDANCE	Y	3.0	5.0			
	SPECIES COMPOSITION	Y	4.1	5.0			
			3.4	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	2.0	75.0	4.5	3.40	5.0	
NON-WOODY	Y	1.0	100.0	3.4	3.36	5.0	
					6.76	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL			77.2				

Table 36: Lower zone for KOU1

		IMPACT RATINGS:					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	3.0	3.0	4.0	cattle, scouring floods when dam broke, unstable banks			
EXOTIC INVASION	5.0		5.0	Acacia mearnsii, clearing attempts but still dominant			
WATER QUANTITY	2.0	2.0	4.0	transpiration by aliens, poor catchment management, dam, irrigation, abstraction			
WATER QUALITY	3.0	2.0	4.0	sewerage spill in upper catchment, sediment load, fertiliser, pesticides			
AVERAGE			4.3				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	4.0	5.0	black wattle invasion & clearing & scouring events in floods		
	ABUNDANCE	Y	4.0	5.0	black wattle invasion & clearing & scouring events in floods		
	POPULATION STRUCTURE	Y	4.0	5.0			
	RECRUITMENT	Y	4.0	5.0			
	SPECIES COMPOSITION	Y	3.7	5.0			
			3.9	5.0			
NON-WOODY	COVER	Y	4.0	5.0			
	ABUNDANCE	Y	4.0	5.0			
	SPECIES COMPOSITION	Y	2.5	5.0			
			3.5	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	3.9	3.95	5.0	
NON-WOODY	Y	2.0	75.0	3.5	2.63	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE					75.2		
						6.58	5.0

Table 37: Upper zone for KOU1

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	3.0	3.0	4.0	upper zone indistinct, same scores as for lower zone			
EXOTIC INVASION	5.0		5.0				
WATER QUANTITY	2.0	2.0	4.0				
WATER QUALITY	3.0	2.0	4.0				
AVERAGE			4.3				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	4.0	5.0			
	ABUNDANCE	Y	4.0	5.0			
	POPULATION STRUCTURE	Y	4.0	5.0			
	RECRUITMENT	Y	4.0	5.0			
	SPECIES COMPOSITION	Y	3.2	5.0			
			3.8	5.0			
NON-WOODY	COVER	Y	4.0	5.0			
	ABUNDANCE	Y	4.0	5.0			
	SPECIES COMPOSITION	Y	2.5	5.0			
			3.5	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	3.8	3.84	5.0	
NON-WOODY	Y	2.0	50.0	3.5	1.75	5.0	less non-woody here
					5.59	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE			74.5				

Table 38: Riparian zone EC for KOU1

LEVEL 4 ASSESSMENT							
RIPARIAN VEGETATION EC METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	WEIGHT	NOTES: (give reasons for each assessment)	
MARGINAL	22.8	8.4	5.0	1.0	100.0	more exposed to impacts	
LOWER ZONE	24.8	8.3	5.0	2.0	90.0		
UPPER ZONE	25.5	7.5	5.0	3.0	80.0		
					3.0	270.0	
LEVEL 4 VEGRAI (%)				24.3			
VEGRAI EC				E			
AVERAGE CONFIDENCE				5.0			

h) LOWER KOUGA RIVER (KOU2)

Table 39: Marginal zone for KOU2

		IMPACT RATINGS								
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)						
REMOVAL	2.0	2.0	5.0							
EXOTIC INVASION	1.0		5.0	recently scoured						
WATER QUANTITY	2.0	2.0	4.0	weirs & farm dams, ctachment management, alien invasion						
WATER QUALITY	2.0	1.0	4.0	quarrying cobble, road infrastructure, sewerage release, sediment load in high flows						
AVERAGE			4.5							
		RESPONSE METRIC RATINGS								
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)					
WOODY	COVER	Y	4.0	5.0	alien displacement & scouring floods					
	ABUNDANCE	Y	4.0	5.0	alien displacement & scouring floods					
	POPULATION STRUCTURE	Y	3.9	5.0						
	RECRUITMENT	Y	3.9	5.0						
	SPECIES COMPOSITION	Y	1.1	5.0						
			3.4	5.0						
NON-WOODY	COVER	Y	3.0	4.0						
	ABUNDANCE	Y	3.0	4.0						
	SPECIES COMPOSITION	Y	0.9	5.0						
			2.3	4.3						
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)			
WOODY	Y	2.0	75.0	3.4	2.53	5.0	less woody in marginal			
NON-WOODY	Y	1.0	100.0	2.3	2.31	4.3				
					4.84	4.7				
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL			55.3							

Table 40: Lower zone for KOU2

		IMPACT RATINGS:					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	2.0	2.0	5.0	roads, alien displacement			
EXOTIC INVASION	3.0		5.0				
WATER QUANTITY	2.0	2.0	5.0	weirs & farm dams, catchment management, alien transpiration			
WATER QUALITY	2.0	1.0	5.0	roads, weirs farm dams, pesticides from alien clearing, sewerage release, tourist use, cobble use			
AVERAGE			5.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	3.0	5.0			
	ABUNDANCE	Y	3.0	5.0			
	POPULATION STRUCTURE	Y	4.2	5.0			
	RECRUITMENT	Y	4.2	5.0			
	SPECIES COMPOSITION	Y	2.0	5.0			
			3.3	5.0			
NON-WOODY	COVER	Y	4.0	5.0			
	ABUNDANCE	Y	4.0	5.0			
	SPECIES COMPOSITION	Y	1.9	5.0			
			3.3	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	3.3	3.26	5.0	
NON-WOODY	Y	2.0	95.0	3.3	3.13	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE					65.5		

Table 41: Upper zone for KOU2

		IMPACT RATINGS					
IMPACTS	INTENSITY	EXTENT	CONFIDENCE	NOTES: (give reasons for each assessment)			
REMOVAL	2.0	2.0	5.0				
EXOTIC INVASION	5.0		5.0	heavily invaded with black wattle			
WATER QUANTITY	1.0	1.0	5.0				
WATER QUALITY	2.0	1.0	5.0				
AVERAGE			5.0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	RESPONSE METRIC	CONSIDER? (Y/N)	RATING	CONFIDENCE	NOTES: (give reasons for each assessment)		
WOODY	COVER	Y	5.0	5.0			
	ABUNDANCE	Y	5.0	5.0			
	POPULATION STRUCTURE	Y	2.7	5.0			
	RECRUITMENT	Y	2.8	5.0			
	SPECIES COMPOSITION	Y	2.5	5.0			
			3.6	5.0			
NON-WOODY	COVER	Y	3.0	5.0			
	ABUNDANCE	Y	3.0	5.0			
	SPECIES COMPOSITION	Y	0.4	5.0			
			2.1	5.0			
VEGETATION COMPONENTS	CONSIDER? (Y/N)	RANK	WEIGHT	RATING	WEIGHTED RATING	MEAN CONFIDENCE	NOTES: (give reasons for each assessment)
WOODY	Y	1.0	100.0	3.6	3.59	5.0	
NON-WOODY	Y	2.0	65.0	2.1	1.38	5.0	
					4.98	5.0	
CHANGE (%) IN VEGETATION COMPONENTS:OVERALL CHANGE			60.3				

Table 42: Riparian zone EC for KOU2

LEVEL 4 ASSESSMENT							
RIPARIAN VEGETATION EC METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	WEIGHT	NOTES: (give reasons for each assessment)	
MARGINAL	44.7	18.6	4.7	1.0	100.0	river banks and backwater pools	
LOWER ZONE	34.5	12.9	5.0	2.0	90.0		
UPPER ZONE	39.7	8.3	5.0	3.0	50.0		
					3.0	240.0	
LEVEL 4 VEGRAI (%)				39.8			
VEGRAI EC				D/E			
AVERAGE CONFIDENCE				4.8			

5.4.1. Description of the PES

Table 43 presents a summary of the VEGRAI results with descriptions of the PES at each of the EWR sites, focusing on indicator taxa within each metric group.

Table 43: Description of the PES for each of the EWR sites based on the VEGRAI outputs

EWR Site	PES	Zone	Indicator taxa/values	Narrative	Conf. Level
BAV1	C	Marginal	<i>Menta longifolia</i> & <i>Salix mucronata</i>	The vegetation was intact with a high diversity of species in all zones. However the extent or cover of the vegetation appears to be declining and is prone to invasion by invasive species because of increased scouring flood events. <i>Ficus sur</i> is important indicator for marginal and lower zone. Cover of trees in all zones.	3
		Lower	<i>Ficus sur</i>		
		Upper	<i>Schotia latifolia</i> & <i>Celtis africana</i>		
BAV3	C	Marginal	<i>Cyperus textilis</i>	Natural vegetation was intact. The channeling of stream bed to accommodate the road has reduced the extent and diversity of marginal zone vegetation. Dominance of <i>Cyperus textilis</i> probably result of increased silt and nutrient load in water. Upper Zone narrow and difficult to detect. Lower zone quite disturbed by floods and browsing game and historically stock, dominated by <i>Acacia karoo</i> & <i>Rhus pyroides</i>	3
		Lower	<i>Acacia karoo</i> & <i>Plumbago auriculata</i>		
		Upper	<i>Ficus sur</i> & <i>Sideroxylon inerme</i>		
GEE1	A	Marginal	<i>Pycerus polystachyos</i> & <i>Todea barbara</i>	The vegetation is pristine and has not been altered. The cover of the two dominant indicator trees is important. High diversity of non-woody vegetation in marginal zone. High diversity of woody vegetation in lower and upper zones. Catchment is relatively small and managed as wilderness area. Relatively low occurrence of aliens.	5
		Lower	<i>Ficus sur</i> & <i>Afrocarpus falcatus</i>		
		Upper	<i>Ficus sur</i> & <i>Afrocarpus falcatus</i>		
WIT1	A	Marginal	<i>Gunnera perpensa</i> & <i>Salix mucronata</i>	The vegetation is pristine and has not been altered. The cover of the two dominant indicator trees is important. High diversity of non-woody vegetation in marginal zone. High diversity of woody vegetation in lower and upper zones. Catchment is relatively small and managed as wilderness area. Relatively low occurrence of aliens.	5
		Lower	<i>Ficus sur</i> & <i>Afrocarpus falcatus</i>		
		Upper	<i>Scotia latifolia</i> & <i>Pittosporum viridifolium</i>		
GRO1	C	Marginal	<i>Cyperus textilis</i>	Natural vegetation intact with less diverse vegetation in marginal and lower zones possibly related to increase in <i>Cyperus textilis</i> cover and extent. Local impact of cattle grazing. Potential for spread of <i>Typha capensis</i> and <i>Arundo donax</i> and other invasive aliens in marginal zone, siltation, causeway, human activities in greater catchment and scouring floods have had negative impact on riparian vegetation.	3
		Lower	<i>Acacia karoo</i>		

EWR Site	PES	Zone	Indicator taxa/values	Narrative	Conf. Level
		Upper	<i>Acacia karoo</i> & <i>Ficus sur</i> & <i>Afrocarpus falcatus</i>		
GAM1	D	Marginal	<i>Phragmites australis</i> & <i>Cyperus textilis</i>	Marginal zone dominated by cosmopolitan reeds that tend to be spreading and canalizing the river. Lower zone open cobble beds and unstable and prone to spread of aliens. Upper zone poorly developed and lost to agriculture in many parts. Loss in species diversity.	4
		Lower	<i>Acacia karoo</i> , & <i>Rhus pyroides</i>		
		Upper	<i>Afrocarpus falcatus</i> & <i>Acacia karoo</i>		
KOU1	E	Marginal	<i>Reeds & herbs</i>	Open sandy banks, loss of species diversity and loss of vegetation cover. Invasion and clearing of black wattle. High potential for re-invasion of exotic vegetation.	4
		Lower	<i>Rhus pyroides</i> & <i>Rhus undulata</i>		
		Upper	<i>Diospyros austro-africana</i> & <i>Rhus pyroides</i>		
KOU2	D/E	Marginal	<i>Prionium serrata</i> & <i>Salix mucronata</i>	Low cover of palmiet (<i>Prionium serratum</i>) and <i>Salix mucronata</i> due to scouring floods. Relatively low cover of woody trees and bushes. Invasion of black wattle and damage caused in floods by alien debris.	4
		Lower	<i>Salix mucronata</i> & <i>Rhus pyroides</i>		
		Upper	<i>Olea europea subsp africana</i> , & <i>Rhus undulata</i>		

5.4.2. Reasons for the PES

Table 44 presents the PES category for the riparian vegetation at each EWR site. The table also highlights the main probable causes for the PES and whether or not these are flow related. The results are given a confidence rating of between 5 and 0 where 5 indicates high confidence and of 0 indicates no confidence.

Table 44: PES category for the Riparian Vegetation component of BAV1 with reasons for the PES

EWR Site	PES	Causes of the PES	Sources of the PES	F/NF ¹	Conf. Level
BAV1	C	Destabilized banks	Scouring floods	F	5
		Reduced ability of catchment to absorb flooding events	Overgrazing	NF	3
		Scouring events more common	Climate change	NF	3
		Invasion of aliens	Destabilization of natural vegetation in floods	F	3

¹ Flow or Non Flow related causes of the PES

EWR Site	PES	Causes of the PES	Sources of the PES	F/NF ¹	Conf. Level
BAV3	C	Channeling of river bed	Human activity	NF	5
		Scouring events more common	Climate change & overgrazing & reduced vegetation cover in catchment	NF	3
		Invasion of aliens	Destabilization of natural vegetation cover in floods	F	3
		Eutrophication	Farming activities in catchment	NF	3
GEE1	A	Pristine riparian vegetation	Catchment in pristine condition with very few aliens	F	4
		Diverse riparian vegetation	Perennial stream with clean water – unaltered from natural condition	F	4
		Diverse riparian trees forming riparian forest	Upper mountain catchment area with limited potential for damaging floods	F	4
WIT1	A	Pristine riparian vegetation	Catchment in pristine condition with very few aliens	F	4
		Diverse riparian vegetation	Perennial stream with clean water – unaltered from natural condition	F	4
		Diverse riparian trees forming riparian forest	Upper mountain catchment area with limited potential for damaging floods	F	4
GRO1	C	Loss of diversity and habitat	Scouring floods, channelling of river, sedimentation and eutrophication favouring dominance and spread of cosmopolitan reeds	F	4
		Reduced flow	Reduced cover of vegetation by overgrazing in catchment increases surface runoff and decreased infiltration	F	4
		Eutrophication	Farming activities in catchment	NF	4
		Invasion of aliens	Destabilization of natural vegetation cover in floods	F	4
GAM1	D	Loss of diversity and habitat	Scouring floods, channelling of river, sedimentation and eutrophication favouring dominance and spread of cosmopolitan reeds	F	4
		Reduced flow	Reduced cover of vegetation by overgrazing in catchment increases surface runoff and decreased infiltration and Kouga Dam and transpiration by alien vegetation in catchment & climate change & agriculture & abstraction	F	4
		Eutrophication	Farming activities in catchment	NF	4

EWR Site	PES	Causes of the PES	Sources of the PES	F/NF¹	Conf. Level
		Invasion of aliens	Destabilization of natural vegetation cover in floods	F	4
KOU1	E	Scouring events more common, destabilized banks – loss of diversity and habitat	Climate change & overgrazing & reduced vegetation cover in catchment & alien invasions and clearing resulting in damaging timber debris in the river	F	4
		Invasion of aliens	Destabilization of natural vegetation cover in floods	F	3
		Eutrophication	Farming activities in catchment & sewerage leaks	NF	3
		Reduced flow	Reduced cover of vegetation by overgrazing in catchment increases surface runoff and decreased infiltration and farm dams common in catchment and transpiration by abundant & spreading alien vegetation in catchment & climate change & agriculture & abstraction	F	4
KOU2	D/E	Scouring events more common, destabilized banks – loss of diversity and habitat	Climate change & overgrazing & reduced vegetation cover in catchment & alien invasions and clearing resulting in damaging timber debris in river	F	4
		Invasion of aliens	Destabilization of natural vegetation cover in floods	F	3
		Eutrophication	Farming activities in catchment & sewerage leaks	NF	3
		Reduced flow	Reduced cover of vegetation by overgrazing in catchment increases surface runoff and decreased infiltration and farm dams common in catchment and transpiration by abundant & spreading alien vegetation in catchment & climate change & agriculture & abstraction	F	4

5.4.3. Trend in the PES

The trend (direction of change from reference condition) in the Present Ecological State (PES) is assessed and the results are given a confidence rating from 1 (low confidence) to 5 (high confidence). The analysis of the PES trend aims to highlight possible risk areas to the current PES if negative. A stable trend is indicative of an ecosystem that is not declining or improving while a positive trend signifies an ecosystem that is in the process of improving and a negative trend one that is declining. Table 45 presents the trends allocated to each biophysical component as well as the reasoning behind the allocation. The “Trend PES” gives an indication of the severity of the anticipated improvement or decline (trend) in the medium term (5 years).

Table 45: PES trend for the Riparian Vegetation component with reasons for the trend

EWR site	PES	%EC	Trend	Trend PES	Conf. Level	Reasons for the trend
BAV1	C	70.6	↓	C	3	Destabilized banks, reduced ability of catchment to absorb flooding events, scouring events more common
BAV3	C	76.5	↓	C	3	Eutrophication and sediment build up and scouring floods
GEE1	A	97.2	↔	A	4	Pristine, catchment intact
WIT1	A	94.7	↔	A	4	Pristine, catchment intact
GRO1	C	71.2	↓	C/D	4	Eutrophication & sedimentation & reduced flow & scouring floods
GAM1	D	48.8	↓	D	4	Destabilized banks, scouring floods, reduced flow, canalization
KOU1	E	24.3	↓	E/F	4	Destabilized banks, scouring floods, reduced flow, alien invasions, reduced diversity
KOU2	D/E	39.8	↓	E	4	Destabilized banks, scouring floods, reduced flow, alien invasions, reduced diversity

5.5. Importance and Sensitivity

The EIS assessment formed part of the greater EWR assessment and the model outputs can be viewed in Annexure 7 of the integrated report. A summary of the EIS assessment results are presented in Table 46.

Table 46: EIS for each EWR site

SITE	RATING	CONF	REASON
BAV1	4	5	Protected tree <i>Sideroxylon inerme</i> and <i>Widdringtonia schwarzii</i> in upper catchment.
BAV3	4	5	<i>Amphiglossa callunoides</i> (National Status Threatened - Vulnerable) and protected trees <i>Sideroxylon inerme</i> and <i>Pittosporum viridifolium</i> .
GRO1	4	5	Protected trees <i>Afrocarpus falcatus</i> (historically)

GEE1	4	5	Protected trees include <i>Sideroxylon inerme</i> , <i>Pittosporum viridifolium</i> , <i>Afrocarpus falcatus</i> , and <i>Widdringtonia schwarzii</i> in upper catchment. Succulent on cliffs, <i>Gasteria rawlinsonii</i> , listed as rare. Protected forest vegetation
WIT1	4	5	Protected trees, <i>Afrocarpus falcatus</i> , <i>Pittosporum viridifolium</i> , <i>Sideroxylon inerme</i> . Protected Forest vegetation
GAM1	4	5	Protected tree <i>Afrocarpus falcatus</i> (historically).
KOU1	4	4	
KOU2	4	5	Protected trees, <i>Pittosporum viridifolium</i> .

5.6. Vegetation community management measures

Riparian plant communities are dependent on the variation in moisture gradients and the establishment of stable banks of deep soil. However, this structural variation within the riparian zone has mostly been flushed out in massive scouring floods, especially in the Kouga and Groot rivers. This has left these larger more open rivers as destabilised and barren boulder beds with a single channel. This habitat is ideal for the establishment and spread of several alien plants that represent a threat to the indigenous riparian habitat. It might be argued that extreme floods are a natural feature of these rivers and that they are thus adapted to them and are an essential part of a rivers functioning. However, it appears that the frequency and intensity of these floods has increased in the past ten or so years, and the riparian habitat has been eroded away more now than ever before. The invasion and clearing of alien trees, especially black wattle (*Acacia mearnsii*), has accelerated the rate of riparian habitat degradation.

6. CONCLUSIONS AND RECOMMENDATIONS

In summary this study has found that the two sites located in the upper catchments (WIT1 and GEE1) with streams draining natural vegetation that has been conserved, are in a near to pristine condition. However, all the other sites that are lower down in the catchment or that have had the natural vegetation disturbed or transformed in some way also have a degraded riparian vegetation condition (BAV1, BAV3, GRO1, GAM1, KOU1 and KOU2). The reasons for this are various and complicated. It needs to be stressed that the study area in general is exposed to a fairly unpredictable and unstable climate. Drought events and flooding events are relatively normal but this makes the rivers extremely sensitive to changes in land use in the catchments. The Albany Thicket vegetation that occurs in the river valleys played an extremely important role in buffering the effects of these climatic events. However, overgrazing of this vegetation has resulted in desertification in several parts and this has transformed the hydrological functioning of the catchment. Historically the intact vegetation would have absorbed the massive rainfall events to which the area is exposed - the water would have infiltrated and taken months to drain out through the rivers. Today these rainfall events tend to run off the surface and rush down the rivers to the sea in a few days scouring out the channels and back water pools and leaving a deeper narrower channel with less water in it and that is prone to drying out completely. Historical reports indicate that the Baviaanskloof River was a perennial river from as high up as the Nuwekloof Pass. Today it is a non-perennial river in its upper reaches (west of Geelhoutbos) and many parts are dry for most of the time. Although this may in part have been caused by a reduction in rainfall in the area, it is argued that this in combination with the reduced cover of thicket vegetation and especially spekboom (*Portulacaria afra*) in the catchments is the cause of reduced annual flow of many rivers in the study area. This is especially true for the area to the north of the Kouga Mountains.

The main impact this has had on the riparian vegetation is most pronounced in the marginal and lower zones. In the smaller streams/rivers with steeper gradients one finds a reduction in cover as a result of scouring events in floods (e.g. KOU1, KOU2 & BAV1). In the lower more gentle gradient rivers (e.g. GRO1 & GAM1) there tends to be a fair degree of sedimentation and expansion of cosmopolitan reeds that tend to further the expansion of the reed-beds and promote the canalisation of the river bed. Overall there is a reduction in the structural heterogeneity of the lower zone and this has reduced the cover and diversity of the vegetation here. A further impact that should not be overlooked is the damage done by felled alien timber as it washes downstream in flood events. These tend to form large debris piles that burst in flooding events and do an enormous amount of bank destabilization and scouring that has resulted in long term changes to the ecological state of the rivers.

7. MANAGEMENT AND MITIGATION MEASURES

Probable impacts associated with water abstraction and/or development and/or agriculture that relate to the water quality and quantity aspects of the Baviaanskloof, Wit, Groot and Kouga Rivers are presented in Table 47 together with suggested management and mitigation measures.

Table 47: Management and mitigation measures for the Riparian Vegetation component of rivers within the Baviaanskloof Mega Reserve study area

EWR component affected	Potential impact	Mitigation measures	Specific objectives
BAVIAANSKLOOF & GEELHOUTBOS			
Ecological condition	Reduced diversity and habitat integrity.	Catchment management. Stock reductions to allow vegetation to recover. Eradication of alien vegetation.	Maintain REC. Monitor the presence of <i>Salix mucronata</i> and <i>Ficus sur</i> in the marginal zone as well as the possible re-appearance of <i>Afrocarpus falcatus</i> .
Riparian & instream habitat	Decreased cover, extent and diversity of wetland habitat in the riparian vegetation.	Ensure recovery of vegetation cover in catchment and reduce or take off stock from overgrazed and eroding areas in catchment. A VEGRAI assessment must be implemented every second year to monitor the ecological status of the river. To restore the flow regime to more sustained levels with less fluctuation and longer post rain runoff events, especially in drier parts of the catchment.	
	Invasion of alien plant species and loss of indigenous diversity.	Eradication of alien plant species. Rehabilitation of riverine habitat in areas where aliens have been removed.	
WIT			
Riparian & instream habitat	Invasion of alien plant species.	Eradication of alien plant species in the catchment. A VEGRAI assessment must be implemented every second year to monitor the ecological status of the river.	Maintain REC. Monitor the presence of <i>Gunnera perpensa</i> and <i>Salix mucronata</i> in the marginal zone, <i>Ficus sur</i> and <i>Afrocarpus falcatus</i> in the lower zone and <i>Scotia latifolia</i> <i>Pittosporum viridifolium</i> in the upper zone.
GROOT			
Riparian & instream habitat	Reduced habitat diversity and plant diversity.	Catchment management to reduce silt loads and reduce input of nutrients into system. A VEGRAI assessment must be implemented every second year to monitor the ecological status of the river.	Maintain REC. Monitor the presence of <i>Cyperus textiles</i> in the marginal zone <i>Acacia karoo</i> in the upper and lower zones and <i>Ficus sur</i> & <i>Afrocarpus falcatus</i> in the upper zone.
	Invasion of alien plant species and loss of indigenous diversity.	Eradication of alien plant species. Rehabilitation of riverine habitat in areas where alien plant species have been removed.	

EWR component affected	Potential impact	Mitigation measures	Specific objectives
KOUGA			
Riparian & instream habitat	Reduced habitat diversity and plant diversity.	Catchment management to reduce silt loads and reduce input of nutrients into system. A VEGRAI assessment must be implemented every second year to monitor the ecological status of the river.	Maintain REC. In the upper reaches, monitor the presence of Reeds & herbs in the marginal zone, <i>Rhus pyroides</i> and <i>Rhus undulata</i> in the lower zone and <i>Diospyros austro-africana</i> and <i>Rhus pyroides</i> in the upper zone. In the lower reaches, monitor the presence of <i>Prionium serrata</i> and <i>Salix mucronata</i> in the marginal zone, <i>Salix mucronata</i> and <i>Rhus pyroides</i> in the lower zone and <i>Olea europea subsp africana</i> , and <i>Rhus undulate</i> in the upper zone.
	Invasion of alien plant species and loss of indigenous diversity.	Eradication of alien plant species. Rehabilitation of riverine habitat in areas where alien plant species have been removed.	
GAMTOOS			
Riparian & instream habitat	Reduced habitat diversity and plant diversity.	Catchment management to reduce silt loads and reduce input of nutrients into system. A VEGRAI assessment must be implemented every second year to monitor the ecological status of the river.	Maintain REC. Monitor the presence of <i>Phragmites australis</i> & <i>Cyperus textiles</i> in the marginal zone, <i>Acacia karoo</i> in the upper and lower zone, <i>Rhus pyroides</i> in the lower zone and <i>Afrocapus falcatus</i> in the upper zone.
	Invasion of alien plant species and loss of indigenous diversity.	Eradication of alien plant species. Rehabilitation of riverine habitat in areas where alien plant species have been removed.	

8. REFERENCES

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