APPENDIX A – WETLAND ASSESSMENT REPORTS

A health and ecosystem services assessment of wetlands for the planning of rehabilitation in the Wakkerstroom Project

1. Introduction

Rehabilitation refers to re-instating the driving ecological forces that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers. Effective rehabilitation planning therefore requires an assessment of how the following three processes have been threatened/impacted upon:

- Hydrological;
- Geomorphological; and
- Ecological.

Furthermore, it requires an assessment of the predicted contribution that wetland rehabilitation will make to improving wetland health and ecosystem delivery through addressing the identified impacts/threats. Without these assessments, a wetland rehabilitation programme is unlikely to have a well-informed basis on which to improve the rehabilitation's "return on investment" (with return being measured in terms of wetland health and ecosystem services delivery).

The approach and results for the assessment of wetland habitat for rehabilitation within the Monontsha Project is outlined in this report. The project is located in and around the town of Phuthaditjhaba in the Free State. The Monontsha Project was selected for a Level 1 assessment.

2. Methods

The assessment of individual wetlands should take place in the context of a broader process involving the prioritization and selection of individual wetlands within the landscape. In some cases, the selection was based only on stakeholder knowledge and preferences, while in other cases it involved the selection of priority catchment/s by stakeholders and then the prioritization and selection of individual wetlands within these catchments based on information gathered in an aerial reconnaissance.

No specific wetland management/rehabilitation objectives were identified for the identified quaternary catchment. However, owing to the importance of the wetland habitat (potential RAMSAR site) in the area, it was assumed that securing/enhancing the biological integrity of the wetlands in the catchment would be important from a reserve management perspective.

In the case of the Monontsha project, prioritization took place as follows:

- The C81F quaternary catchment was selected by the South African National Biodiversity Institute-Working for Wetlands (*WfWet*) for wetland rehabilitation work.

- An orthophoto was used to prioritise areas for field identification of problems (*e.g.* erosion headcuts and drainage channels) considered potentially suitable for structural rehabilitation.

Once areas had been identified, assessments were carried out infield. The time and resources required for detailed assessments of the wetlands within the catchment were generally limited and thus a rapid procedure was devised to assist in systematically carrying out these assessments under stringent time and resource constraints. The procedure is based on the following steps:

- Assess impacts and threats;
- Set rehabilitation objectives and choose appropriate measures for achieving the objectives; and
- Assess the likely contribution of rehabilitation intervention to wetland health and ecosystem delivery.

2.1. Assess impacts and threats

The following steps were followed to assess the impacts and threats within each wetland system:

- Describe the hydro-geomorphic setting of the wetland according to Kotze *et al.* (2005)
- Describe the overall health of the wetland at a Level 1 using WET-Health (Macfarlane *et al.*, 2006)
- Based on the above, identify specific impacts and/or threats to be addressed by structural rehabilitation and describe these at a Level 2. For example, for headcut erosion, the specific dimensions and level of activity of headcuts are described.

2.2. Set rehabilitation objectives and choose appropriate measures for achieving the objectives[1]

Objectives are informed by the above assessment (*e.g.*, if the primary threat to the wetland was identified as an erosion headcut threatening to propagate through the wetland then an appropriate rehabilitation objective would be to halt propagation of the erosion headcut)

2.3. Assess the likely contribution of rehabilitation intervention to wetland health and ecosystem delivery

The following steps were followed to assess the contribution of rehabilitation interventions within each wetland system:

- Identify the spatial area likely to be affected by the proposed intervention/s.
- Assess the benefits that are likely to result from achievement of the rehabilitation objective/s in terms of the integrity of the affected area of

[1]This is dealt with in detail in the main document.

the wetland (using WET-Health) and the ecosystem services that the area delivers (using WET-Ecoservices: Kotze *et al.*, 2005).

The same approach and currency was used for the assessment of the different threats/impacts that are to be addressed through rehabilitation: the situation without rehabilitation (i.e. no intervention) was compared with the situation with rehabilitation. For health, both situations were scored on a scale of 0 (critically altered) to 10 (pristine), and this was undertaken for the hydrology, geomorphology and vegetation components of health. The benefit achieved, would be the improvement in relation to the maximum score.

Example:
If the hydrological integrity without rehabilitation scored 3 owing to the desiccating effect of a network of drains and this was predicted to be improved to a score of 8 through the construction of rehabilitation plugs then the improvement would be (8-3=5)/10, i.e. an increase in the hydrological integrity of 50%. If the area rehabilitated was 60 ha, for example, then this would be equivalent to re-instating 30 ha (60 ha x 5/10) of wetland integrity. If, however, the score had only been increased from 3 to 5 (perhaps because of insufficient plugs) then this would be equivalent to re-instating 12 ha (60 ha x 2/10).

For areas threatened by headcut erosion which are to be rehabilitated by halting the propagation of the headcut, the benefits in terms of health would be determined based on the difference between the current health and the projected health if the headcut proceeded to erode through the threatened area. In this case, halting the propagation of the headcut was assumed to secure the current situation. Generally, written justification was provided of the rationale underlying the scores.

3. Prioritization of Sites

The aerial reconnaissance identified the presence of twelve sites as potential candidates for wetland rehabilitation. Following the review of these sites using aerial imagery and infield verification, eight sites were considered a priority for wetland rehabilitation planning.

4. A hydro-geomorphic description of the Monontsha wetland

The wetlands associated within the project occur within the C81F catchment, with a Mean Annual Precipitation (MAP) of 894.4mm and Potential Evapotranspiration (PET) of 1741.3mm. The MAP to PET ratio is 0.51, which is considered to be *Moderately Low* in terms of the wetlands' sensitivity to hydrological impacts. The study area consisted of one large valley-bottom system incorporating approximately twenty hydrogeomorphic (HGM) units. Three of these HGM units were identified as having the potential for wetland rehabilitation activities, and the following information serves to describe the hydrogeomorphic settings of the identified wetlands.

Wetland C81F-01

This is a broad historically unchannelled valley bottom wetland situated at the head of the system, immediately behind the geological control. The northern half of the HGM unit is comprised mostly of permanent and seasonal wetland zones still in reasonable condition, the permanent zone characterised by *Schoenoplectus brachyceras, Leersia hexandra* and *Typha capensis* (refer to **Figure 4-1**). The unit was originally a peat wetland, however over successive seasons of major sediment deposition this peat is now 1 to 1.5m below the surface. This accumulation of sediment has created a large alluvial fan behind the control point which has led to localised oversteepening. The consequent change in gradient, together with other factors such as increased flood intensity in the catchment, has contributed to the introduction of a head-cut that has receded over time, creating a channel through the HGM unit.

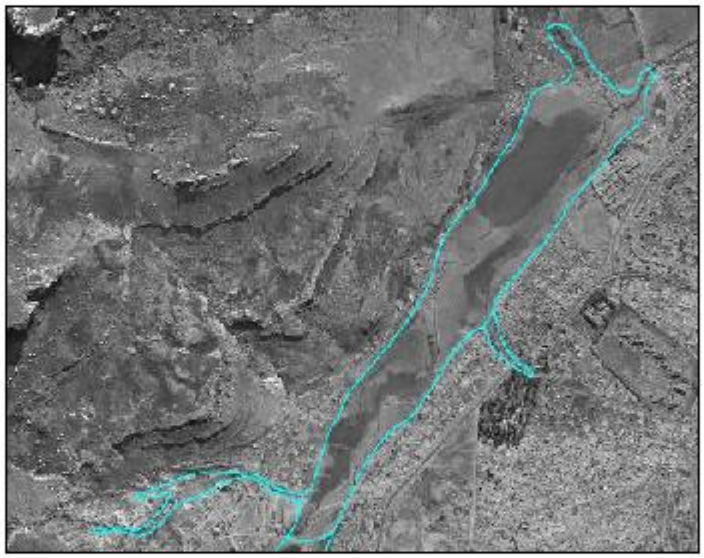

Figure 4-1: Wetland HGM unit C81F-01

The southern half of the HGM unit has undergone significant anthropogenic disturbance with the excavation of a channel diagonally through the HGM unit. This has led to the desiccation of the wetland, the rationale behind this being to cultivate crops or expand the grassland area available for autumn grazing. The soil displayed hydromorphic characteristics associated with a seasonally wet saturation regime but the vegetation was more indicative of a temporarily wet zone, being dominated by *Eragrostis plana* and *Sporobolus africanus*. The eroded channel from the northern part of the HGM unit has linked up with the excavated channel, and further incision has occurred. The excavation has had the added

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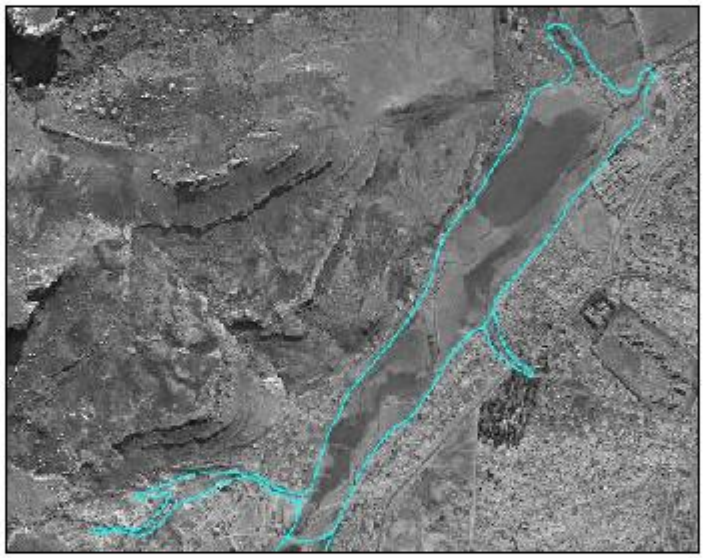

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impact of introducing a head-cut that has eroded upstream, producing a channel that extends into the adjacent HGM unit.

The catchment for this HGM unit has been significantly altered through residential development with the consequent increase in hardened surfaces increasing the amount of water entering the system, and the intensity of flood events. The western catchment has been overgrazed and the reduction in grass basal cover and increase in abundance of shrub species has also influenced the runoff characteristics of this part of the catchment.

Previous rehabilitation efforts have centred around the northern edge of the permanently wet area, with gabion structures built across the main channel to stabilise and counter further soil erosion and trap sediment. This has the added advantage of providing a substrate for the colonisation of the channel bottom by wetland plants. A number of head-cuts were also addressed by the construction of gabion structures and Hyson cells.

Several new problems were encountered in this HGM unit. The gabion structure at intervention C81F-01-110 has been bypassed by flow from the cut-off drain built to protect an area of multiple nick-points. This has produced an active head-cut that is eroding back to the cut off drain. An earthen berm was also located extending into the wetland from the western side. This is having the dual impact of impounding flow upstream, creating unnaturally wet conditions above the berm, and preventing water from reaching the area below the berm creating drier conditions than would occur under the natural regime.

The excavated channel is intercepting and draining water away from the northern section of the HGM unit. Four gabion structures have been planned at intervals along the channel, the primary purpose being to raise the water table in this region and cause overtopping of the banks during peak flow periods. It is hoped that this will return seasonally wet conditions to the wetland in the immediate vicinity.

A berm was located running transversely across the wetland at the southern boundary of the HGM unit. Soil has been excavated from the wetland to construct the impoundment, creating a drain approximately 100m long with a berm approximately 0.5m high immediately adjacent to it. This is having the effect of preventing the diffuse movement of water through the breadth of the wetland, concentrating it into the drain at the foot of the berm, and pushing it to the end of the drain in the centre of the wetland. This has scoured out an artificial pan about 1.5m deep, 3m wide and 15m long. The pan is not connected to the channel system at present, but should scouring continue and constant flow become established, the feature could pose a significant erosion threat. It is recommended that the drain be filled in, in the process removing the berm, to prevent the concentration of flow and encourage diffuse water movement through the area.

Wetland C81F-02

This is the largest HGM unit in the system, with an area of approximately 214ha and extending from the C81F-01 through the length of the valley for a distance of 5km (**Figure 4-2**). The HGM unit can be separated into two distinct halves. The northern half is a narrow, historically unchannelled valley bottom wetland approximately 200m wide. The sides of the valley are steep and densely populated.

Roads have been constructed across the wetland and straightened channels excavated upstream to concentrate water below each bridge. The channels have eroded upstream to link up with the excavated drains, forming a continuous deep, incised channel composed of successive portions of excavated and eroded segments. The channel runs the entire length of the northern half of this HGM unit. The main tarmac road runs parallel to the channel with culverts and excavated drains transporting water beneath the road and into the main channel. A significant amount of water from the catchment is intercepted by the road and drain network, concentrated and deposited into the main channel, bypassing the wetland habitat in this area. This has consequently undergone desiccation.

The channel continues the length of approximately half the HGM unit before ending at the point where the valley turns to the west and widens out. The lower part of this HGM unit is a wide, unchannelled valley bottom wetland with predominantly permanent and seasonal zones, and large sediment deposits where two lateral valley bottom wetlands enter the system. The permanent and seasonal zones in the centre of the HGM unit are in relatively good condition, and it is a high priority that these be conserved. The area between the alluvial fans at the top of the HGM unit is dominated by *Phragmites australis*, a species characteristic of high sediment deposition loads.

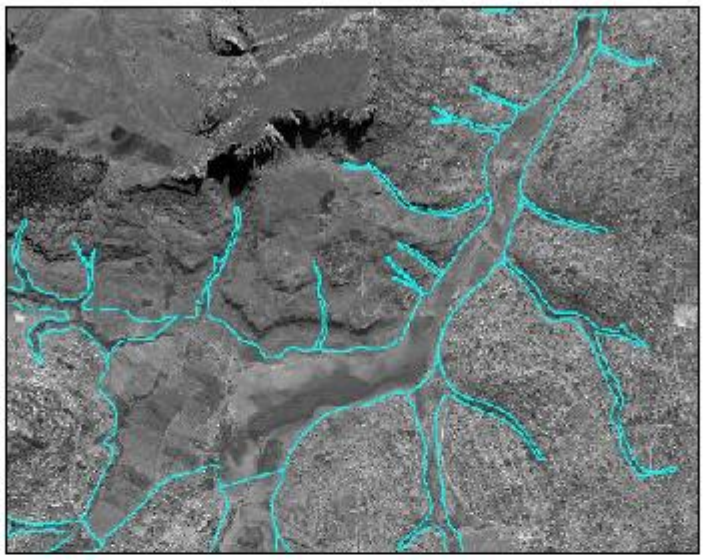

Figure 4-2: Wetland HGM unit C81F-02

Most of the southern section of the HGM unit has been modified for cultivation. Two deeply incised channels are intercepting the majority of the water flow into the wetland, leading to desiccation. The channels lead in from two riparian HGM units that drain into the wetland. Historically it is likely that the riparian channels would spill water out into a large flat unchanneled wetland. However as human development in the catchment has increased, the degree of hardened surface in the catchment has also increased. This has led to a significant increase in the magnitude and intensity of water inputs into the wetland during rainfall events. This increase in water velocity has led to the scouring out and incision of the channels, with the resultant massive sediment deposition at the point where the gradient allows the water to slow down enough to drop its sediment load. This occurs below the historically cultivated lands and just above the permanently wet area, where the HGM unit becomes narrower as it is confined by the valley.

Four gabion interventions (C81F-02-001 to -004) were planned at intervals along the main channel, with the main intention of lifting the water-table in the vicinity and causing over-spilling thereby regularly saturating the adjacent wetland. It is hoped that seasonally wet soil conditions will return under this regime.

A berm was located across the wetland in the same region, and this is having a marked effect on the hydrology of the wetland. Removing the berm will encourage uniform diffuse flow across the wetland, rewetting the seasonal zone.

The top section of the channel was characterised by numerous lateral head-cuts. The channel intercepts flow from the base of a large area of relatively healthy permanent and seasonal wetland, and these head-cuts pose a significant threat to this area. Structures have been planned to address the head-cuts. A gabion wall has also been planned to prevent water from flowing into the side of the channel, in so doing creating new head-cuts.

The upper reaches of this HGM unit have been drained for cultivation. Two large historic sediment fans were also evident caused by the deposition of sediment from the three eroded streams flowing into the HGM unit. It was decided to re-wet the cultivated area by building a series of concrete structures across the central channel to lift the water-table and encourage over-spilling.

Wetland C81F-03

This is a small channelled valley bottom wetland of approximately 4.5ha that feeds into C81F-02 (**Figure 4-3**). The channel has become incised, and while a number of gabion structures have already been established to stabilise the gully, these have failed due to vandalism. There is a large, active head-cut at the top of the gulley, and an intervention has been planned to prevent its migration upstream. However the head-cut is already near the top of the system and there is little wetland habitat left to save. The potential return on investment is therefore less here than on other sites and it was decided not to implement these structures.

Figure 4-3: Wetland HGM unit C81F-03

Wetland Rehabilitation Plan - Monontsha March 2007

Wetland C81F-01

	Category / Score		Table Reference	Land-use factors contributing to impacts, and any additional notes		
Reduced inputs	None (0-0.9)		Table 1			
Reduced floodpeaks	Large increase (>6)		Table 2			
Combined Impact Score	3		Table 3	Refer to Table 3 to determine combined score, depending on nature of wetland		
	Extent (%)	Intensity (0 - 10)	Magnitude	Land-use factors contributing to impacts, and any additional notes		
Artificial drainage channels	30	7	2.1			
Modifications to existing channels	0	0	0			
Deep flooding by dams	0	0	0			
Reduced roughness	20	2	0.4	4		
Increased on-site water use	0	1	0			
Combined Impact Score			2.6	See Table 1 for interpretation of score obtained		
Changes to water distribution & retention patterns		2.6			Changes to Water input charachteristics	3.0
Combined Hydrology Impact Score						4
Health Score						6.0
	Extent (%)	Intensity (0 - 10)	Table Reference	Magnitude	Land-use factors contributing to impacts, and any additional notes	
Erosional features	45	4	Tables 3.5 & 3.6	1.8		
Depositional features	5	1	Tables 3.7 & 3.8	0.05		
Loss of organic sediment			Tables 3.9 - 3.12	0		
Geomorphoology Impact Score						1.9
Health Score						8.1
	Extent (%)	Intensity (0 - 10)	Table Reference	Magnitude	Land-use factors contributing to impacts, and any additional notes	
Removal of indigenous vegetation	0	10	N/A	0		
Alien introduced species	0	4	Table 4	0		
Alien invasive plants	1	4	Table 4	0.04		
Subtle compositional changes (increase in ruderal & other invasive indigenous spp)	50	7	Table 5	3.5		
Combined Vegetation Impact Score						3.5
Health Score						6.5

Wetland C81F-02

	Category / Score		Table Reference	Land-use factors contributing to impacts, and any additional notes		
Reduced inputs	None (0-0.9)		Table 1			
Reduced floodpeaks	Large increase (>6)		Table 2			
Combined Impact Score	3		Table 3	Refer to Table 3 to determine combined score, depending on nature of wetland		
	Extent (%)	Intensity (0 - 10)	Magnitude	Land-use factors contributing to impacts, and any additional notes		
Artificial drainage channels	50	5	2.5			
Modifications to existing channels	0	0	0			
Deep flooding by dams			0			
Reduced roughness	20	2	0.4			
Increased on-site water use	0		0			
Combined Impact Score			2.9	See Table 1 for interpretation of score obtained		
Changes to water distribution & retention patterns		2.9			Changes to Water input charachteristics	3.0
Combined Hydrology Impact Score						4
Health Score						6.0
	Extent (%)	Intensity (0 - 10)	Table Reference	Magnitude	Land-use factors contributing to impacts, and any additional notes	
Erosional features	50	8	Tables 3.5 & 3.6	4		
Depositional features	0	0	Tables 3.7 & 3.8	0		
Loss of organic sediment	0		Tables 3.9 - 3.12	0		
Geomorphoology Impact Score						4.0
Health Score						6.0
	Extent (%)	Intensity (0 - 10)	Table Reference	Magnitude	Land-use factors contributing to impacts, and any additional notes	
Removal of indigenous vegetation	0	10	N/A	0		
Alien introduced species	1	4	Table 4	0.04		
Alien invasive plants	1	4	Table 4	0.04		
Subtle compositional changes (increase in ruderal & other invasive indigenous spp)	60	5	Table 5	3		
Combined Vegetation Impact Score						3.1
Health Score						6.9

Wetland C81F-03

	Category / Score		Table Reference	Land-use factors contributing to impacts, and any additional notes	
Reduced inputs	Small (1-1.9)		Table 1		
Reduced floodpeaks	No effect (-1.5 to 1.5)		Table 2		
Combined Impact Score	2		Table 3	Refer to Table 3 to determine combined score, depending on nature of wetland	
	Extent (%)	Intensity (0 - 10)	Magnitude	Land-use factors contributing to impacts, and any additional notes	
Artificial drainage channels	30	4	1.2		
Modifications to existing channels	0	0	0		
Deep flooding by dams			0		
Reduced roughness	0	0	0		
Increased on-site water use			0		
Combined Impact Score			1.2	See Table 1 for interpretation of score obtained	
Changes to water distribution & retention patterns	1.2			Changes to Water Input characteristics	2.0
Combined Hydrology Impact Score					4
Health Score					6.0
	Extent (%)	Intensity (0 - 10)	Table Reference	Magnitude	Land-use factors contributing to impacts, and any additional notes
Erosional features	65	4	Tables 3.5 & 3.6	2.6	
Depositional features			Tables 3.7 & 3.8	0	
Loss of organic sediment			Tables 3.9 - 3.12	0	
Geomorphology Impact Score					2.6
Health Score					7.4
	Extent (%)	Intensity (0 - 10)	Table Reference	Magnitude	Land-use factors contributing to impacts, and any additional notes
Removal of indigenous vegetation	0	0	N/A	0	
Alien introduced species	0		Table 4	0	
Alien invasive plants	0		Table 4	0	
Subtle compositional changes (increase in ruderal & other invasive indigenous spp)	50	3	Table 5	1.5	
Combined Vegetation Impact Score					1.5
Health Score					8.5

[1] "Extent" refers the extent of the wetland affected by the particular impact
[2] "Intensity" refers the intensity of the impact in the affected area of the wetland, scored on a scale of 0 (no impact) to 10 (critical impact)
[3] Magnitude = Extent (%)/100 x Intensity
[4] These result from reduced infiltration leading to increased flood peaks
[5] See WET-Health, Table 2.6 for combining the scores for reduced inputs, reduced flood peaks and less sustained inputs
[6] Based on the sum of the scores for the above factors
[7] See WET-Health, Table 2.20 for combining the scores for overall catchment impacts with overall on-site impacts

Table 2: An overview of the current health of the Monontsha wetlands

Based on the impact scores given in Table 1, the current integrity for the respective components of health are as follows:

	C81F-01		*C81F-02*		*C81F-03*	
	Health Score	Health Class	Health Score	Health Class	Health Score	Health Class
Hydrology	6.0	C	6.0	C	6.0	C
Geomorphology	8.2	B	6.0	C	7.4	C
Vegetation	6.5	C	6.9	C	8.5	B

Table 3: Characteristics of the head cuts in Monontsha wetlands

Characteristics	*C81F-01*	*C81F-02*	*C81F-03*
Depth	1.01-1.50m	>2.00m	1.01-1.50m
Width	2-5m	5.1-8m	2-5m
Planform	Single	Multiple->2 fingers	Single
Drops	>2-stepped drop	Single drop	Single drop
State of wetness	Receives perennial flow over the head cut	Receives intermittent flow & subject to extreme wetting and drying	Receives intermittent flow but remains moist (i.e. not subject to extreme drying)
Current level of activity	Active erosion across 5-25% of the face of the head cut; sods recently broken off the face are sometimes visible	Active erosion across 5-25% of the face of the head cut; sods recently broken off the face are sometimes visible	Active erosion visible across >50% of the face of the head cut; several sods recently broken off the face are usually visible below the head cut unless conditions are favorable for all to be washed away

Table 4: Characteristics of the drains and gullies in Monontsha wetlands

Characteristics of the drains/gullies	*C81F-01*		*C81F-02*		*C81F-03*	
	Before plugs	After plugging	Before plugs	After plugging	Before plugs	After plugging
(3) Depth of the drains/gullies	0.51-0.80 m	0.20-0.50 m	0.81-1.10	0.51-0.80 m	>1.10 m	>1.10 m
(4) Density of drains (meters of drain per hectare of wetland) [R]	<25 m/ ha	<25 m/ ha	<25 m/ ha	<25 m/ ha	<25 m/ ha	<25 m/ ha
(5) Location of drains/gullies i. r. t. flows into and through the wetland[R]. Drains/gullies are located such that flows are:	Intermediately intercepted	Moderately poorly intercepted	Moderately well intercepted	Very well intercepted	Moderately well intercepted	Moderately well intercepted
(6) Obstructions in the drains/ gullies[#]	No obstruction	Moderate obstruction	No obstruction	High obstruction	Low obstruction	High obstruction

Table 5: Characteristics of the wetland area threatened by the head cuts

	C81F-01	*C81F-02*	*C81F-03*
Area of wetland under threat (ha)	**4**	**16**	**1**
Longitudinal slope (%)	0.8	0.9	3.7
Vulnerability (based on longitudinal slope and wetland area, assessed on a scale of 0 [low] to 10 [high])	2	8	2
Historical rate of propagation of head cut assessed on a scale of 0 [low] to 10 [high]	2	2	2
Severity of head cut (based on consideration of the factors given in Table 1)	6.3	8.3	7.0
Threat posed by increased flood peaks delivered by the wetland's catchment, assessed on a scale of 0 [low] to 10 [high])	6	6	6
Overall intensity of threat (assessed on a scale of 0 [low] to 10 [high]) and scored based on the above 5 characteristics)	2	2	0.5

Table 6: Characteristics of the wetland area impacted by drainage canals

	C81F-01		C81F-02	
	Before plugs	After plugging	Before plugs	After plugging
(1) Slope of the wetland[R]	0.5-0.9%	0.5-0.9%	0.5-0.9%	0.5-0.9%
(2a) Texture of mineral soil, if present[F*]	Loam	Loam	Loam	Loam
(2b) Degree of humification of organic soil, if present[F*]	5-6 (moderate)	5-6 (moderate)	5-6 (moderate)	5-6 (moderate)
	C81F-03			
	Before plugs	After plugging		
(1) Slope of the wetland[R]	>3%	>3%		
(2a) Texture of mineral soil, if present[F*]	Sandy loam	Sandy loam		
(2b) Degree of humification of organic soil, if present[F*]	3-4 (low)	3-4 (low)		

Table 7 highlights that loss of integrity is likely to be significant within the various wetlands if the erosion of the systems continue. Table 8 highlights the potential gains in hydrological integrity of the wetland systems can be improved by rehabilitating drains and gullies.

Table 7: Predicted level of integrity of the affected area likely to be secured if head cut erosion through the affected area is halted

Integrity component	***C81F-01***	***C81F-02***	***C81F-03***
Current hydrological integrity (i.e. before further advancement of the head cut through the affected area).	6	6	6
Hydrological integrity if the head cuts proceeded unhindered through the affected area	4	3	6
Secured hydrological integrity if the head cut is halted in their current locations	**2**	**3**	**0**
Geomorphic integrity *before* the advancement of the head cut through the affected area	8.2	6	7.4
Geomorphic integrity *after* the advancement of the head cut through the affected area	6	4	7
Secured geomorphic integrity	**2.2**	**2**	**0.4**
Vegetation integrity *before* the advancement of the head cut through the affected area	6.5	6.9	8.5
Vegetation integrity *after* the advancement of the head cut through the affected area	4	4	8
Secured vegetation integrity	**2.5**	**2.9**	**0.5**

Score: 0=Integrity completely lost, 10=Completely natural (pristine)

Figures **in bold** represent the integrity benefits that would result from rehabilitation averting loss

Note: It is predicted that the decline in vegetation integrity will take place over an extended period (possibly several decades) following advancement of the head cut through the wetland.

A prediction is made of the likely loss of integrity (**Table 7**) and associated loss of ecosystem services delivery (**Table 9**) that would result should the head cuts proceed throughout the affected areas. This effectively equates with the benefits that would result if the propagation of the head cut is successfully halted. Based on the extent of the area impacted and the loss score for the impacted area, this would equate with the following areas being saved by the rehabilitation in the case of head-cuts or restored in the case of gullies and drains:

Wetland Hectare Equivalents threatened by Head cuts

	C81F-01	*C81F-02*	*C81F-03*
Area affected (ha)	4	16	1
Hydrological integrity	0.48 ha (4 x 2/10)	4.8 ha (16 x 3/10)	0 ha (1 x 0/10)
Geomorphological integrity	0.88 ha (4 x 2.2/10)	3.2 ha (16 x 2/10)	0.04 ha (1 x 0.4/10)
Vegetation integrity	1 ha (4 x 2.5/10)	4.6 ha (16 x 2.9/10)	0.05ha (1 x 0.5/10)

Wetland Hectare Equivalents that can be gained by rehabilitating gullies/drains

	C81F-01	*C81F-02*	*C81F-03*
Area affected (ha)	18	53	1
Hydrological integrity	1.98 ha (18 x 1.1/10)	10.6 ha (53 x 2/10)	0.36 ha (1 x 3.6/10)
Geomorphological integrity	0.54 ha (18 x 0.3/10)	5.3 ha (53 x 1/10)	0 ha (1 x 0/10)
Vegetation integrity	0.54 ha (18 x 0.3/10)	4.2 ha (53 x 0.8/10)	0 ha (1 x 0/10)

Table 8: Predicted gain in integrity of the affected area likely to result from "plugging" of drains/gullies

Predicted gain	***C81F-01***	***C81F-02***	***C81F-03***
Current hydrological integrity of the affected area	6.9	5.5	5.1
Predicted hydrological integrity *after* plugging the drains/gullies in the affected area	8.0	7.5	8.7
Gain in hydrological integrity from plugging drains/gullies	**1.1**	**2.0**	**3.6**
Current geomorphic integrity of the affected area	8.2	6	7.4
Predicted geomorphic integrity *after* plugging the drains/gullies in the affected area	8.5	7	7.4
Gain in geomorphic integrity from plugging drains/gullies	**0.3**	**1**	**0**
Current vegetation integrity of the affected area	6.5	6.9	8.5
Predicted vegetation integrity *after* plugging the drains/gullies in the affected area	6.8	7.8	8.5
Gain in vegetation integrity from plugging drains/gullies	**0.3**	**0.8**	**0**

Losses of ecosystem service delivery are expected for a number of the ecosystem services considered (Table 9). The implementation of the proposed interventions is likely to avert the loss in ecosystem services.

Table 9: Loss of ecosystem services likely to result from head-cut erosion through the affected area, and which could be averted by halting the head-cut erosion through rehabilitation measures

Ecosystem service	*C81F-01*	*C81F-02*	*C81F-03*
Flood attenuation	0	1	1
Stream flow regulation	0	1	1
Sediment trapping	2	2	1
Phosphate assimilation	2	2	1
Nitrate assimilation	2	2	1
Toxicant assimilation	1	1	1
Erosion control	2	2	2
Carbon storage	2	2	1
Biodiversity maintenance	2	2	1
Water supply for human use	0	0	0
Natural resources	0	0	0
Cultivated foods	0	0	0
Cultural significance	0	0	0
Tourism and recreation	0	0	0
Education and research	0	0	0
Overall loss of ecosystem services anticipated	**0.9**	**1.0**	**0.7**

Score for Individual services
0=no significant loss anticipated
1=slight loss anticipated
2=substantial loss anticipated

Should the head-cut erosion be allowed to continue it is likely that the wetland habitat in
C81F-01 and C81F-02 will become drier. The lengthening channel will result in a quicker passage of water through the wetland, reducing its capacity to catch sediment. There will also be less wetland surface area in contact with the water, and so less opportunity to slow down water flow and trap sediment particles. This reduced ability to trap sediment will also affect the wetlands ability to assimilate phosphates since these are adsorbed to sediments. Likewise the higher the rate at which water leaves the wetland, the less time there is for the wetland to assimilate these phosphates. Nitrate assimilation is likewise affected.

The implementation of rehabilitation activities is likely to improve the ecoservices delivery of a number of wetland habitats within the area (Table 10).

Table 10: Predicted increase in ecosystem services likely to result from "plugging" drains/gullies

Predicted increase in ecosystem services	***C81F-01***	***C81F-02***	***C81F-03***
Flood attenuation	0	1	0
Streamflow regulation	0	1	0
Sediment trapping	0	1	1
Phosphate assimilation	1	1	0
Nitrate assimilation	1	1	0
Toxicant assimilation	1	1	0
Erosion control	0	1	1
Carbon storage	0	1	0
Biodiversity maintenance	1	1	0
Water supply for human use	0	0	0
Natural resources	0	0	0
Cultivated foods	0	0	0
Cultural significance	0	0	0
Tourism and recreation	0	0	0
Education and research	0	0	0
Overall gain in ecosystem services anticipated	**0.27**	**0.6**	**0.13**

Score for Individual services
0=no significant loss anticipated
1=slight loss anticipated
2=substantial loss anticipated

References

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MACFARLANE D M, KOTZE D, WALTERS D, ELLERY W, KOOPMAN V, GOODMAN P, and GOGE C, 2006. WET-Health: a technique for rapidly assessing wetland health. Unpublished draft report submitted to the Water Research Commission, Pretoria

Working for Wetlands: Free State Province
Maluti a-Phofung Project: Wetland Assessment Report
Springvale Wetland: C81J-02

For:

aurecon

By:

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October 2010

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1. INTRODUCTION:

Rehabilitation refers to re-instating the driving ecological forces that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers. Effective rehabilitation planning therefore requires an assessment of how the following three groups of processes have been threatened/impacted upon:

- Hydrological;
- Geomorphological; and
- Vegetation.

Furthermore, it requires an assessment of the predicted contribution that wetland rehabilitation will make to improving wetland health and ecosystem delivery through addressing the identified impacts/threats. Without these assessments, a wetland rehabilitation programme is unlikely to have a well-informed basis on which to improve the rehabilitation's "return on investment" (with return being measured in terms of wetland health and ecosystem services delivery).

2. PROJECT DETAILS:

2.1 General Approach for Specific Category of Project

The approach and results for the assessment of wetland rehabilitation within the Maluti a-Phofung Project are outlined in this report. Planning for the project was undertaken as a Category 3 project, with identified quaternary catchments being visually surveyed from a light aircraft. This comprehensive overview of the particular catchment enabled wetland habitat to be identified and potential problem points within these wetlands to be evaluated quickly and efficiently according to the potential for rehabilitation work. In combination with desktop mapping using aerial imagery, the information was used to rate the potential work as below.

Score	Description of the class
0	The returns are considered to be very low or the sites considered lost causes that are extremely degraded.
1	A site which has potential (e.g. intact area threatened by headcut erosion) but where the returns are likely to be low (e.g., because the intact areas is small, <3 ha) or uncertain.
2	A site where the returns are potentially moderate.
3	A site where returns are potentially high (e.g. a large area, i.e., greater than 20ha, threatened by gully erosion).

These ratings were used in combination with the identified catchment rehabilitation objectives, catchment priority areas and operational considerations to prioritise wetlands for potential rehabilitation. Once the prioritised wetlands were identified detailed infield assessments were undertaken to identify problems and assess the ecosystem benefits and services and ecological integrity of the wetland systems.

2.2 Project Description, Location, Category and Catchment Information

The Springvale wetland is situated in quaternary catchment C81J, approximately 40km east of Harrismith, and is part of the Maluti-a-Phofung wetland rehabilitation project. This is a new wetland, with work scheduled to begin in the forthcoming 2011/ 2012 season. The wetland consists of two hydrogeomorphic (HGM) units, namely an unchannelled valley bottom wetland fed by a large hillslope seepage wetland.

The respective watersheds of both HGM units have been impacted by commercial crop cultivation, the primary landuse, with vestiges of primary grassland remaining. Rehabilitation is planned within this wetland with the intention of maintaining the wetland habitat in the landscape by arresting the evident headcut erosion, and preventing canalisation and subsequent desiccation. The wetland is found within a catchment characterised by a Mean Annual Precipitation of (MAP) of 617.5mm and a Potential Evapotranspiration (PET) of 1924.9mm. The MAP to PET ratio is 0.32, indicating a seasonal rainfall regime of mostly irregular, high-intensity rainfall events.

3. METHODS:

3.1 Assess Impacts and Threats

The following steps were followed to assess the impacts and threats within each wetland system:

- Describe the hydro-geomorphic setting of the wetland;
- Describe the overall health of the wetland at a Level 1 using WET-Health (Macfarlane et al., 2006)
- Based on the above, identify specific impacts and/or threats to be addressed by structural rehabilitation and describe these at a Level 2. For example, for headcut erosion, the specific dimensions and level of activity of headcuts are described.

3.2 Set rehabilitation objectives and choose appropriate measures for achieving the objectives [1]

Objectives are informed by the above assessment (e.g., if the primary threat to the wetland was identified as an erosion headcut threatening to propagate through the wetland then an appropriate rehabilitation objective would be to halt propagation of the erosion headcut).

[1] This is dealt with in detail in the main document.

3.3 Assess the likely contribution of rehabilitation intervention to wetland health and ecosystem delivery

The following steps were followed to assess the contribution of rehabilitation interventions within each wetland system:

- Identify the spatial area likely to be affected by the proposed intervention/s.
- Assess the benefits that are likely to result from achievement of the rehabilitation objective/s in terms of the integrity of the affected area of the wetland (using WET-Health) and the ecosystem services that the area delivers (using WET-Ecoservices: Kotze et al., 2007).

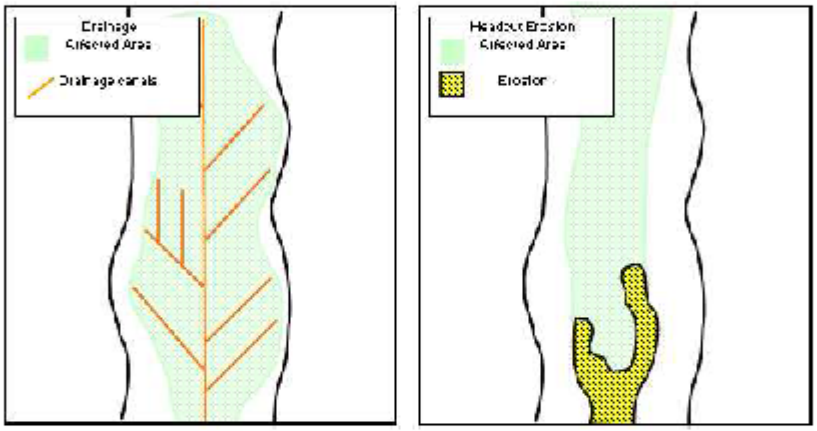

Figure 3.1. Determination of wetland areas affected by drainage canals or threatened by headcut erosion

The same approach and currency was used for the assessment of the different threats/impacts that are to be addressed through rehabilitation: the situation without rehabilitation (i.e. no intervention) was compared with the situation with rehabilitation. For health, both situations were scored on a scale of 0 (critically altered) to 10 (pristine), and this was undertaken for the hydrology, geomorphology and vegetation components of health. The benefit achieved, would be the improvement in relation to the maximum score.

Example:

If the hydrological integrity without rehabilitation scored 3 owing to the desiccating effect of a network of drains and this was predicted to be improved to a score of 8 through the construction of rehabilitation plugs then the improvement would be (8-3=5)/10, i.e. an increase in the hydrological integrity of 50%. If the area rehabilitated was 60 ha, for example, then this would be equivalent to re-instating 30 ha (60ha x 5/10) of wetland integrity. If, however, the score had only been increased from 3 to 5 (perhaps because of insufficient plugs) then this would be equivalent to re-instating 12 ha (60ha x 2/10).

For areas threatened by headcut erosion which are to be rehabilitated by halting the propagation of the headcut, the benefits in terms of health would be determined based on the difference between the current health and the projected health if the headcut proceeded to erode through the threatened area. In this case, halting the propagation of the headcut was assumed to secure the current situation. Generally, written justification was provided of the rationale underlying the scores.

4. WETLAND DETAILS FOR: SPRINGVALE (C81J-02)

4.1 Wetland Description:

The wetland consists of two hydrogeomorphic (HGM) units (refer to **Figure 4.1**). HGM-01, 14.1ha in extent, is considered to be an unchannelled valley bottom wetland, while HGM-02 is a hillslope seep wetland of 36.2ha draining into HGM-01. The natural hydrological regime of both wetlands is likely to be characterised by subsurface seepage through the well-drained apedal soils in the catchment, accompanied by groundwater discharge. The vegetation of the both units consists of sedge meadow and hygrophilous grassland, although erosion and cultivation have replaced much of the natural vegetation.

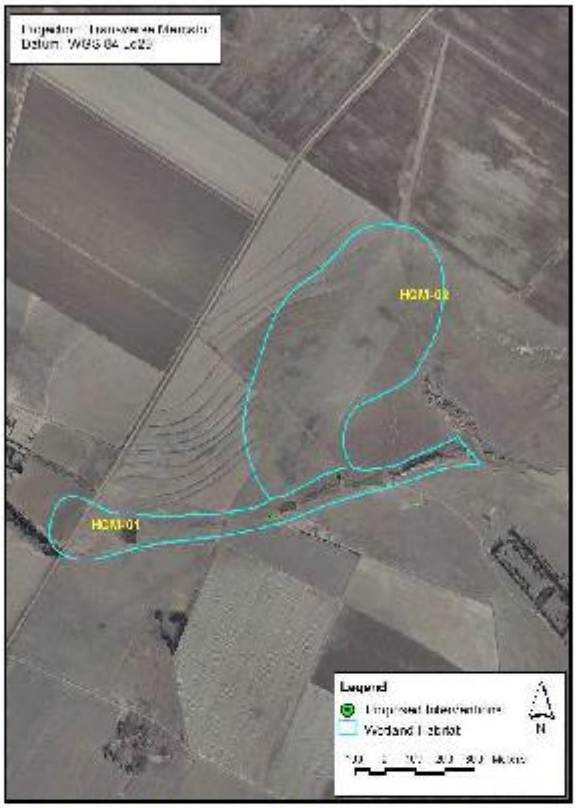

Figure 4.1. Springvale hydrogeomorphic units

4.2 Wetland Problems

Problem 1:

A headcut (refer to **Figure 4.2**) was identified immediately upstream of the middle dam in HGM-01 (refer to **Figure 4.1**). The wetland habitat in this area is characterised by diffuse subsurface flow that supports dense sedge meadow and hygrophilous grass communities. The headcut, although relatively stable, does threaten to migrate upstream, draining this habitat and depositing sediment into the dam downstream. This may reduce the capacity of the dam, increasing the risk of water flowing over and breaching the dam wall, which is likely to result in severe soil erosion.

Figure 4.2: Headcut upstream of dam

Problem 2

The spillway of the middle dam in HGM-01 has been diverted using an earthen berm so that it discharges peak flows approximately 175m downstream into the channel immediately above the eastern-most dam. The rationale behind this was to transfer the erosion caused by this discharge to a point further away, in so doing keeping the central dam's wall intact. However, this has resulted in the initiation of a severe lateral headcut (refer to **Figure 4.3**) which is threatening to migrate:

1. Along the flowpath of the dam overspill, adjacent to the berm; and
2. Through the intact wetland habitat in HGM-02.

This poses a major threat to the ecological integrity and wetland functioning of both HGM units.

Figure 4.3: Headcut at the discharge point of the earthen berm

Problem 3

The contour banks of the cultivated lands in the catchment above HGM-02 are serving to concentrate water flow from the lands into grassed swales. This concentrated flow has resulted in the creation of a large gully, which is threatening to migrate upstream into the wetland habitat.

4.3 How are rehabilitation plans going to address the above problems:

Rehabilitation consists of the implementation of structures that will:

1. Deactivate the headcuts identified, safeguarding the intact wetland habitat upstream;
2. Prevent further channel incision;
3. Stabilise the points of entry of water into the main channel; and
4. Prevent sediment deposition into the system downstream.

Problem 3 was not assessed during the current planning, but has been noted and earmarked for evaluation during next year's planning site visit. Rehabilitation is likely to involve dissipating the concentrated flow before it reaches the donga, thereby reducing its erosive potential.

5. HGM ASSESSMENTS:

WET ECO-SERVICES: BOTH HGM UNITS

The most important benefits provided by these HGM units are likely to be:

- Streamflow augmentation;
- Sediment trapping;
- Erosion control;
- Flood attenuation through diffuse flow over a substrate with high surface roughness;
- Water quality enhancement; and
- Biodiversity maintenance;

It is anticipated that the implementation of rehabilitation measures will significantly improve the wetlands ability to control erosion, through deactivating the identified headcuts. Rehabilitation is aimed at stabilisation, rather restoration, and hence the current levels of wetland functioning are likely to be maintained rather than increased. The two HGM units were considered collectively in assessing the potential influence of rehabilitation on the provision of wetland ecological services.

REDUCTION IN WATER INPUTS		
Ecosystem Service	**Score**	**Comments**
Flood Attenuation	No Effect Anticipated	The pattern of flow in the catchment and through the wetland will remain unchanged.
Stream flow Regulation	No Effect Anticipated	Unlikely to be a change from the current scenario.
Sediment Trapping	No Effect Anticipated	Unlikely to be a change from the current scenario, because there will be no change in surface roughness within the HGM unit.
Phosphate Assimilation	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Nitrate Assimilation	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Toxicant Assimilation	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Erosion Control	Large Positive Effect Anticipated	The interventions will deactivate the headcuts, preventing the upstream migration of eroded gullies.
Carbon Storage	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Biodiversity Maintenance	No Effect Anticipated	Unlikely to change significantly from the current scenario.

REDUCTION IN WATER INPUTS		
Ecosystem Service	**Score**	**Comments**
Water Supply for Human Use	No Effect Anticipated	Not used as such.
Natural Resources	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Cultivated Foods	No Effect Anticipated	Not used as such.
Cultural Significance	No Effect Anticipated	Not used as such.
Tourism and Recreation	No Effect Anticipated	Not used as such.
Education and Research	No Effect Anticipated	Not used as such.

HGM-01: UNCHANNELLED VALLEY BOTTOM WETLAND

HYDROLOGY:

The major hydrological impacts sustained by the wetland are:

- The three dams constructed across the length of the HGM unit, which are having the dual effect of impounding water upstream and impeding drainage downstream;
- Concentrated flow through the dam spillways, the likely causal agent of the considerable gully erosion evident in the lower half of the unit;
- The change in runoff characteristics associated with crop cultivation in the catchment. This is likely to have slightly favoured surface flow at the expense of subsurface flow, increasing the volume and velocity of water entering the system.
- The earthen berm that is directing concentrated flow from the middle dam into the channel. It was felt that, although it is undoubtedly having an impact, removal of the berm would result in accelerated lateral erosion. Hence it will be left intact.

A. ASSESSMENT OF IMPACTS:

Assessment	Category/Score
1. Reduced Inputs	Negligible increase (-1.5 to 1.5)
2. Reduced Flood peaks	Moderate increase (4 to 6)
3. Flood banks and channeled valley bottoms driven primarily by over-bank flooding	False
Combined impact score:	**1.5**

Assessment	Extent (%)	Intensity (0-10)	Magnitude
1. Deep flooding by dams/Impoundments	55	7.0	3.6
2. Reduced roughness	0	0	0.0
3. Increased on-site water use	0	0	0.0
4. Deposition/infilling or excavation	0	0	0.0
5. Artificial drainage channels	30	8.0	2.4
6. Modifications to existing channels/ canalisation	0	0	0.0
Combined Impact Score:			**6.0**
Combined Hydrological Impact Score:			**7.0**

B. THREATS AND OPPORTUNITIES:

Aspect	Threat	Opportunity	Score	Symbol
Erosion Gullies	Slowly Deteriorate	High	-1	(↓)
HGM Hydrology Threat Score:			**-1**	(↓)

GEOMORPHOLOGY:

The main impacts on the geomorphological integrity of the wetland are:

- The two headcuts;
- Concentration of flow through the spillways of the dams; and
- Increased runoff from the surrounding catchment.

The threat of the headcuts to the integrity of the wetland habitat is estimated as being moderately high, with geomorphological condition likely to deteriorate over the next 5 years.

A. ASSESSMENT OF IMPACTS:

FLOOD PLAINS			
Description	**HGM Type**	**Extent (%)**	**Intensity**
1. Infilling	All non-floodplain HGMs	70.0	2.8
2. Stream Diversity/Shortening	Floodplain, Channeled valley bottom	0.0	0.0
3. Road Crossings	Floodplain, Channeled valley bottom	0.0	0.0
4. Increased runoff	All non-floodplain HGMs	70	0.7
5. Erosional Features	All non-floodplain HGMs	50	2.5
6. Depositional Features	All non-floodplain HGMs	0.0	0.0
7. Loss of organic matter (direct)	All non-floodplain HGMs with peat	0.0	0.0
Geomorphology Impact Score:			**2.8**

B. THREATS AND OPPORTUNITIES:

GEOMORPHOLOGICAL CONTROLS		
GEOMORPHOLOGICAL CONTROLS:		
1. Longitudinal Slope (%)	4.0	
2. Extent of wetland under threat (%)	30.00	
3. Control Description	Geological	
Hydro Reduced Floodpeaks:		
1. Altered floodpeaks	Moderate Increase	
Vulnerability Score:	5	
THREATS POSED BY HEADCUTS:		
1. Predicted length of wetland, occupied by gullies, as a % of HGM length	>70%	
2. Predicated average gully width in relation to wetland length	60%	
3. Rate of advancement measured at least over the last 15yrs	<5 m/yr	
4. Depth of gully	>2m	
5. Width of gully	20-30m	
6. Number of gully branches	Two	
7. Type of headcut (vertical drop for gullies > 1m)	Single drop	
8. Wetness state of the headcut	Seasonally Moist	
9. Level of activity of the headcut	20% active erosion	
Adjusted overall magnitude threat score:	-1	(1)

VEGETATION:

The natural vegetation has been removed or transformed by:

- Deep flooding by dams;
- Eroded gullies;
- Crop lands

A. ASSESSMENTS OF IMPACTS:

VEGETATION			
Description	**Extent**	**Intensity**	**Magnitude**
1. Infrastructure (10)	0.0	0.0	0.00
2. Deep flooding by dams (10)	10.0	10.0	1.00
3. Shallow flooding by dams (4-8)	0.0	0.0	0.0
4. Crop lands (8-10)	5.0	9.0	0.5
5. Commercial Plantations (7-10)	0.0	0.0	0.00
6. Annual Pastures (9-10)	0.0	0.0	0.00
7. Perennial Pastures (6-10)	0.0	0.0	0.00
8. Dense Alien Vegetation Patches (5-10)	0.0	0.0	0.00
9. Sports fields (7-10)	0.0	0.0	0.00
10. Gardens (6-10)	0.0	0.0	0.00
11. Area of sediment deposition/infilling and excavation (4-10)	0.0	0.0	0.00
12. Eroded areas (3-9)	20.0	8.0	1.60
13. Old/Abandoned lands (Recent) (7-9)	0.0	0.0	0.00
14. Old/Abandoned lands (Old) (3-8)	0.0	0.0	0.00
15. Seepage below dams (1-5)	0.0	0.0	0.00
16. Untransformed areas (0-3)	65.0	1.0	0.70
Desiccated wetland	0.0	0.0	0.00
Vegetation Impact Score:			**3.8**

B. THREATS AND OPPORTUNITIES:

THREATS/OPPORTUNITIES				
Aspect	**Threat**	**Opportunity**	**Score**	
Erosion Gullies	Slowly Deteriorate	High	-1	
HGM Vegetation Threat Score:			**-1**	**(↓)**

HGM-02: HILLSLOPE SEEP WETLAND

HYDROLOGY:

The major hydrological impacts sustained by the wetland are:

- Increased runoff from the croplands in the catchment;
- Reduced surface roughness from croplands and hayfields within the wetland; and
- Gully erosion through the eastern section of the HGM unit.

A. ASSESSMENT OF IMPACTS:

Assessment	Category/Score
1. Reduced Inputs	No effect (-1.5 to 1.5)
2. Reduced Flood peaks	Moderate increase (4 to 6)
3. Flood banks and channeled valley bottoms driven primarily by over-bank flooding	False
Combined impact score:	**1.5**

Assessment	Extent (%)	Intensity (0-10)	Magnitude
1. Deep flooding by dams/Impoundments	0	0.0	0.0
2. Reduced roughness	45	3.0	1.4
3. Increased on-site water use	0	0	0.0
4. Deposition/infilling or excavation	0	0	0.0
5. Artificial drainage channels	15	7	1.1
6. Modifications to existing channels/ canalisation	0	0.0	0.0
Combined Impact Score:			**2.4**
Combined Hydrological Impact Score:			**3.5**

B. THREATS AND OPPORTUNITIES:

Aspect	Threat	Opportunity	Score	Symbol
Erosion Gullies	Rapidly Deteriorate	High	-2	(↓↓)
HGM Hydrology Threat Score:			**-2**	(↓↓)

GEOMORPHOLOGY:

The main impacts on the geomorphological integrity of the wetland are:

- Increased surface flow from the croplands in the catchment.
- Associated with this is the confinement of flow brought about by the creation of contour banks.
- Two major erosional features. The headcut that is of primary concern is located within HGM-01, but it is threatening to migrate upstream and into HGM-02, potentially causing severe erosion, sediment mobilisation and desiccation of the habitat.

The threat of the headcuts to the integrity of the wetland habitat is estimated as being high, with geomorphological condition likely to deteriorate rapidly and substantially over the next 5 years.

A. ASSESSMENT OF IMPACTS:

FLOOD PLAINS			
Description	**HGM Type**	**Extent (%)**	**Intensity**
1. Upstream Dams	Floodplain	0.0	0.0
2. Stream Diversity/Shortening	Floodplain, Channeled valley bottom	0.0	0.0
3. Road Crossings	Floodplain, Channeled valley bottom	0.0	0.0
4. Erosional Features	All non-floodplain HGMs	10	1.0
5. Change in runoff characteristics	All non-floodplain HGMs	95	3.8
6. Depositional Features	All non-floodplain HGMs	0.0	0.0
7. Loss of organic matter (direct)	All non-floodplain HGMs with peat	0.0	0.0
Geomorphology Impact Score:			**2.4**

Note: It is anticipated that rehabilitation will remove the erosional impact, and while it will not affect the change in runoff characteristics represented by runoff from the catchment, it will stabilise and to some extent negate these impacts. The vulnerability score of the wetland is 8, indicating that the wetland is vulnerable to erosion due to its slope, position in the landscape and size.

B. THREATS AND OPPORTUNITIES:

GEOMORPHOLOGICAL CONTROLS		
GEOMORPHOLOGICAL CONTROLS:		
1. Longitudinal Slope (%)	3.7%	
2. Extent of wetland under threat (%)	80%	
3. Control Description	Wetland downstream	
Hydro Reduced Floodpeaks:		
1. Altered floodpeaks	Moderate Increase	
Vulnerability Score:	8	
THREATS POSED BY HEADCUTS:		
1. Predicted length of wetland, occupied by gullies, as a % of HGM length	80%	
2. Predicated average gully width in relation to wetland length	15-20%	
3. Rate of advancement measured at least over the last 15yrs	5-10 m/yr	
4. Depth of gully	1.01-2.0m	
5. Width of gully	8.1-16m	
6. Number of gully branches	Single	
7. Type of headcut (vertical drop for gullies > 1m)	Single drop	
8. Wetness state of the headcut	Remains Moist	
9. Level of activity of the headcut	30% active erosion	
Adjusted overall magnitude threat score:	-2	(↓↓)

VEGETATION:

The natural vegetation within the wetland has been transformed by croplands and *Eragrostis* hay fields. There has been erosion in the eastern part of the HGM unit. The vegetation threat score is high because the erosion of the gully upstream will result in desiccation and a consequent transformation in the local vegetation.

A. ASSESSMENTS OF IMPACTS:

VEGETATION			
Description	**Extent**	**Intensity**	**Magnitude**
1. Infrastructure (10)	0.0	0.0	0.00
2. Deep flooding by dams (10)	0.0	0.0	0.00
3. Shallow flooding by dams (4-8)	0.0	0.0	0.00
4. Crop lands (8-10)	15.0	10.0	1.5
5. Commercial Plantations (7-10)	0.0	0.0	0.00
6. Annual Pastures (9-10)	0.0	0.0	0.00
7. Perennial Pastures (6-10)	25.0	10.0	2.5
8. Dense Alien Vegetation Patches (5-10)	0.0	0.0	0.00
9. Sports fields (7-10)	0.0	0.0	0.00
10. Gardens (6-10)	0.0	0.0	0.00
11. Area of sediment deposition/infilling and excavation (4-10)	0.0	0.0	0.00
12. Eroded areas (3-9)	5.0	8.0	0.4
13. Old/Abandoned lands (Recent) (7-9)	0.0	0.0	0.00
14. Old/Abandoned lands (Old) (3-8)	0.0	0.0	0.00
15. Seepage below dams (1-5)	0.0	0.0	0.00
16. Untransformed areas (0-3)	55.0	1.0	0.6
Desiccated wetland	0.0	0.0	0.0
Vegetation Impact Score:			**5.0**

B.THREATS AND OPPORTUNITIES:

THREATS/OPPORTUNITIES				
Aspect	**Threat**	**Opportunity**	**Score**	
Erosion Gullies	Rapidly Deteriorate	High	-2	
HGM Vegetation Threat Score:			**-2**	**(↓↓)**

6. A DESCRIPTION OF THE INTEGRITY OF THE SPRINGVALE WETLANDS

The following information serves to summarise the current ecological integrity of the respective wetland HGM units. Impact scores were also obtained under hypothetical rehabilitation conditions, which allowed corresponding health scores to be derived in order to calculate the potential number of hectare equivalents of wetland integrity gained by rehabilitation. The potential consequences of not implementing rehabilitation were also quantified to estimate the number of hectare equivalents to be secured by rehabilitation.

HGM-01	14.1ha		
Current Scenario	**Hydrology**	**Geomorphology**	**Vegetation**
Impact Scores	7.0	2.8	3.8
Health Score	3.0	7.2	6.2
Health Category	**E**	**C**	**C**
Without Rehabilitation			
Health Score	1.0	5.3	2.7
Health Category	**F**	**D**	**E**
With Rehabilitation			
Health Score	3.0	8.1	6.2
Health Category	**E**	**B**	**C**
Hectare Equivalents Gained	**0.0**	**1.2**	**0.0**
Hectare Equivalents Secured	**2.8**	**2.6**	**4.9**

As can be seen, implementation of the rehabilitation interventions is expected to gain approximately 1.2ha equivalents of geomorphological integrity. The hydrology and vegetation integrity scores are not expected to change because the interventions proposed will not actually address the issues that are undermining these two components. Rehabilitation will however stabilise the wetland, maintaining the current *status quo* and securing the wetland against the loss of 2.8, 2.6 and 4.9ha equivalents for the hydrology, geomorphology and vegetation components respectively.

The above expression of hectare equivalents is useful in illustrating the loss or gain of each of the ecological components separately. However, in expressing this loss or gain collectively, it is necessary to weight each component against its perceived relative contribution to determining ecological health. In calculating the hectare equivalents as a single expression of wetland ecological integrity, it was found that rehabilitation would result in 0.2ha equivalents being gained, while not implementing the rehabilitation measures would result in the further loss of 3.2ha equivalents of ecological integrity.

HGM-02	36.2ha		
Current Scenario	**Hydrology**	**Geomorphology**	**Vegetation**
Impact Scores	3.5	2.4	5.0
Health Score	6.5	7.6	5.0
Health Category	**C**	**C**	**D**
Without Rehabilitation			
Health Score	2.5	4.5	1.5
Health Category	**E**	**D**	**F**
With Rehabilitation			
Health Score	6.5	8.0	5.0
Health Category	**C**	**B**	**D**
Hectare Equivalents Gained	**0.0**	**1.4**	**0.0**
Hectare Equivalents Secured	**14.4**	**11.2**	**12.6**

Likewise, the proposed rehabilitation interventions are likely to result in the gain of 1.4ha equivalents of geomorphological integrity, with no gains in hydrology or vegetation integrity. The primary headcut is actually situated within HGM-01, and as such is not having an impact on the seepage wetland yet. However, the threat it does pose is illustrated by the number of hectare equivalents to be secured, or prevented from being lost from the system, by implementing rehabilitation measures.

In calculating the collective ecological integrity, HGM-02 currently comprises approximately 23.6 ha equivalents. Rehabilitation will result in a gain of 0.5ha equivalents, while not rehabilitating the wetland will result in the further loss of 13.2 ha equivalents from the landscape.

7. CONCLUSION

Rehabilitation of this wetland consists of implementing three structures aimed at deactivating migrating erosional features and safeguarding existing wetland habitat upstream. As such it should be noted that these measures will only affect the geomorphological integrity of the wetland. The hydrological impacts mostly originate in the wetland catchments, and it is not feasible to address these. The structures within the wetland are also not aimed at restoring degraded wetland habitat, and hence the opportunity to make significant gains in hydrological and vegetation integrity is limited.

The real value of implementing rehabilitation measures is in the removal of the threat of future wetland degradation through unchecked erosion. The structures are expected to stabilise the habitat, protect against erosion and maintain wetland conditions upstream. The hillslope seep wetland, HGM-02, is a particularly important wetland within the local landscape because of the ecoservices it provides. It is critical that it is secured against further erosion due to the irreversible nature of the potential degradation.

The structure deactivating the headcut just above the bottom dam is the highest priority intervention. Importantly, this structure will not only address a problem identified in HGM-01, but will also remove the major threat to HGM-02, hence contributing to the securing of wetland ecological integrity in both units.

8. REFERENCES

KOTZE D C, MARNEWECK G C, BATCHELOR A L, LINDLEY D S, AND COLLINS N B, 2007. WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands. (In Progress). Water Research Commission, Pretoria.

MACFARLANE D M, KOTZE D, WALTERS D, ELLERY W, KOOPMAN V, GOODMAN P, and GOGE C, 2007. WET-Health: A technique for rapidly assessing wetland health. (In Progress). Water Research Commission, Pretoria.

Working for Wetlands: Free State Province
Maluti a-Phofung Project: Wetland Assessment Report
Tamworth Wetland: C81K-05

For:

aurecon

By:

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October 2010

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1. INTRODUCTION:

Rehabilitation refers to re-instating the driving ecological forces that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers. Effective rehabilitation planning therefore requires an assessment of how the following three groups of processes have been threatened/impacted upon:

- Hydrological;
- Geomorphological; and
- Vegetation.

Furthermore, it requires an assessment of the predicted contribution that wetland rehabilitation will make to improving wetland health and ecosystem delivery through addressing the identified impacts/threats. Without these assessments, a wetland rehabilitation programme is unlikely to have a well-informed basis on which to improve the rehabilitation's "return on investment" (with return being measured in terms of wetland health and ecosystem services delivery).

2. PROJECT DETAILS:

2.1 General Approach for Specific Category of Project

The approach and results for the assessment of wetland rehabilitation within the Maluti a-Phofung Project are outlined in this report. Planning for the project was undertaken as a Category 3 project, with identified quaternary catchments being visually surveyed from a light aircraft. This comprehensive overview of the particular catchment enabled wetland habitat to be identified and potential problem points within these wetlands to be evaluated quickly and efficiently according to the potential for rehabilitation work. In combination with desktop mapping using aerial imagery, the information was used to rate the potential work as below.

Score	Description of the class
0	The returns are considered to be very low or the sites considered lost causes that are extremely degraded.
1	A site which has potential (e.g. intact area threatened by headcut erosion) but where the returns are likely to be low (e.g., because the intact areas is small, <3 ha) or uncertain.
2	A site where the returns are potentially moderate.
3	A site where returns are potentially high (e.g. a large area, i.e., greater than 20ha, threatened by gully erosion).

These ratings were used in combination with the identified catchment rehabilitation objectives, catchment priority areas and operational considerations to prioritise wetlands for potential rehabilitation. Once the prioritised wetlands were identified detailed infield assessments were undertaken to identify problems and assess the ecosystem benefits and services and ecological integrity of the wetland systems.

2.2 Project Description, Location, Category and Catchment Information

The Tamworth wetland is situated in quaternary catchment C81K, approximately 22km east of Harrismith, and is part of the Maluti-a-Phofung wetland rehabilitation project. This is a new wetland, with work scheduled to begin in the forthcoming 2011/ 2012 season. Several problems were identified from the district road during the 2009 planning site visit, and earmarked for rehabilitation once higher priority work had been completed. The wetland is considered to be a hillslope seep wetland draining into the Wilge River floodplain. The vegetation within the wetland is composed of moist primary grassland and, with the exception of the channel bed, is still largely intact. A key species indicating the presence of wetland soil characteristics is *Pennisetum thunbergii*. The soil within the wetland indicated temporary to seasonal hydromorphic conditions.

The wetland's catchment is comprised of gentle slopes of primary grassland, with the predominant landuse being commercial beef production. The condition of the sward and the degree of plant basal cover would indicate that overgrazing is not an issue, and that natural hydrological conditions still persist.

Rehabilitation is planned within this wetland with the intention of maintaining the wetland in the landscape by arresting the evident headcut erosion, preventing canalisation and subsequent desiccation. The wetland is found within a catchment characterised by a Mean Annual Precipitation of (MAP) of 622.8mm and a Potential Evapotranspiration (PET) of 1951.4mm. The MAP to PET ratio is 0.31, indicating a seasonal rainfall regime of mostly irregular, high-intensity rainfall events.

3. METHODS:

3.1 Assess Impacts and Threats

The following steps were followed to assess the impacts and threats within each wetland system:

- Describe the hydro-geomorphic setting of the wetland;
- Describe the overall health of the wetland at a Level 1 using WET-Health (Macfarlane et al., 2006)
- Based on the above, identify specific impacts and/or threats to be addressed by structural rehabilitation and describe these at a Level 2. For example, for headcut erosion, the specific dimensions and level of activity of headcuts are described.

3.2 Set rehabilitation objectives and choose appropriate measures for achieving the objectives [1]

Objectives are informed by the above assessment (e.g., if the primary threat to the wetland was identified as an erosion headcut threatening to propagate through the wetland then an appropriate rehabilitation objective would be to halt propagation of the erosion headcut).

[1] This is dealt with in detail in the main document.

3.3 Assess the likely contribution of rehabilitation intervention to wetland health and ecosystem delivery

The following steps were followed to assess the contribution of rehabilitation interventions within each wetland system:

- Identify the spatial area likely to be affected by the proposed intervention/s.
- Assess the benefits that are likely to result from achievement of the rehabilitation objective/s in terms of the integrity of the affected area of the wetland (using WET-Health) and the ecosystem services that the area delivers (using WET-Ecoservices: Kotze et al., 2007).

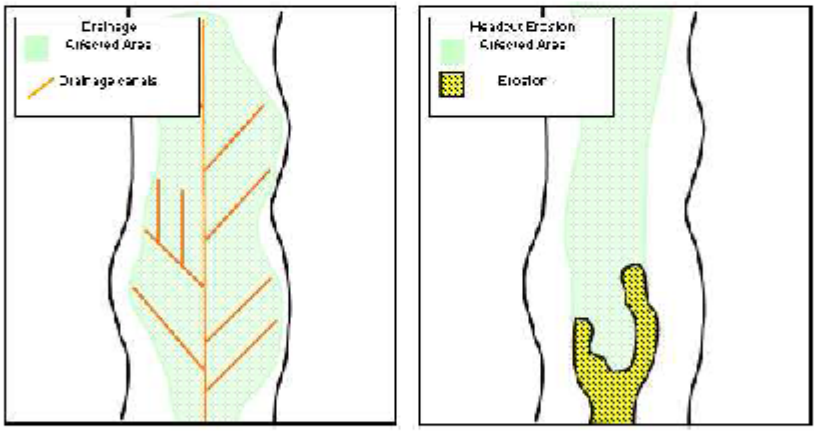

Figure 3.1. Determination of wetland areas affected by drainage canals or threatened by headcut erosion

The same approach and currency was used for the assessment of the different threats/impacts that are to be addressed through rehabilitation: the situation without rehabilitation (i.e. no intervention) was compared with the situation with rehabilitation. For health, both situations were scored on a scale of 0 (critically altered) to 10 (pristine), and this was undertaken for the hydrology, geomorphology and vegetation components of health. The benefit achieved, would be the improvement in relation to the maximum score.

Example:

If the hydrological integrity without rehabilitation scored 3 owing to the desiccating effect of a network of drains and this was predicted to be improved to a score of 8 through the construction of rehabilitation plugs then the improvement would be (8-3=5)/10, i.e. an increase in the hydrological integrity of 50%. If the area rehabilitated was 60 ha, for example, then this would be equivalent to re-instating 30 ha (60ha x 5/10) of wetland integrity. If, however, the score had only been increased from 3 to 5 (perhaps because of insufficient plugs) then this would be equivalent to re-instating 12 ha (60ha x 2/10).

For areas threatened by headcut erosion which are to be rehabilitated by halting the propagation of the headcut, the benefits in terms of health would be determined based on the difference between the current health and the projected health if the headcut proceeded to erode through the threatened area. In this case, halting the propagation of the headcut was assumed to secure the current situation. Generally, written justification was provided of the rationale underlying the scores.

4. WETLAND DETAILS FOR: TAMWORTH

4.1 Wetland Description:

The wetland is 3.2ha in extent, and is considered to be a hillslope seep feeding a stream. The hydrological regime is dominated by subsurface seepage, with surface runoff most likely to flow over the wetland and into the floodplain system downstream. The vegetation of the intact wetland habitat above the identified erosion features consists of moist grassland that contains a mixture of hygrophilous species such as *Pennisetum thunbergii* and terrestrial species such as *Themeda triandra*. The base of the eroded gully below the headcut is characterised by pioneer species. The soils are sandy clays and display temporary and seasonal wetland hydromorphic characteristics.

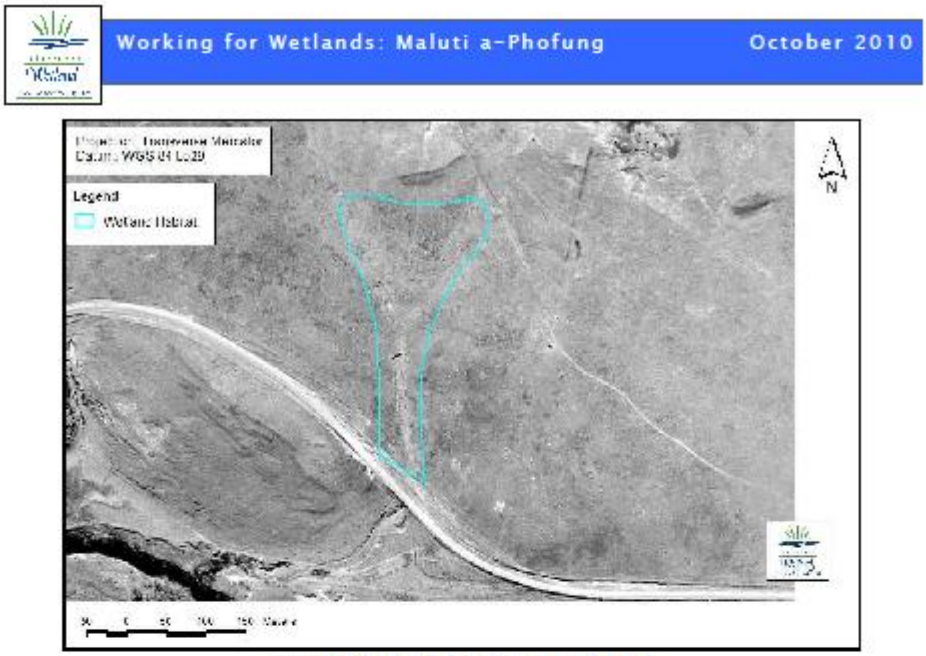

Figure 4.1. Tamworth Wetland: C81K-05

4.2 Wetland Problems

Problem 1:

A large headcut was located approximately 140m from the base of the wetland (refer to **Figure 4.2**). Although relatively stable, this feature does pose a threat to wetland ecological integrity and functioning. It is likely to become active during peak flow events, and its migration upslope may have the following consequences:

- The erosion of considerable amounts of soil, with subsequent sediment deposition into downstream water resources;
- A drop in the local water table;
- Desiccation of the wetland habitat, and resultant colonisation by terrestrial plant species, with an overall loss in biodiversity;
- Loss in streamflow-augmentation capacity.

Figure 4.2: Headcut within the wetland habitat

Problem 2:
A smaller, less active headcut was identified further up the wetland.

4.3 How are rehabilitation plans going to address the above problems:

Rehabilitation measures entail the construction of a gabion intervention across the larger, more active headcut, as well as a softer structure, such as Macmat, across the smaller headcut. These interventions will ensure that surface water flows over a hardened surface, and lands on a hardened surface, thereby preventing further soil erosion, slumping and desiccation of the wetland and the loss of the biodiversity associated with it.

5. HGM ASSESSMENTS:

5.1 WET ECO SERVICES: HILLSLOPE SEEPAGE WETLAND

The most important benefits provided by the wetland are likely to be:

1. Maintenance of biodiversity;
2. Streamflow augmentation;
3. Erosion control; and

Rehabilitation within this wetland revolves around stabilisation, and is unlikely to improve wetland functioning to a large degree, with the exception of erosion control and biodiversity maintenance. Most importantly, however, it will maintain the current *status quo* of most of the wetland functions. The lack of rehabilitation will eventually result in the loss of the habitat from the landscape, and with it the loss of the current ecological benefits provided.

REDUCTION IN WATER INPUTS		
Ecosystem Service	**Score**	**Comments**
Flood Attenuation	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Stream flow Regulation	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Sediment Trapping	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Phosphate Assimilation	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Nitrate Assimilation	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Toxicant Assimilation	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Erosion Control	Large Positive Effect Anticipated	The threat of major erosion will be removed.
Carbon Storage	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Biodiversity Maintenance	Large Positive Effect Anticipated	This important habitat will be maintained within the landscape
Water Supply for Human Use	No Effect Anticipated	Water resource is reinforced.
Natural Resources	No Effect Anticipated	Unlikely to change significantly from the current scenario.
Cultivated Foods	No Effect Anticipated	Not used as such.
Cultural Significance	No Effect Anticipated	Not used as such.
Tourism and Recreation	No Effect Anticipated	Not used as such.
Education and Research	No Effect Anticipated	Not used as such.

5.2 HYDROLOGY:

The major hydrological impacts sustained by this wetland have most likely resulted from the construction of a culvert beneath the gravel road at the base of the wetland. The culvert has had two effects:

1. It has dropped the base level of the wetland; and
2. It confines peak surface flow, which results in a higher flow velocity and a consequent increase in erosion potential.

These effects have combined to initiate the headcut erosion that has subsequently migrated upstream. It should however be noted that the base of the channel is wide, flat and well vegetated and hence, although the water table has dropped, the hydrological impacts have been negated to a certain extent through continued diffuse subsurface flow through the channel bed.

A. ASSESSMENT OF IMPACTS:

Assessment	Category/Score
1. Reduced Inputs	No change (0)
2. Reduced Flood peaks	Negligible increase (0.6)
3. Flood banks and channeled valley bottoms driven primarily by over-bank flooding	False
Combined impact score:	**0**

Assessment	Extent (%)	Intensity (0-10)	Magnitude
1. Deep flooding by dams/Impoundments	0.0	0.0	0.0
2. Reduced roughness	0.0	0.0	0.0
3. Increased on-site water use	0	0	0.0
4. Deposition/infilling or excavation	0	0	0.0
5. Artificial drainage channels	17	4	0.7
6. Modifications to existing channels/ canalisation	0	0.0	0.0
Combined Impact Score:			**0.7**
Combined Hydrological Impact Score:			**0.5**

B. THREATS AND OPPORTUNITIES:

Aspect	Threat	Opportunity	Score	Symbol
Erosion Gullies	Slowly Deteriorate	High	-1	(↓)
HGM Hydrology Threat Score:			**-1**	**(↓)**

5.3 GEOMORPHOLOGY:

The main impacts on the geomorphological integrity of the wetland are:

- Confined surface flow through the culvert downstream with an associated drop in base level; and
- Two significant eroding features identified within the wetland, likely to have been initiated by confined flow through the culvert.

A. ASSESSMENT OF IMPACTS:

FLOOD PLAINS			
Description	**HGM Type**	**Extent (%)**	**Intensity**
1. Upstream Dams	Floodplain	0.0	0.0
2. Stream Diversity/Shortening	Floodplain, Channeled valley bottom	0.0	0.0
3. Road Crossings	Floodplain, Channeled valley bottom	0.0	0.0
4. Erosional Features	All non-floodplain HGMs	50	5.0
5. Infilling	All non-floodplain HGMs	0.0	0.0
6. Increase Runoff	All non-floodplain HGMs	0.0	0.0
7. Loss of organic matter (direct)	All non-floodplain HGMs with peat	0.0	0.0
Geomorphology Impact Score:			**1.3**

B. THREATS AND OPPORTUNITIES:

GEOMORPHOLOGICAL CONTROLS		
GEOMORPHOLOGICAL CONTROLS:		
1. Longitudinal Slope (%)	5.4	
2. Extent of wetland under threat (%)	90.00	
3. Control Description	Geological	
Hydro Reduced Floodpeaks:		
1. Altered floodpeaks	Negligible change	
Vulnerability Score:	**3**	
THREATS POSED BY HEADCUTS:		
1. Predicted length of wetland, occupied by gullies, as a % of HGM length	90%	
2. Predicated average gully width in relation to wetland length	37%	
3. Rate of advancement measured at least over the last 15yrs	<5 m/yr	
4. Depth of gully	1.01-2.00m	
5. Width of gully	15-20m	
6. Number of gully branches	1	
7. Type of headcut (vertical drop for gullies > 1m)	Vertical Drop	
8. Wetness state of the headcut	Seasonally Wet	
9. Level of activity of the headcut	10%	
Adjusted overall magnitude threat score:	**-1**	**(↓)**

5.4 VEGETATION:

The eroded gully has removed the natural grassland vegetation that would have occurred within the footprint of the gully, and replaced it with secondary vegetation consisting of a combination of terrestrial and hygrophilous pioneer species.

A. ASSESSMENTS OF IMPACTS:

VEGETATION			
Description	**Extent**	**Intensity**	**Magnitude**
1. Infrastructure (10)	0.0	0.0	0.00
2. Deep flooding by dams (10)	0.0	0.0	0.0
3. Shallow flooding by dams (4-8)	0.0	0.0	0.0
4. Crop lands (8-10)	0.0	0.0	0.00
5. Commercial Plantations (7-10)	0.0	0.0	0.00
6. Annual Pastures (9-10)	0.0	0.0	0.00
7. Perennial Pastures (6-10)	0.0	0.0	0.00
8. Dense Alien Vegetation Patches (5-10)	0.0	0.0	0.00
9. Sports fields (7-10)	0.0	0.0	0.00
10. Gardens (6-10)	0.0	0.0	0.00
11. Area of sediment deposition/infilling and excavation (4-10)	0.0	0.0	0.00
12. Eroded areas (3-9)	20.0	8.0	1.6
13. Old/Abandoned lands (Recent) (7-9)	0.0	0.0	0.00
14. Old/Abandoned lands (Old) (3-8)	0.0	0.0	0.0
15. Seepage below dams (1-5)	0.0	0.0	0.00
16. Untransformed areas (0-3)	80.0	1.0	0.8
Desiccated wetland	0.0	0.0	0.0
Vegetation Impact Score:			**2.4**

B. THREATS AND OPPORTUNITIES:

THREATS/OPPORTUNITIES				
Aspect	**Threat**	**Opportunity**	**Score**	
Erosion Gullies	Slowly Deteriorate	High	-1	
HGM Vegetation Threat Score:			**-1**	**(↓)**

6. A DESCRIPTION OF THE INTEGRITY OF THE TAMWORTH WETLAND

The following information serves to summarise the current ecological integrity of the wetland HGM unit. Impact scores were also obtained under hypothetical rehabilitation conditions, which allowed corresponding health scores to be derived in order to calculate the potential number of hectare equivalents of wetland integrity gained by rehabilitation. The potential consequences of not implementing rehabilitation were also quantified to estimate the number of hectare equivalents to be secured by rehabilitation.

HGM-01	3.2ha		
Current Scenario	**Hydrology**	**Geomorphology**	**Vegetation**
Impact Scores	0.5	1.3	2.4
Health Score	9.5	8.7	7.6
Health Category	**A**	**B**	**C**
Without Rehabilitation			
Health Score	5.0	7.7	2.7
Health Category	**D**	**C**	**E**
With Rehabilitation			
Health Score	**9.5**	**9.7**	**7.6**
Health Category	**A**	**A**	**C**
Hectare Equivalents Gained	**0.0**	**0.32**	**0.0**
Hectare Equivalents Secured	**1.4**	**0.32**	**1.6**

Implementation of the proposed rehabilitation intervention is likely to result in the gain of 0.32 ha equivalents of geomorphological integrity, however the *status quo* of the hydrological and vegetation components is unlikely to change. More importantly, deciding not to intervene is likely to result in substantial losses in the integrity of all three components, with 1.1 ha equivalents collectively secured by rehabilitation. Although relatively small, this wetland is important for biodiversity within the landscape context and its degradation should be avoided.

7. CONCLUSION

Rehabilitation of this wetland at this point consists of deactivating the headcut erosion within the wetland, which is considered to be posing a threat to the wetland habitat upstream. The wetland is an important source of biodiversity within the montane landscape, and rehabilitation of this wetland is considered to be a worthwhile investment.

8. REFERENCES

KOTZE D C, MARNEWECK G C, BATCHELOR A L, LINDLEY D S, AND COLLINS N B, 2007. WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands. (In Progress). Water Research Commission, Pretoria.

MACFARLANE D M, KOTZE D, WALTERS D, ELLERY W, KOOPMAN V, GOODMAN P, and GOGE C, 2007. WET-Health: A technique for rapidly assessing wetland health. (In Progress). Water Research Commission, Pretoria.

Wetland Assessment: Ferndale C81K-02 October 2010

Province: **Free State**
Project: **Maluti-A-Phofung**
Assessor: **Doug McCulloch**
Wetland No: **Ferndale: C81K-02**

Report Date: **09/09/2009**

1. INTRODUCTION:

Rehabilitation refers to re-instating the driving ecological forces that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers. Effective rehabilitation planning therefore requires an assessment of how the following three processes have been threatened/impacted upon:

- Hydrological;
- Geomorphological; and
- Ecological.

Furthermore, it requires an assessment of the predicted contribution that wetland rehabilitation will make to improving wetland health and ecosystem delivery through addressing the identified impacts/threats. Without these assessments, a wetland rehabilitation programme is unlikely to have a well-informed basis on which to improve the rehabilitation's "return on investment" (with return being measured in terms of wetland health and ecosystem services delivery).

2. PROJECT DETAILS:

2.1 General Approach for Specific Category of Project

The approach and results for the assessment of wetland rehabilitation within the Maluti-a-Phofung Project are outlined in this report. The Maluti-a-Phofung wetland rehabilitation project planning was undertaken as a Category 3 project, with the identified quaternary catchments being visually surveyed from a light aircraft obtaining a comprehensive overview of the catchment and identifying problem points within the identified wetlands. These problem points were used in combination with desktop mapping using aerial imagery of identified wetlands to rate the potential for rehabilitation as below.

re	Description of the class
0	The returns are considered to be very low or the sites considered lost causes that are extremely degraded.
1	A site which has potential (e.g. intact area threatened by headcut erosion) but where the returns are likely to be low (e.g., because the intact areas is small, <3 ha) or uncertain.
2	A site where the returns are potentially moderate.
3	A site where returns are potentially high (e.g. a large area, i.e., greater than 20ha, threatened by gully erosion).

These ratings were used in combination with the identified catchment rehabilitation objectives, catchment priority areas and operational considerations to prioritise wetlands for potential rehabilitation. Once the prioritised wetlands were identified detailed infield assessments were undertaken to identify problems and assess the ecosystem benefits and services and ecological integrity of the wetland systems.

2.2 Project Description, Location, Category and Catchment Information

The Ferndale wetland is situated in quaternary catchment C81K, approximately 30km from Harrismith, and is part of the Maluti-a-Phofung wetland rehabilitation project. This is a new wetland, with work scheduled to begin in the forthcoming 2010/ 2011 season. Several problems were identified from the air, and those considered most important were addressed in planning during 2009. The wetland is considered to be a hillslope seep wetland feeding the Wilge River floodplain. The vegetation within the wetland is composed of hygrophilous grassland and is, with the exception of peripheral cultivation, still largely intact.

The predominant landuse in the quaternary catchment is commercial beef production and commercial rowcrop cultivation. Rehabilitation is planned within this wetland with the intention of maintaining the wetland in the landscape by preventing channel erosion and subsequent desiccation. The wetland is found within a catchment characterised by a Mean Annual Precipitation of (MAP) of 622.8mm and a Potential Evapotranspiration (PET) of 1951.4mm. The MAP to PET ratio is 0.31, indicating a semi-arid regime with irregular, high-intensity rainfall events. The ratio is considered to be high in terms of the wetland's sensitivity to hyrological impacts.

The wetland's catchment is comprised of gentle slopes of primary grassland, with some areas cultivated for commercial rowcrop production. The hydrological regime of the catchment is considered to approximate the natural condition.

3. METHODS:

3.1 Assess Impacts and Threats

The following steps were followed to assess the impacts and threats within each wetland system:

- Describe the hydro-geomorphic setting of the wetland according to Kotze et al. (2005)
- Describe the overall health of the wetland at a Level 1 using WET-Health (Macfarlane et al., 2006)
- Based on the above, identify specific impacts and/or threats to be addressed by structural rehabilitation and describe these at a Level 2. For example, for headcut erosion, the specific dimensions and level of activity of headcuts are described.

3.2 Set rehabilitation objectives and choose appropriate measures for achieving the objectives [1]

Objectives are informed by the above assessment (e.g., if the primary threat to the wetland was identified as an erosion headcut threatening to propagate through the wetland then an appropriate rehabilitation objective would be to halt propagation of the erosion headcut)

[1] This is dealt with in detail in the main document.

3.3 Assess the likely contribution of rehabilitation intervention to wetland health and ecosystem delivery

The following steps were followed to assess the contribution of rehabilitation interventions within each wetland system:

- Identify the spatial area likely to be affected by the proposed intervention/s.

- Assess the benefits that are likely to result from achievement of the rehabilitation objective/s in terms of the integrity of the affected area of the wetland (using WET-Health) and the ecosystem services that the area delivers (using WET-Ecoservices: Kotze et al., 2005).

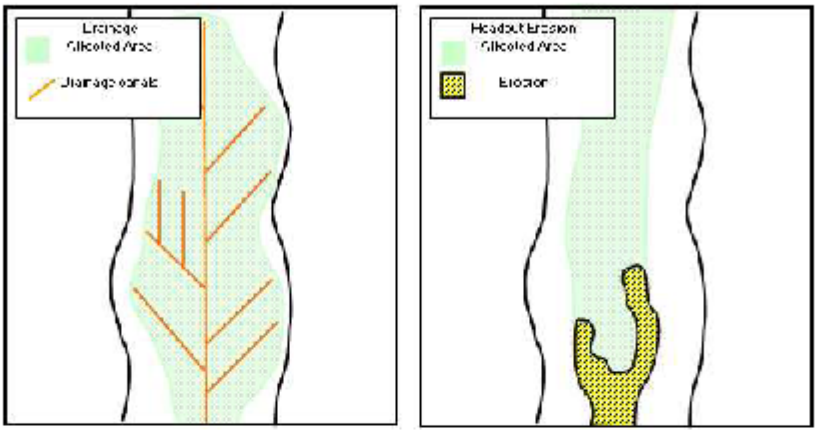

Figure 1. Determination of wetland areas affected by drainage canals or threatened by headcut erosion

The same approach and currency was used for the assessment of the different threats/impacts that are to be addressed through rehabilitation: the situation without rehabilitation (i.e. no intervention) was compared with the situation with rehabilitation. For health, both situations were scored on a scale of 0 (critically altered) to 10 (pristine), and this was undertaken for the hydrology, geomorphology and vegetation components of health. The benefit achieved, would be the improvement in relation to the maximum score.

Example:

If the hydrological integrity without rehabilitation scored 3 owing to the desiccating effect of a network of drains and this was predicted to be improved to a score of 8 through the construction of rehabilitation plugs then the improvement would be (8-3=5)/10, i.e. an increase in the hydrological integrity of 50%. If the area rehabilitated was 60 ha, for example, then this would be equivalent to re-instating 30 ha (60 ha x 5/10) of wetland integrity. If, however, the score had only been increased from 3 to 5 (perhaps because of insufficient plugs) then this would be equivalent to re-instating 12 ha (60 ha x 2/10).
For areas threatened by headcut erosion which are to be rehabilitated by halting the propagation of the headcut, the benefits in terms of health would be determined based on the difference between the current health and the projected health if the headcut proceeded to erode through the threatened area. In this case, halting the propagation of the headcut was assumed to secure the current situation. Generally, written justification was provided of the rationale underlying the scores.

4. WETLAND DETAILS FOR: FERNDALE

4.1 Wetland Description:

The wetland is approximately 49ha in extent, and is considered to be a hillslope seep feeding a stream. The hydrological regime of water inputs is likely to be dominated by subsurface seepage through the sandy soils in the catchment, with additional inputs from surface runoff following rainfall events. The vegetation consists of exclusively of hygrophilous grassland, although cultivated fields have also encroached.

4.2 Wetland Problems

Problem 1: C81K-02-1

A large, active, multiple headcut is located at the base of the wetland and is threatening to erode upstream into intact habitat.

Figure 2: headcut at the base of the wetland

Several smaller headcuts were located downstream of the large headcut.

Problem 2: C81K-02-2

A channel has eroded through the lower reaches of the wetland, facilitating the rapid passage of water through the wetland and a lowering of the water table, with consequent wetland desiccation.

Figure 3: incised channel

Problem 3: C81K-02-3

The lower reaches of the wetland have become infested with young *Salix babylonica* trees, which is having an impact on the hydrological and vegetation integrity of the wetland, as well as posing a future threat to the habitat.

Figure 4: alien plant infestation (*Salix* spp.)

Problem 4: C81K-02-4

The dirt road across the wetland is disrupting water movement down the length of the wetland, significantly affecting the hydrological integrity of the habitat. This effect is being exacerbated by the concentration of water into the excavated drain.

Figure 5: Excavated drain, culvert and road across the centre of the wetland

4.3 How are rehabilitation plans going to address the above problems:

It is anticipated that the rehabilitation measures will:
1. Deactivate the headcuts located, safeguarding the intact habitat upstream;
2. Prevent further channel incision;
3. Trap sediment and re-establish an appropriate base-level; and
4. Promote revegetation; and
5. Restore the natural hydrology to the wetland habitat.

5. HGM ASSESSMENTS:

HILLSLOPE SEEPAGE FEEDING A STREAM - 824

HGM Description:

The wetland is classified as a hillslope seep feeding a stream, and is approximately 49ha in extent. The overall length of the HGM unit is approximately 1.1km.

Wetland Assessment: Ferndale C81K-02 October 2010

WET ECO SERVICES:

The most important benefits provided by the wetland are likely to be:
1. Streamflow regulation;
2.Biodiversity maintenance;
3. Water quality enhancement (fertilizer inputs from the surrounding lands); and
3.Natural resource utilization in the form of grazing.

It is likely that the implementation of rehabilitation measures will improve the wetlands ability to control erosion, through deactivating headcuts, as well as trap sediment behind the structures and through the enhanced vegetation growth resulting from the improved hydrological regime.

REDUCTION IN WATER INPUTS		
Ecosystem Service	**Score**	**Comments**
Flood Attenuation	No Effect Anticipated	No change in current scenario anticipated
Stream flow Regulation	No Effect Anticipated	No change in current scenario anticipated
Sediment Trapping	Large Positive Effect Anticipated	Interventions will trap sediment, as will the enhanced revegetation.
Phosphate Assimilation	No Effect Anticipated	No change in current scenario anticipated
Nitrate Assimilation	No Effect Anticipated	No change in current scenario anticipated
Toxicant Assimilation	No Effect Anticipated	No change in current scenario anticipated
Erosion Control	Large Positive Effect Anticipated	Interventions will deactivate headcuts, reducing extent of erosion.
Carbon Storage	No Effect Anticipated	No change in current scenario anticipated
Biodiversity Maintenance	No Effect Anticipated	No change in current scenario anticipated
Water Supply for Human Use	No Effect Anticipated	No change in current scenario anticipated
Natural Resources	No Effect Anticipated	No change in current scenario anticipated
Cultivated Foods	No Effect Anticipated	No change in current scenario anticipated
Cultural Significance	No Effect Anticipated	No change in current scenario anticipated
Tourism and Recreation	No Effect Anticipated	No change in current scenario anticipated
Education and Research	No Effect Anticipated	No change in current scenario anticipated

Wetland Assessment: Ferndale C81K-02 October 2010

HYDROLOGY:

The major impact to the hydrological integrity of the wetland is the disruption of surface flow through the wetland, as well as into the wetland, resulting from:
1.the construction of the road across the centre of the wetland; and
2.the dam built in the upper reaches of the HGM unit.

A. ASSESSMENT OF IMPACTS:

Assessment	Category/Score
1. Reduced Inputs	None (<1)
2. Reduced Flood peaks	No effect (-1.5 to 1.5)
3. Flood banks and channeled valley bottoms driven primarily by over-bank flooding	FALSE
Combined impact score:	**0.00**

Assessment	Extent (%)	Intensity (0-10)	Magnitude
1. Deep flooding by dams/Impoundments	50	4	2.0
2. Reduced roughness	0	0	0
3. Increased on-site water use	0	0	0
4. Deposition/infilling or excavation	0	0	0
5. Artificial drainage channels	0	0	0
6. Modifications to existing channels	0	0	0
Combined Impact Score:			**2.0**
Combined Hydrological Impact Score:			**3.00**

B. THREATS AND OPPORTUNITIES:

Aspect	Threat	Opportunity	Score
Erosion Gullies	Rapidly Deteriorate	High	4
HGM Hydrology Threat Score:			**4**

GEOMORPHOLOGY:

The main impacts on the geomorphological integrity of the wetland are from a large headcut at the base of the wetland, and several smaller ones further downstream. The considerable slope, allied to the position of the headcuts at the bottom of the wetland, constitute a considerable threat to the future geological integrity of the wetland.

A. ASSESSMENT OF IMPACTS:

FLOOD PLAINS			
Description	**HGM Type**	**Extent (%)**	**Intensity**
1. Upstream Dams	Floodplain	0.0	0.5
2. Stream Diversity/Shortening	Floodplain, Channeled valley bottom	0.0	0.5
3. Road Crossings	Floodplain, Channeled valley bottom	0.0	0.0
4. Erosional Features	All non-floodplain HGMs	25.0	3.0
5. Depositional Features	All non-floodplain HGMs	5.0	0.5
6. Loss of organic matter (direct)	All non-floodplain HGMs with peat	0.0	0.5
Geomorphology Impact Score:			**0.8**

Wetland Assessment: Ferndale C81K-02 October 2010

B. THREATS AND OPPORTUNITIES:

GEOMORPHOLOGICAL CONTROLS	
GEOMORPHOLOGICAL CONTROLS:	
1. Longitudinal Slope (%)	2.10
2. Extent of wetland under threat (%)	80.00
3. Control Description	Floodplain
Hydro Reduced Floodpeaks:	
1. Altered floodpeaks	No effect or reduction
Vulnerability Score:	**2**
THREATS POSED BY HEADCUTS:	
1. Predicted length of wetland, occupied by gullies, as a % of HGM length	40-60%
2. Predicated average gully width in relation to wetland length	5-10%
3. Rate of advancement measured at least over the last 15yrs	<5m/yr
4. Depth of gully	20.50-1.00m
5. Width of gully	1-5m
6. Number of gully branches	Single
7. Type of headcut (vertical drop for gullies > 1m)	Single drop
8. Wetness state of the headcut	Remains Moist
9. Level of activity of the headcut	10-40% active erosion
Magnitude of headcut advancement threat:	**0.69**
Adjusted overall magnitude threat score:	**7**

Wetland Assessment: Ferndale C81K-02 October 2010

VEGETATION:

The encroachment of cultivated croplands into the wetland habitat is having a significant impact on the vegetation integrity of the wetland. The land adjacent to the channel has become desiccated, with the subsequent encroachment of terrestrial grasses into the wetland habitat.

A. ASSESSMENTS OF IMPACTS:

VEGETATION			
Description	**Extent**	**Intensity**	**Magnitude**
1. Infrastructure (10)	0.0	0.0	0.00
2. Deep flooding by dams (10)	0.0	0.0	0.00
3. Shallow flooding by dams (4-8)	1.2	7.0	0.08
4. Crop lands (8-10)	21.4	10.0	2.14
5. Commercial Plantations (7-10)	0.0	0.0	0.00
6. Annual Pastures (9-10)	0.0	0.0	0.00
7. Perennial Pastures (6-10)	0.0	0.0	0.00
8. Dense Alien Vegetation Patches (5-10)	0.0	0.0	0.00
9. Sports fields (7-10)	0.0	0.0	0.00
10. Gardens (6-10)	0.0	0.0	0.00
11. Area of sediment deposition/infilling and excavation (4-10)	0.0	0.0	0.00
12. Eroded areas (3-9)	0.0	0.0	0.00
13. Old/Abandoned lands (Recent) (7-9)	0.0	0.0	0.00
14. Old/Abandoned lands (Old) (3-8)	0.0	0.0	0.00
15. Seepage below dams (1-5)	0.0	0.0	0.00
16. Untransformed areas (0-3)	66.1	2.0	1.32
Desiccated wetland	11	6	0.7
Vegetation Impact Score:			**4.22**

1. THREATS AND OPPORTUNITIES:

THREATS/OPPORTUNITIES			
Aspect	**Threat**	**Opportunity**	**Score**
Erosion Gullies	Rapidly Deteriorate	High	4
HGM Vegetation Threat Score:			**4**

2. ALIEN INVASIVE PLANT SPECIES:

ALIEN SPECIES		Total Extent: 2.00 %
Genus	**Species**	**Extent**
Salix	babylonica	2.00

6. A DESCRIPTION OF THE INTEGRITY OF THE FERNDALE WETLAND

A number of wetlands were identified within the catchment with potential for rehabilitation activities and the following information serves to describe the hydro geomorphic settings of the identified wetland.

HGM Unit	Area	Hydro Health	Hydro Threat	Geo Health	Geo Threat	Veg Health	Veg Threat
PRE:							
Hillslope seepage feeding a stream	49.00	7.0	4.0	9.2	7.0	5.8	2.5
PRE AREA SCORE:		**7.0**	**4.0**	**9.2**	**7.0**	**5.8**	**2.5**
POST:							
Hillslope seepage feeding a stream	49.00	9.0	0.0	9.8	7.0	6.9	0.0
POST AREA SCORE:		**9.0**	**0.0**	**9.8**	**7.0**	**6.9**	**0.0**

The above information shows the current/pre-rehabilitation levels of integrity within the identified wetland system and the anticipated improvement in the system's integrity associated with the proposed rehabilitation. As can be seen, a significant improvement is anticipated to the hydrology and vegetation components of the ecological integrity of the wetland, with a slight improvement to the geomorphological integrity. This will be coupled to a significant anticipated improvement in the provision of certain wetland benefits, justifying rehabilitation measures.

7. CONCLUSION

The assessments of the wetland functioning and integrity show that the rehabilitation of the wetland is likely to provide improvements in wetland functioning and integrity, but it is important to quantify the benefits of the proposed rehabilitation against the anticipated costs required to achieve the desired outcomes. Using hectare/functional equivalents of the wetland habitat allows the various scenarios regarding the management of the wetland habitat to be compared using the same currency. To allow comparisons to be made, the future situation without rehabilitation (i.e. no intervention) was compared with the future situation with rehabilitation.

Using the hectare/functional equivalents it was possible to illustrate the loss or gain in functioning wetland habitat associated with and without the implementation of the proposed rehabilitation activities. Based on these derived hectare equivalents it is important to show the loss associated with the advancement of headcut erosion and the gain associated with the deactivation drains or incised channels within the wetland system. The costs of the proposed interventions are then compared to the lost or gained hectare equivalent of wetland habitat to show the cost per unit of functioning wetland habitat.

COST EFFECTIVENESS OF PROPOSED INTERVENTION/S	
Estimated Cost of Rehabilitation of the Entire HGM Unit: [2]	
Estimated cost of restoration component (drains etc.)	R 532,316
Estimated cost of stabilisation component (headcuts etc.)	R 938,188
Hectare/Functional Equivalents of Wetland Habitat:	
Future scenario with no intervention/s	7.27
Future scenario with intervention/s	43.28
Hectare/Functional Equivalents Gained or Lost:	
Wetland hectare equivalents gained by deactivating drains	6.91
Wetland hectare equivalents secured by stabilising headcut erosion	29.10
Cost per Hectare/Functional Equivalent:	
Cost per hectare equivalent of restoring wetland functioning (linked to rehabilitating drainage/incised channels)	R 77,041.29
Cost per hectare equivalent of stabilising wetland functioning (linked to halting headcut erosion)	R 32,243.48
Overall cost per hectare equivalent of wetland habitat	R 109,284.77
Maintenance Requirement:	**Low**

[2] The costs of rehabilitating the wetland system were extrapolated to provide a more representative indication of the required rehabilitation, as detailed costings were only undertaken for the rehabilitation of the lower reaches of the system.

Generally, the stabilisation of active erosion and securing wetland functioning and integrity incurs less cost per hectare equivalent than wetland restoration activities. While the cost per hectare equivalent to restore functioning to the regions of the wetland that have been impacted upon by drainage and channel incision is greater than the costs of stabilising active erosion, the improved system functioning and integrity associated with the rehabilitation is considered to be important considering the size of the wetland unit and hectare equivalents that would be restored. The wetland represents an important source of biodiversity within the landscape, and the cost per hectare to maintain it is considered to be acceptable.

APPENDIX B - GENERAL CONSTRUCTION NOTES

(Ignore notes which are inapplicable)

1. **Occupational health and safety is a priority!** All necessary precautionary measures must be undertaken to ensure safety of the team. Particular attention must be given to deep excavations where gentle sloping back of soil or shoring must be applied to prevent possible soil collapse. Where risks are foreseen, these must be reported to the Occupational Health and Safety Agent employed by SANBI, who may need to seek further advice. In addition, no excavated earth or other materials should be stockpiled within a distance of one metre from the edge of any excavation. The one metre wide strip along the edges of all sides of an excavation should at all times be kept clear of objects such as lumps of clay, rocks or tools that could injure workers in the excavation if they were to fall in.

2. Check all dimensions on site to determine if any amendments to the designs are necessary. Note the required final height of the structure relative to the original ground level. The responsible engineer must be consulted before any changes are made to dimensions.

3. Excavation must be carried out to the final levels. Soil must be placed in areas best suited for re-use, for example, when building an earthen diversion embankment, the soil excavated should be used immediately in building up the embankment (on condition the excavated soil is of suitable quality). The excavated soil should alternatively be stockpiled immediately upstream of the site of the proposed wall. The topsoil must be stockpiled separately from the subsoil.

4. Where soil is to be the foundation for non-soil structures (for example, gabions and rafted weirs), all sand deposits must be removed and the floor well compacted while the soil is at optimum moisture content.

5. In instances where the addition of Gypsum (CaSO4) or lime has been specified for the amelioration of a dispersive soil, mixing must be carried out off site, after which it must be transported to the construction site.

6. When the final level of the soil construction has been reached the previously stockpiled topsoil must be added as an extra height and planted to suitable vegetation (unless other provision for protection of the structure has been specified).

7. When backfilling soil against concrete or gabion work, extra care must be taken to ensure that a waterproof join with the structure is, as far as possible, achieved. Compaction must be carried out in layers as specified by the engineer. Material containing organic matter must not be used for this backfilling purpose.

8. Ensure that the correct steel reinforcing, as specified, has been delivered to site. Ensure that the minimum cover, as specified by the engineer, is achieved at all times. All welded steel mesh joins must have an overlap of at least 200mm and must be securely tied with 2mm building wire. At least three rings at 150mm spacing are required. Where reinforcing bars are used, bars at joins must be overlapped as per the distance specified on the drawings. Particular attention must be paid to ensure the correct placing of steel reinforcing (particularly steel mesh with different bar sizes).

9. Before placing concrete on a rock foundation, carefully chip away any loose surface layers and wash away all debris. New surfaces must be painted with a cement slurry prior to the placing of the concrete.

10. Ensure that all shuttering is strong and well supported. It is recommended that the concrete be placed in layers no greater than one metre per day. The shuttering must be well oiled on the inside to prevent the concrete from sticking. Spacers between shuttering must be placed every one metre, both vertically and horizontally, with a minimum of two in both directions.

11. Note that when mixing concrete it is preferable to use a full pocket of cement with each mix. The specified cement water ratio must be maintained at all times.

12. The poured concrete must be "rodded" to ensure proper compaction. Never add more than one metre height of concrete in any one day, and attempt to lay the concrete in even, horizontal layers throughout the length of any section. Check the specifications for any requirement of expansion joints. The shuttering should be left for at least two days before stripping. Wetting the concrete while it is curing will make for a strong construction. Backfilling of soil against the completed structure may only be done after a period of at least seven days.

13. The use of "plums" in concrete: in some instances it may be feasible and economic to reduce the amount of concrete in mass gravity structures, by replacing up to 33% of the volume of concrete by the judicious use of suitable hand sized quarried rock. Where this is specified the rocks (purchased as handstone) must be so placed that there is always a minimum cover of 50mm between the rock and the shuttering, as well as between any two adjacent rocks. This should only be done where it is stated on the drawings that is permissible.

14. The standard procedures for the opening up and wiring together of gabion baskets and mattresses are well documented, and supplied with every delivery of the products. They must be strictly adhered to in all respects. Ensure that the lids of the final (top) baskets are always folded down and wired in a downstream direction.

15. Where rock-filled gabion baskets are used for the construction of keywalls, the trenches must be dug wide enough so that sufficient access is available to properly backfill and compact all the way around them. Making the trench only wide enough to receive the baskets is not acceptable, as water will eventually find its way around the structures and cause problems.

16. Where structures are to be built in dispersive soils, the following should be noted:

    - Impermeable cut off wall (at least 500mm deep) to be constructed under spillway section of the structure
    - Key walls to be impermeable
    - Impermeable barriers to be constructed between key walls and spillway section of structures

17. Sloping and vegetating gully banks where specified:

    Where the gully is no more than approximately 1.0 metre deep, and the catchment area small (say ten hectares), the topsoil of the site immediately adjoining the channel is removed and stockpiled in a safe place nearby. The subsoil thus laid bare is excavated at a slope not less than 1:3 (V:H) and deposited in the gully. This deposit is carefully compacted while in a moist state. The topsoil is now returned to the sloped area, and spread as evenly as possible over it. Vegetation suitable to the site is planted. The additional advantage to this idea is that, as the channel cross section is made shallower and wider and established to vegetation, so the chances of floodwaters overflowing into the adjacent flood area will be that much greater. Note that the base of the modified channel should be planted to strong, hydrophitic plants while the outer edges will require plants more suited to drier regimes. It must be emphasised that the stockpiling of the topsoil and its replacement is vital, especially where very erodible subsoil is present. Failure to do this will be tantamount to a waste of money and effort.

18. The orientation of all wetlands and interventions is to be taken facing downstream i.e. left bank and right bank are to be identified **facing downstream**.

19. The Bill of Quantities for the various rehabilitation interventions only included revegetation in those instances where the engineer considered the re-vegetation of the denuded area as important due to the size of the area affected or due to the risk associated with scouring and erosion.

APPENDIX C – DESIGN DRAWINGS

Note: designs are available for download as a separate document. Please refer to the Aurecon website (www.aurecongroup.com). Click on the "***Public Participation"***, and then the "**SANBI Working for Wetlands project**" links.

APPENDIX D – ENVIRONMENTAL AUTHORISATION RECORD OF DECISION

Note: this is a draft document for public comment. The Record of Decision will only be available once the final document has been submitted to the Department of Environmental Affairs and they have made a decision on the application for authorization.

APPENDIX E – LANDOWNER TERMS AND CONDITIONS AGREEMENT

Oct 25 2008 12:32PM HP LASERJET FAX p.4

WFW 003

national biodiversity institute
S A N B I

South African National Biodiversity Institute
Working for Wetlands Programme

Wetlands Rehabilitation Activities Consent

Property Details	
Property Type:	Farm
Registration Division:	
Farm Number:	
Portion Number:	
Farm Name:	Ferndale
Surveyor-General Key:	
Province:	Free State
Unique Wetland Number:	C81K-02

Owner Details					
Owner Name: (Full Names/Full Registered Name)	Johan Jacob Ferreira				
Person Type:	Company	Close corporation	Trust	X	Natural person
Registration/Identity Number:	5211055053084 (Where applicable. For a trust, attach a copy of the latest letters of trusteeship issued by the Master of the High Court.)				
Owner's chosen address for delivery of notices and documents:	Postal Address: Box 311 Harrismith 9880		Physical Address: Grootdraai farm		

Project Name: Maluti a phofung wetland

I/We hereby consent to the Working for Wetlands Programme of the SA National Biodiversity Institute and its appointed implementers undertaking the wetland rehabilitation activities listed in annexure "WFW 003A" attached hereto, for the project referred to above, subject to my/our approval of the relative Wetland Rehabilitation Plan, on the property described above of which I am the owner.

Name	J J FERREIRA	Position	owner
Signature		Date	2009-10-20

Please fax or post this form to:
The Working for Wetlands Project Manager
Land Resources International
PO Box 1211, PIETERMARITZBURG, 3200
FAX (086) 6859059 TEL (033) 3928360

With a copy to:
The Planning, Monitoring and Evaluation Manager
Working for Wetlands, SA National Biodiversity Institute
Private Bag X101, PRETORIA, 0001
FAX (012) 8435155 TEL (012) 8435191

Page 1 of 2

APPENDIX F – CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PROGRAMME (CEMP) FOR WORKING FOR WETLANDS PROJECTS

September 2010
CEMP Version: 1

***Prepared by*:**
Working for Wetlands programme
Planning, Monitoring and Evaluation Section

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TABLE OF CONTENTS

Section Page

1 Introduction

1.1 Context

This Construction Environmental Management Programme (CEMP) has been compiled as a guideline for the mitigation and management measures to be implemented during construction for the proposed wetlands rehabilitation projects in South Africa. **THIS CEMP MUST BE READ IN CONJUNCTION WITH THE FOLLOWING DOCUMENTS:**

- **BASIC CONDITIONS OF EMPLOYMENT ACT, 1997: CODE OF GOOD PRACTICE FOR EMPLOYMENT AND CONDITIONS OF WORK FOR SPECIAL PUBLIC WORKS PROGRAMMES (Annex 1) AND;**
- **BASIC ASSESSMENT REPORT**

1.2 Background to the request for the CEMP

The Department of Environmental Affairs (DEA) requested the compilation of a CEMP after the evaluation and authorisation of the Basic Assessment Report (BAR) applications for rehabilitation of wetlands in South Africa. The CEMP is based on Impacts Assessments, Public Participation input and Environmental Practitioner's experience.

The purpose of this document is to ensure that all projects implemented under the Working for Wetlands programme adopt an effective and appropriate approach to wetland rehabilitation and that all activities are compliant with relevant legislation. This includes, as top priority, ensuring that the safety of people involved in the projects is not compromised at any time, that rehabilitation interventions are sustainable and that the objectives of the Expanded Public Works Programme (EPWP) and Working for Wetlands are maximised through the projects.

This document forms part of the agreement between the South African National Botanical Institute (SANBI) and each project implementer. This document outlines areas in which compliance is required and serves as a reference against which practices shall be audited. Given that each project operates under specific conditions, innovation by the implementers, and modification of the CEMP, where appropriate, are encouraged within the framework of the prescripts in Section 2.

1.3 Site description

1.3.1 Proposed project and associated construction and operational activities

Refer to the attached Basic Assessment Report appendix A and D

1.3.2 Affected biophysical, economic and social environment

Refer to the attached Basic Assessment Report appendix A and D

1.3.3 Potential Issues Identified during the Impact Assessment in BAR

Refer to the attached Basic Assessment Report appendix A and D

2 Prescripts

2.1 Expanded public works programme

2.1.1 Compliance with the requirements of the Expanded Public Works Programme

All projects shall comply with:

- The Ministerial Determination on Special Public Works Programmes (Government Notice No. R 63, 25 January 2002)
- The Code of Good Practice for Employment and Conditions of Work for Special Public Works Programmes (Government Notice No. R 64, 25 January 2002)

2.1.2 Employment

The implementer shall not employ any contractor or staff member who has been dismissed from any other project or expanded public works programme. The implementer shall ensure representivity with respect to race and gender in the selection of staff.

2.1.3 Target groups

Projects shall work towards the following targets in all occupational categories, with respect to employment:

- 60 % women
- 20 % youth (18 to 25 years)
- 2% disabled

Where these targets are not immediately realized, a transformation plan shall be put in place to achieve them. The plan will include targets and reasonable timeframes. Progress will be evaluated annually.

2.1.4 Remuneration

All work must be task based. Written approval from the Regional Coordinator is required when this is not possible. Workers are to be paid on the basis of the number of tasks completed.

Employers will pay workers rates provided for in the approved PIP guideline for the current financial year

Contractors shall pay the workers the wage agreed for the task. All production bonuses shall be distributed equitably amongst team members when production targets are achieved.

2.1.5 Employment contracts

Contractors shall have an employment contract with each of their workers. Workers shall have the contents of the contract explained to them, and shall indicate that they understand its contents and the grievance procedure and disciplinary code shall be available to all workers

2.1.6 Management structure

The implementer's management organogram shall be made available to Working for Wetlands upon request. Project management capacity shall be adequate to deal with the size of project. Each contractor may only have one team.

The implementer and his/her staff shall not have any financial involvement with contractors outside of the formal tender agreements

2.2 Health and safety

2.2.1 Medical examinations

Prior to employment, all employees shall undergo a medical examination performed by a registered occupational health practitioner. Specific job classes shall have annual medical examinations or other tests as specified in the Occupational Health and Safety (OHS) Act.

Records of all medical examinations shall be kept by the implementer.

2.2.2 First aid kit

An adequately equipped first aid kit shall be easily accessible at all work sites. The first aid kit shall be kept fully stocked according to the stock list.

All first aid treatment and usage of stock shall be recorded in the dressing book kept on site.

The first aid kit shall be under control of a trained and competent first aid officer with a current certificate. Each team shall have at least one trained first aid officer and one alternate

2.2.3 Personal protective equipment and clothing (PPE)

The PPE prescribed in the agreement between the implementer and contractor shall be worn at all times during work. PPE shall meet the minimum prescribed standards of quality (SABS approved). PPE shall be replaced when it becomes ineffective through wear and tear.

In order to maintain consistency within the programme, Working for Wetlands shall provide designs to be used on the t-shirts worn by the workers

2.2.4 Occupational health and safety

Each project manager and contractor shall have a copy of the OHS Act. All relevant OHS standards will be fully implemented.

In terms of the OHS Act, the provincial director shall be notified of planned construction work.

The designated health and safety officer shall also be appointed as the construction safety officer. The appointment letter shall be available on site.

Incident reports shall be up to date and available. All incidents shall be reported within 24 hours to the Regional Coordinator. All incidents shall be investigated by a trained incident investigator within 7 days of the incident.

All near misses shall be reported to the Regional Coordinator on a quarterly basis.

Health and safety meetings shall be held for all implementers at the quarterly national implementers' forum.

The programme manager, technical advisors and regional coordinators of Working for Wetlands shall intervene to suspend operations at projects where clear violations of health and safety legislation and the best management practices are observed, and where these violations constitute a clear health and safety risk.

2.2.5 Compensation for Injuries and diseases

It is the responsibility of the employers (contractors) to arrange for all persons employed on a Special Public Works Programme (SPWP) to be covered in terms of the Compensation for Occupational Injuries and Diseases Act, 130 of 1993. The employer (contractor) shall pay a worker who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer shall be refunded this amount by the Compensation Commissioner. This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.

2.2.6 Water quality

In wetlands with a high risk of pollution, such as those in urban areas, the project manager shall take steps to ensure that he/she is aware of changes in water quality. If water quality is found to be so poor that it is a threat to health, the following steps shall be taken:

- Workers shall be made aware of it immediately.
- If unable to supply appropriate PPE, work shall stop.
- Workers shall be encouraged not to drink water directly from the wetland.
- Technical Advisors shall be informed of poor water quality.

2.2.7 Water and flooding

Teams working near open water shall have life jackets on site. Consideration shall be given to the safety of team members working near water who are unable to swim.

Given the nature of the work, project managers and contractors shall be sensitive to the potential dangers of floods. A highly risk averse approach shall be followed whenever dealing with an actual or potential flood event. Rainfall in the catchment above the wetland, and flow within the wetland shall continually be visually monitored by project managers and contractors. In high rainfall events where there is an increased risk of sudden floods, workers shall be withdrawn from the site.

2.2.8 Substance abuse

The use of any narcotic substances is not allowed on sites.

The implementer and contractors shall ensure that workers do not perform their duties under the influence of any narcotic or alcoholic substances. Workers who are under the influence during work hours shall be dealt with in terms of the appropriate disciplinary procedures

2.3 Transport

2.3.1 Compliance of vehicles

All vehicles (including trailers) used by projects shall comply with all legal requirements in terms of roadworthiness and licensing and shall display a valid license at all times. The following vehicles shall display a valid Certificate of Fitness:

- Any truck, bus or minibus where the gross vehicle mass exceeds 3500 kg. Any vehicle designed or adapted to convey 12 persons or more, including the driver.
- Vehicles used in transporting persons for reward.

Vehicle size shall be suitable for the number of passengers to be transported. For bakkies, the minimum space required per person translates to the following capacity, including driver and passengers in the front and back:

- Short wheelbase bakkie 0,25m^2 per person standing = 15 persons 0,35m^2 per person seated = 11 persons
- Long wheelbase bakkie 0,25m^2 per person standing = 17 persons 0,35m^2 per person seated = 13 persons.

Minibus taxis shall not carry more than the number of people for which they are certified.

Retreads shall not be fitted to the front wheels of vehicles used for carrying passengers. Wheels on the same axle must be of the same size and be fitted with the same type of tyre.

2.3.2 Daily vehicle checklist

A daily pre-trip vehicle check shall be done and recorded by the driver on a suitable checklist. The checklist shall be up to date and kept in the vehicle. Trailers shall form part of the daily checklist. The project manager shall verify and sign the checklists weekly.

Faults affecting the roadworthiness of the vehicle shall be repaired immediately or alternative transport used.

2.3.3 Driver's licenses and permits

All drivers shall have a valid driver's license for the vehicle category used. The competence of all drivers shall be verified by the implementer. All contractor drivers shall be in possession of a valid appropriate Professional Driving Permit (PDP) for the category of vehicle.

Drivers shall undergo an annual medical check and the results shall be filed with the project manager.

Driver's licenses shall be verified annually by the local traffic authority or by telephoning 012 303 2718.

2.3.4 Passenger safety

Vehicles used for transporting workers shall have suitable passenger facilities, including as a minimum:

- Sufficiently strong railings to a height of 350mm above seat surface or 1000mm above standing surface.

- If installed, benches shall be properly secured
- If installed, canopies or tarpaulins shall be properly secured and ventilated.
- Tools, equipment and containers shall be suitably secured and isolated from passengers .
- Workers and materials, such as rock, cement etc, shall not be transported in the same vehicle at the same time.
- Bakkie-drawn trailers may under no circumstances be used for transporting people.

3 Administration

3.1 Contractor's documents

The contract between the implementer and the contractor shall be readily accessible to project managers and contractors. The project manager must ensure that the contractor and workers understand the contract.

Each contract shall be allocated a unique identity number.

The following shall form part of the contract between the implementer and contractors:

- Rehabilitation specifications
- Technical drawings of the structures, including a list of the material required.
- Environmental management plan
- Site plans

3.2 Records, data and quality control

Each contractor shall maintain an up to date timesheet of daily worker attendance. Details of new appointments shall be submitted to the implementer. Timesheets shall be available for inspection by any Working for Wetlands staff member. A record shall be kept of equipment and consumables issued against the contract document. A quality control sheet completed by the implementer shall record on-going quality checks and the final check before payment. This shall certify that work done complies with contract specifications.

3.3 Payments

The implementer shall ensure that the contractors' workers have been paid on time and in the amount to which they are entitled. Proof of such payment, signed by all team members, shall be submitted to Working for Wetlands on request.

Disabled team members shall be paid the same amount for the days worked as other workers, and the contractor shall claim the half disabled wage back from the implementer.

In situations where tasks are completed before the expected time period, workers shall still be paid for the original number of days quoted. For example, if a team planned to take 15 days to complete a task that is subsequently accomplished in 10 days, the contractor shall still pay the workers for the full 15 days.

Each worker shall receive a payment advice that complies with the requirements of the EPWP documents listed in Section 1. A copy of all contracts and documentation relating to payments to workers shall be retained by the contractor and implementer. This documentation shall provide proof of receipt of payment by workers, and shall be made available to Working for Wetlands on request.

4 General Environmental Guidelines for Construction

4.1 Introduction

As requested by the DEA, this document serves as a guideline for the management of the site by the Environmental Control Officer (ECO). Duties of the ECO shall be carried out by the Provincial Coordinator (PC) (monthly inspections) in order to minimise adverse environmental impacts and effects. The PC shall be informed of incidents and accidents on site by the Implementer and His/her staff.

The CEMP provides specifications and regulations that shall in all instances be adhered to. However, it is the responsibility of all people involved to commit themselves to the implementation of the CEMP in all phases of the project or in those instances where specific instructions are provided. The implementer shall be responsible for ensuring compliance of the contractors with the CEMP and shall rely on regular monitoring for compliance. The contractor shall monitor his/her employees to ensure their compliance with the provisions of the CEMP. The contractors shall receive copies of the CEMP from the client at which time he/she will be given the opportunity to resolve any misconceptions and uncertainties. The CEMP shall form part of the contract and will therefore be a legally binding document. In the event of discrepancy with regard to environmental matters or environmental specifications this document shall take precedence.

4.1.1 Environmental Control Officer (ECO)

The contractor shall direct all his/her queries regarding any environmental issues or aspects to the ECO. The ECO shall discuss the matter with the DEA as required and give feedback to the contractor. The ECO shall be responsible for evaluating compliance of all aspects of the CEMP. Monthly site audits shall be undertaken by the ECO and a detailed report submitted to the SANBI and the DEA for review prior to the following audit. If queries or problems arise for issues that cannot be proficiently addressed by the ECO, the ECO shall seek advice from the Project Manager who shall seek assistance from a person or persons that are educated and experienced in the relevant field.

4.1.2 Feedback to the DEA

Any problems or areas of non-compliance with regard to the CEMP shall be communicated to the Contractor by the ECO, in addition to informing the DEA, who will decide on appropriate action.

4.1.3 Failure to comply with the Environmental Considerations

The ECO shall order the contractor to suspend part or all of the works if the contractor causes damage to the environment by not adhering to the specifications set in the CEMP. The suspension shall be enforced until such time as the offending party/ies' actions, procedure and/or equipment are corrected. No extension of time shall be granted for such delays and all costs shall be borne by the Implementer.

The programme manager, technical advisors and regional coordinators of Working for Wetlands shall intervene to suspend operations at projects where clear violations of the environmental management plan and the best management practices are observed, and where these violations are having or have the potential to cause a significant environmental impact

4.1.4 Environmental training programme

The ECO, with the assistance of the contractor, shall communicate all aspects of the CEMP to the site staff (i.e. from site agents to labourers) prior to commencement of excavation or any other environmentally disturbing activity. Basic environmental awareness training shall be carried out for all employees and shall be included in safety training. A copy of the CEMP shall always be made available on site.

4.1.5 Progress / site meetings

Environmental issues shall be put on the agenda as a discussion point during progress/site meetings. The Implementer, or a designated person involved with environmental issues on the project, shall attend the progress and/or site meetings on a regular basis to provide feedback on any outstanding or contentious environmental matter.

4.2 Public participation

Public participation was undertaken as a component of the BAR. The links to the community that have been established shall be maintained and utilised to the mutual benefit of all parties. The ECO is responsible for addressing any environmental problems or queries that are raised by the community and therefore shall maintain close contact with the representatives of the immediate community. This CEMP shall be made available, on request, for the public to peruse.

5 Site Establishment

5.1 Site plan

The project manager shall design a site plan for each site that identifies suitable locations for all work, storage, parking, toilet, processing and other areas. The Contractor shall erect and maintain temporary boundary markers of the type and in the locations directed by the Engineer. Such markers, such as danger tape or suitable equivalent, shall be erected before undertaking designated activities.

5.2 Site clearance

The Contractor shall ensure that the clearance of vegetation is restricted to that required to facilitate the execution of the Works. Site clearance shall occur in a planned manner, and cleared areas shall be stabilised as soon as possible. The detail of vegetation clearing shall be to the Engineer's approval. All cleared vegetation shall either be mulched and mixed into the topsoil stockpiles or disposed of at an approved disposal site. The disposal of vegetation by burying or burning is prohibited without the requisite permit from the local authority.

The Contractor shall strip the Topmaterial within the working areas. The Topmaterial shall be stockpiled separately from subsoil and used for subsequent rehabilitation and revegetation. Topmaterial stockpiles shall not be compacted.

Should fauna be encountered during site clearance, earthworks shall cease until fauna have been safely relocated.

5.3 "No-go" areas

The construction site shall be contained in an area required to undertake the works. Any area beyond shall be

considered "no go" areas. The Contractor shall ensure that, insofar as she/he has the authority, no unauthorised entry, stockpiling, dumping or storage of equipment or materials shall be allowed within the demarcated “no go” areas.

“No go” areas shall be demarcated with fencing consisting of wooden or metal posts at 3 m centres with 1 plain wire strand tensioned horizontally at 900 mm from ground level. Commercially available danger tape, or suitable equivalent, shall be wrapped around the wire strand. The Contractor shall maintain the construction site boundary for the duration of construction and ensure that the danger tape does not become dislodged.

5.4 Waste currently on site

The site shall be cleared of all litter/waste prior to any construction related activities and the waste shall be disposed of at a registered waste disposal facility. This is to ensure that no waste is incorporated into the environment during the construction process. Recycling of waste material shall be encouraged.

5.5 Vegetation clearing

Vegetation on the site shall be removed but care shall be taken to confine removal of vegetation during construction activities to within the boundaries of the development area. The removal, damage or disturbance of any flora and fauna outside the construction area shall not be permitted unless specifically authorised by the ECO.

No areas may remain cleared (bare soil exposed) for longer than 3 weeks. Efficient construction planning must ensure that all relevant materials, construction equipment and manpower are available upon commencement of construction in an area. Thereafter, the cleared areas must be suitably re-vegetated (refer to Section 12).

5.6 Biodiversity

Disturbance of indigenous plants and animals shall be minimised. Collection of indigenous plants, parts of plants or animals may only take place with the appropriate permits.

Level 2 and 3 structures shall take into consideration the migration of fish species.

Bio-engineering methods that involve re-vegetation will, as far as possible, use individuals of local species taken from surrounding areas, in order to avoid or reduce genetic pollution. Collection must not lead to habitat destruction. Alien species may not be used for re-vegetation unless approved by the Provincial Coordinator.

5.7 Removal of topmaterial

Topmaterial (up to a maximum of 30 cm) shall be removed from the work area and stockpiled for re-use in subsequent rehabilitation and landscaping activities. The topmaterial shall be stockpiled separately from the subsoil and construction materials. The contractor shall ensure that no remnants of stockpiles are left in positions or states that may be eroded during and after construction.

5.8 Defacement of natural features

Trees, natural vegetation, or any other natural features outside the work area, which will not be cleared for construction purposes, shall not be defaced or painted for benchmarks. No damage is permissible, not even for survey purposes. The latter shall only be undertaken if agreed to by the ECO. Any feature defaced by the contractor shall be reinstated to the satisfaction of the ECO.

Should any Red Data species be encountered, *in situ* conservation shall be undertaken if at all possible. Should

this not be considered possible then a specialist shall be consulted for possible relocation.

In addition, any bird nests encountered should not be interfered with. If impact is unavoidable the nest shall be relocated by a suitably qualified individual.

No pesticides of any description shall be used during the construction phase. Pesticides should also be discouraged from use during the operational phase of the project.

For the conservation of wildlife, should any be found, species may not be killed or otherwise deliberately disturbed. It is anticipated that as a result of the construction wildlife species will take shelter in neighbouring areas and reserves. Although highly unlikely, construction workers should be advised not to catch or kill any wild animals in the area, including snakes.

5.9 Heritage sites and features

No archaeological or heritage sites have been identified on site. If archaeological or heritage sites are exposed during construction work all activities shall be halted and the incident shall immediately be reported the appropriate provincial heritage authority[1] for investigation and evaluation of the find. Old burial grounds (if found) will be reported to the ECO who will advise the contractor as to the mode of action, which will include informing the South African Police Service (SAPS) and the South African Heritage Resources Agency (SAHRA).

5.10 Stabilizing of steep slopes

The disturbance of steep slopes, for example by the removal of vegetation, may result in slope instability and erosion by rain and surface runoff. All slopes that are disturbed during construction shall immediately be stabilised to prevent erosion. The rehabilitation measures listed in Section 12 must be implemented in the rehabilitation.

5.11 Removal of alien vegetation

The contractor shall ensure that invasive alien vegetation is cleared from the entire site prior to the commencement of construction activities. Any species that are declared invasive species [according to the Conservation of Agricultural Resources Act (Act 43 of 1983)] must be removed from site. Follow up clearing may be necessary if the species re-establish following the initial clearing. No trees within environmentally sensitive areas may be removed, whether alien species or not, unless permitted by the ECO.

Other alien species (non-listed) occurring on site shall not be used for landscaping activities and shall be removed from site where possible.

5.12 Revegetation

Once construction is complete, rehabilitation (i.e. the planting of indigenous vegetation) of all disturbed areas shall be undertaken in order to restore the aesthetic and ecological value of the area. Only locally appropriate indigenous vegetation shall be utilised. Rehabilitation shall be undertaken according to the following schedule:

- Infilling of all excavation work. Subsoil shall be filled in first to ensure that topsoil is present on the surface to secure a suitable plant growth medium. Substrate that is not suitable for plant growth should not be used for infilling of excavations unless it is used at a suitable depth e.g. deeper than 2 m.

[1] If no provincial heritage authority in place then the South African Heritage Resources Agency (SAHRA) shall be contacted.

- Removal of all construction rubble from the site, including substances that cannot be used for infilling of excavations, shall be undertaken.
- Steep and unstable slopes shall have stabilising measures put in place to prevent collapse of the slopes or soil erosion. Slope stabilisation and soil erosion prevention measures include the placement of silt fences, staked grass sods and rows of sawdust filled onion bags.
- The exposed ground should be seeded and mulched with an appropriate stabilising grass mixture. A good stabilising grass seed mix should include:
    - *Andropogon eucomus* (Snowflake Grass)
    - *Aristida congesta* (Tassel Three-awn)
    - *Cenchrus ciliaris* (Foxtail Buffalo Grass)
    - *Cynodon dactylon* (Kweek/Couch grass)
    - *Digitaria eriantha* (Common Finger Grass)
    - *Eragrostis curvula* (Weeping Love Grass)
    - *Imperata cylindrica* (Cottonwool Grass)
    - *Melinis repens* (Natal Red Top)

The site shall be watered following seeding and mulching, and continued on a regular basis, the frequency depending on the amount of rainfall received. Should germination not occur within one month of planting, the site should be reseeded and mulched.

6 Environmental planning

The implementation of wetland rehabilitation activities has potential impacts on the wetland site and the downstream habitat. The implementation of these activities shall take into consideration the following potential impacts.

6.1 Hydrological impacts

The construction of interventions within watercourses is likely to have difficulties associated with the presence of water, under both normal and wet conditions. In the event that the planned interventions are located within the seasonal and permanent zones of the wetland, diversions may need to be put in place to temporarily divert water away from the work site.

In order to reduce the requirements to divert water from the construction site, implementation of the rehabilitation activities within seasonal and permanent wetness zones shall take place within the dry season:

- Winter rainfall areas - November to March
- Summer rainfall areas - May to September

In those cases where working in wet conditions is unavoidable the following shall be implemented:

- Water shall be diverted away from the intervention site during the implementation of rehabilitation activities
- Diversions shall be temporary in nature (e.g. sand bags, eco-logs)
- Upon completion of the rehabilitation activities at the site, the diversions shall be removed to restore natural flow patterns
- In those instances where the impact of the diversions are negligible and removal may result in further disturbance, diversions structures shall be left *in situ* (this shall be decided in consultation with Working for Wetlands)

Water courses are subject to unanticipated flooding and adequate precautions shall be taken to avoid damage to facilities, equipment and wetland habitat:

- Ensure storage areas are located outside of floodable areas
- Minimise the extent of disturbed/exposed areas to reduce extensive damage during flood events

6.2 Disturbances

6.2.1 Vegetation

Disturbance of indigenous plants within the wetland and surrounding catchment shall be minimised. In the event that vegetation needs to be removed during construction, the vegetation shall be stored in a shaded and moist area, for use in revegetation. Re-vegetation of all exposed soil must be done before the team leaves the site.

Bio-engineering methods involving the re-vegetation or planting of specified areas shall, as far as possible, use local plant species obtained from the following sources:

- vegetation removed during excavation,
- local ‘borrow’ sites, or
- naturally sourced seed mixes

This should limit the threat of introducing genetically-modified and genetically different species into the area. Non-invasive alien plant species shall not be used for re-vegetation unless approved by the Working for Wetlands (e.g. Vetiver grass)

The collection of indigenous plant or parts thereof shall only take place if the following guidelines are followed:

- Obtain the required collection permits
- Limit habitat destruction
- Implement 'mosaic' collection to ensure limited disturbance and adequate recovery of the 'borrow' site.

6.2.2 Faunal species

Disturbance of faunal species within the wetland and surrounding catchment shall be minimised. This includes minimising:

- disruptions to the movements/migration of species;
- interruptions of breeding activities and behaviour;
- disturbance of feeding and breeding sites.

The presence of species of conservation importance shall be known prior to the commencement of rehabilitation activities. In those instances where these species are present, work shall be scheduled to reduce the impacts on the abovementioned activities. This information shall be determined by means of consultation with specialists.

The construction of interventions within wetlands and watercourses necessitates the planning of these interventions taking into consideration the migration of fish species where applicable.

6.2.3 Local resources

In some instances locally available resources may be utilised in the implementation of wetland rehabilitation activities. This would primarily be rocks for the construction of gabion structures. Prior approval of the technical advisor shall be obtained, with respect to:

- suitable rock types,
- suitable areas for collection, and
- appropriate collection methods

All purchased rock shall be from registered and approved crushers. Copies of the certificates shall be kept on file by the implementer. Any rock that is collected from old quarries or mine dumps shall have the necessary documentation from the land owner.

6.3 Compaction

The storage of materials and access to the site is likely to result in the compaction of the soil around the site. This increases the risk of erosion and sediment generation originating from the site.

All impacted areas shall be rehabilitated (loosen soil and re-vegetate) once work has been completed and prior to the team leaving the site. These activities shall include the closure and rehabilitation of temporary access routes and addressing any potential erosion risks.

6.4 Sediment mobilisation

The construction of interventions within watercourses is likely to have impacts on downstream habitat associated with the presence of sediment within runoff water. In order to reduce impacts associated with sediment from the construction site, implementation of the rehabilitation activities should take place within the dry season:

- Winter rainfall areas - November to March
- Summer rainfall areas - May to September

In those instances where the toes of structures are designed to be flooded by the downstream structures work shall commence from the top of the system down. This shall ensure that work occurs in drier conditions and less sediment would be mobilised during excavation. The impacts associated with sediment generated during earthworks shall be minimised by constructing temporary sediment traps downstream, preferably at the location of the next intervention, to reduce disturbance footprints.

In those instances where structures are not designed to be flooded by downstream structures, the interventions shall be constructed from the bottom of the system up, so that each structure then serves as a sediment trap for the construction upstream.

Further measures to reduce sediment generated from construction activities include ensuring that soil is not deposited into a watercourse and the re-vegetation of the exposed areas as soon as possible as per Section 10.2.

7 Construction Site

7.1 Restriction to working area

It is important that activities are conducted within a limited area so as to facilitate control and to minimise the impact on the existing natural environment and disturbance to the neighbouring communities. Working areas are defined as those areas required by the contractor to undertake the works as agreed with the ECO.

7.2 Contractor's camp

An area to be approved by the ECO shall be taped off for the purpose of temporary staff accommodation facilities during the construction period. . The contractor's camp, offices and storage facilities shall be located within the site boundaries. No person shall be allowed to stay on the neighbouring site. Any temporary structures erected during construction will be restricted to the construction campsite. The taped area shall include that of a 10 m buffer zone between the site and the 1:100 year floodline of any watercourse and/or dam.

All staff remaining on site shall be supplied (by the contractor) with adequate protective clothing, water and refuse facilities (with regular collection) and facilities for cooking and heating. No open fires shall be permitted.

The contractor shall provide water and/or washing facilities at the construction camp for the site staff.

All contractor vehicles shall be stored in a location where an oil trap shall be installed to prevent soil pollution. The ECO shall advise the contractor on a suitable area on the site.

7.3 Stores and workshops

Stores buildings and containers shall be secure and provide safe storage space where equipment and materials will not deteriorate.

All stores and workshops shall comply with the OHS Act and shall show a high standard of housekeeping.

7.4 Refuse

Refuse refers to all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc), waste and surplus food, food packaging, organic waste etc. The contractor shall be responsible for the establishment of a refuse control and removal system that prevents the spread of refuse within and beyond the construction site.

The contractor shall ensure that all refuse is disposed of by him/her and his/her sub-contractors' employees in refuse bins which he/she shall supply and arrange to be emptied on a daily basis. These bins shall all have lids and shall be adequate in number and accessibility.

Waste shall be separated as follows:

- Hazardous waste, consisting of substances that may be harmful to the receiving environment, and therefore require precautionary measures when handled. Examples include (but not limited to) oil, paint, diesel etc, (in addition, refer to Section 7.7 and 10.8).

- General waste, consisting of non-hazardous substances and substances that cannot be recycled. Examples include (but not limited to) construction rubble, excess construction materials that cannot be reused, and food waste.
- Reusable construction material, which can be used at other construction sites.
- Where possible, glass and metal waste should be separated and removed from site for recycling purposes

Refuse bins shall be watertight, wind-proof and scavenger proof and shall be appropriately placed throughout the site and shall also be conspicuous (e.g. painted bright yellow). Refuse shall also be protected from rain, which may cause pollutants to leach out. Particular caution shall be exercised with regards to handling of hazardous waste, to ensure that it does not spill or leak from the waste collection containers. The utmost care shall be taken to ensure that no waste is able to enter wetlands and/or dams on or near to the site.

The contractor or the appointed Waste Removal Company shall truck refuse collected out of the construction site. Refuse shall be disposed of at a Department of Water Affairs (DWA) registered site, which is also approved of by the contractor and the local authority. Refuse shall not be burned or buried on or near the site.

The contractor shall ensure that the contractor's camp and construction site is cleaned on a daily basis. These areas shall then be inspected by the contractor to ensure compliance with this requirement. A litter patrol around the construction area shall take place twice weekly to ensure that all litter is cleared up.

The contractor shall be warned, in writing, by the ECO of any infringement and shall be expected to clear the litter within 24 hours of the notification.

The contractor shall be responsible for cleaning the contractor's camp and construction site of all structures, equipment, residual litter and building materials at the end of the contract and where necessary and appropriate, the ground scarified, topsoil restored and indigenous vegetation re-established.

The contractor will be responsible for removal of rubbish, which may wash into watercourses as a result of litter. The contractor will also be responsible for any litter in the sensitive areas, which is dumped or left there by the construction crew.

7.5 Ablution facilities

The contractor shall be responsible for provision of sanitation for his/her and the sub-contractor's staff. Where possible, a minimum of one pit latrine shall be provided per 15 persons. Toilets may not be situated within 50 metres of a watercourse. Should toilets be needed elsewhere, their location shall first be approved by the ECO. The ECO is responsible for ensuring that any toilets placed are suitably situated and comply with requirements stated below.

The toilets shall be provided with doors and locks and shall be secured to prevent them from falling over. Toilets shall be placed outside areas susceptible to potential flooding. The contractor shall supply toilet paper at all toilets at all times. Toilet paper dispensers shall be provided in all toilets. The contractor shall ensure that the labourers make use of the toilets provided.

The contractor shall be responsible for the cleaning, maintenance and servicing of the toilets. The contractor shall ensure that the toilets are protected from vandals. No litter or general waste shall be placed in the toilets.

Upon completion of the contract the pit latrines shall be filled in and all structures shall be removed from site.

Washing areas with soap and sufficient clean water shall be provided for hand washing after ablutions . .

7.6 Eating areas

The contractor shall, in conjunction with the ECO, designate restricted areas for eating. The contractor shall provide adequate refuse bins that must be cleaned on a daily basis.

The feeding, or leaving of food, for stray or other animals in the area is strictly prohibited.

7.7 Fuel and chemical management

The contractor shall ensure that fuels and chemicals (e.g. drums of fuel, grease, oil, brake fluid, hydraulic fluid) are stored and handled carefully so as to prevent spillage. In the event of a spill, appropriate steps shall be undertaken to prevent widespread pollution. These liquids shall be confined to specific and secured areas within the contractor's camp and shall be clearly marked. The liquids shall be stored in a bunded area with adequate containment (at least 1.5 times the volume of the fuel) with an impermeable floor beneath them for potential spills or leaks, in such a way that does not pose any danger of pollution even during times of high rainfall.

In addition, the contractor shall ensure that workers do not smoke or take part in any activity that may result in sparks in the vicinity of fuels and other flammable substances to prevent ignition.

Refuelling of vehicles shall only take place at a predetermined area, where adequate pollution prevention measures are in place to such as a smooth impermeable floor (concrete or 250 µm plastic covered in sand). Appropriate signage shall be erected indicating the refuelling and storage areas. Mixing of lubricants will be on the non-pervious layer at least 20m from the wetland edge.

A specialist waste contractor shall dispose of any hazardous waste off-site at a licensed hazardous waste disposal site.

The contractor shall be responsible for ensuring that any party delivering potentially dangerous chemicals and oil to site is aware of the appropriate storage and drop-off locations and procedures. Transfer of hazardous chemicals and other potentially hazardous substances shall be carried out so as to minimise the potential leakage and prevent spillage onto the soil.

7.7.1 Equipment

Drip trays shall be put in place in relevant locations (inlets, outlets, points of leakage, etc) so as to prevent spillage or leakage during transfer. The contractor shall stand any equipment that may leak, and does not have to be transported regularly on watertight drip trays to catch any pollutants. The drip trays shall be of a size that the equipment can be placed inside it. Drip trays shall be cleaned regularly and shall not be allowed to overflow. Substances, which cannot be reused, shall be disposed of according to the relevant waste disposal procedure. The ECO shall inform and advise the contractor as to the best waste disposal procedure.

If fuel is dispensed from 200 litre drums, only empty externally clean drums may be stored on the bare ground. All empty externally dirty drums shall be stored on an area where the ground has been protected. The proper dispensing equipment shall be used, and the drum shall not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage drum shall be stored in a waterproof container when not in use.

7.7.2 Spill procedure

The contractor shall keep the necessary materials and equipment on site to deal with spillage of the relevant hazardous substances present on site. The contractor shall set up a procedure for dealing with spills, which will include notifying the ECO and the relevant authorities immediately following the spillage event. These

procedures must be developed with consultation and approval by the appointed ECO.

The cleanup of spills caused as a result of the construction activities, and any damage to the environment, shall be for the contractor's own account. A record must be kept of all spills and the corrective action taken.

7.8 Vehicles

Site vehicles shall only permitted within the demarcated construction camp, as required, to complete their specific task.

All construction vehicles shall be in a good working order to reduce possible noise pollution. Local and Provincial Noise Regulations shall be complied with at all times.

On-site vehicles shall be limited to approved access routes and areas (including turning circles and parking) on the site so as to minimise excessive environmental disturbance to the soil and vegetation on site. Servicing and maintenance of vehicles on-site shall be avoided as far as possible.

Construction shall be limited to normal working hours (as described in Section 10.1), in order to limit disturbance from vehicles and construction activity.

7.9 Hand tools

Hand tools will be suited to the nature of the work. Tools will have correct, properly secured handles and will be in safe working order. Tools will be properly maintained and sharpened regularly. Tools will be used in the correct and safe manner.

7.10 Concrete mixers, compactors and other machinery

All machinery will have the required machine guards. All nip points, pulleys, fan belts and revolving parts will be suitably enclosed. Power take offs will be provided with suitable covers in good condition. Covers will be chained to non-revolving machinery.

Only trained operators may operate machinery, and will wear the required PPE. Workers, other than machine operators, will not be within two spade lengths of operating machinery

Concrete mixers may only operate on a stable, level site.

Machinery will be in good working order. If owned by the implementer or contractor there will be a maintenance schedule and record for the machinery. Machinery will be used safely and efficiently at all times.

7.11 Stockpiling of materials

The contractor shall temporarily stockpile excavated materials (e.g. soils and rocks) and construction materials in such a way that the spread of materials is minimised. The stockpiles may only be placed within the demarcated stockpile area, which must fall within the demarcated construction area. The contractor shall, where possible, avoid stockpiling materials in vegetated areas that will not be cleared. Stockpiles of construction materials must be clearly separated from topsoil stockpiles in order to limit any contamination of the topsoil. Stockpiles shall be located away from sensitive hydrological features (including but not limited to dams, wetlands, watercourses, ponds, pans, drainage channels, etc.). Stockpiles shall be less than 2 metres in height.

Storm water runoff from the stockpile sites and surrounding areas shall be directed into the storm water system

and shall not run freely into the surrounding environment, or create “ponding” or accumulation of water. Stockpiles shall be stabilised if signs of erosion are visible. Erosion control measures such as silt fences must be placed around the stockpiles.

7.12 Stock control

The receipt and issue of all equipment and supplies will be adequately controlled. All issues and receipts will be recorded. The balance of stock recorded will correspond at all times with stock in the stores. Designated managers will verify stock periodically and an bi-annual stocktaking will be done. The proper procedures will be followed in disposing of unserviceable or surplus items.

Where contractors cannot make use of proper dedicated stores, all equipment and supplies will be safely and securely stored with controlled access.

7.13 Temporary fencing

The contractor shall ensure that the construction camp is demarcated with danger tape, or suitable equivalent, for the duration of the construction period.

The tape shall serve to prevent public access to the camp, for public safety and security reasons. Tape shall be placed around the sensitive hydrological features buffer no-go areas on site.

The contractor must maintain the tape for the duration of the construction period. All tape must be removed and the site restored on completion of the project.

8 Method of work

8.1 Verification of work

Actual work done (volumes and areas) shall be verified and recorded by the implementer, who is responsible for ensuring that contractors' invoices correspond to actual production. The implementer shall verify a minimum of 5% of work completed during the month. On completion of an intervention, a certificate of completion shall be submitted to the regional coordinator by the implementer.

8.2 Corrective action for sub-standard work

Payment shall not be made for work that does not comply with contract specifications. A record shall be kept of non-compliance to standards and poor performance. Copies of instructions issued to contractors to correct deficiencies shall be kept.

8.3 Minimum standards for construction

8.3.1 Gabions

Gabion work shall be done according to design specifications.

Minimum 2.5mm double galvanised wire shall be used, with a mesh size that is appropriate to the size of the rock being used. Support and binding wire shall be a minimum 2.2 mm. Lacing will be done according to specification. Support wires shall be in place (bracing). All adjoining baskets shall be laced together. Geotextile shall line all faces of the gab ion baskets that are exposed to earth and certain water exposed sides.

Water corrosivity shall be determined at each site; if necessary PVC coated gabions shall be used.

Soil dispersivity shall be determined at each site. If dispersive soils are detected, the technical advisor shall be contacted.

Density of fill material shall satisfy the gabion design. Clay bricks, weathered rock and sandstone and shale shall not be used as fill material. Any unconventional fill material shall be approved by the technical advisor. Fill material shall not be smaller than mesh size. Where fill material is hauled to its point of placement by means of wheelbarrows, the haul distance shall not be greater than 150m.

Workers shall be trained in gabion construction by an accredited organisation.

8.3.2 Cement and concrete batching

Concrete mix shall be according to specifications and correct MP A concrete must be used. Manufacturer's directions for mixing, consistency and treatment after pouring will be complied with.

Cement shall be stored in dry conditions for no longer than six weeks after delivery. When cement is stored temporarily infield it shall be kept on a dry waterproof base with a waterproof cover.

A demarcated site at least 20m away from water/wetland edge shall be used for cement mixing. No batching activities shall occur directly on unprotected ground. The batching plant shall be located on a smooth impermeable surface (concrete or 250 µm plastic covered with 5 cm of sand). The area shall be bunded and sloped towards a sump to contain spillages of substances. All wastewater resulting from batching of concrete

shall be disposed of via a contaminated water management system and shall not be discharged into the environment. Contaminated water storage areas shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented

Empty cement bags shall be stored in weatherproof containers to prevent wind blown cement dust and water contamination. Empty cement bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose. Unused cement bags shall be stored so as not to be affected by rain or runoff events. In this regard, closed steel containers shall be used for the storage of cement powder and any additives. The Contractor shall ensure that sand, aggregate, cement or additives used during the mixing process are contained and covered to prevent contamination of the surrounding environment.

The Contractor shall take all reasonable measures to prevent the spillage of cement/ concrete during batching and construction operations. During pouring, the soil surface shall be protected using plastic and all visible remains of concrete shall be physically removed on completion of the cement/ concrete pour and appropriately disposed of. All spoiled and excess aggregate/ cement/ concrete shall be removed and disposed of via the solid waste management system.

Construction using shuttering shall not take place at more than 1m height increments. Reinforcing shall be used according to specification. Concrete will be mixed and used on the same day. Where sand, stone and cement are hauled to their point of placement by means of wheel barrows, the haul distance may not be greater than 150m.

Where applicable, the location of the batching plant (including the location of cement stores, sand and aggregate stockpiles) shall be as approved by the Engineer. The concrete/cement batching plant shall be kept neat and clean at all times.

8.3.3 Geo cells

Geo cells shall not be used in conditions that exceed their design specifications. Geo cell material shall be UV resistant. Geo cells shall be anchored in by the "trench" method and in such a way that prevents undermining of the cells. Fill material shall conform to the design specifications. The following general rules shall be applied:

- If soil is used to fill the cells, it shall be re-vegetated immediately,
- If concrete is used to fill the cells, some degree of permeability of the structure shall be permitted. If concrete is used as fill, concrete baffles shall be inserted. Rock is not suitable for this purpose.

8.3.4 Earth works

Excavations may not exceed 1.5m depth without shoring and reinforcement. Excavation and compaction must comply with design specifications. The technical advisor must be consulted for work undertaken in dispersive, unstable and organic soils. Backfilling in trenches must be done in layers of thickness not exceeding 100mm before compaction. Each layer shall be compacted using hand compactors. Where excavation material is hauled by means of wheelbarrows, the haul distance may not be greater than 150m.

All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities, particularly with regards to erosion and dust generation. No equipment associated with earthworks shall be allowed outside of the Site and defined access routes unless expressly permitted by the Engineer.

9 Training

9.1 Training entitlement

In compliance with EPWP requirements, each worker shall be entitled to a minimum of two days training for every 22 days worked.

All training funded through the Department of Labour shall be planned in conjunction with the department's provincial representatives. A minimum of 30% of all training shall be accredited, and all first aid and health and safety training shall be accredited.

9.2 Wetland awareness

All project personnel shall be trained in basic wetland awareness, including a basic understanding of the components of wetlands, how wetlands function, the benefits they provide, why they need to be conserved and used sustainably, and the importance of rehabilitation in contributing to wetland conservation and sustainable use

9.3 Wildlife

Where work takes place in areas containing dangerous game, especially nature reserves and national parks, workers shall receive training in basic animal behaviour. In these areas, before work commences each day, the site shall be checked for dangerous animals.

A person trained in dangerous animal behaviour shall be present and suitably equipped to deal with such threats at all times. Wherever possible, first aid training shall be include treatment of snakebite.

9.4 Environmental induction training

Within seven days of the commencement date, the Contractor's site staff including foremen and site management staff shall attend an environmental awareness training course, of approximately one-hour duration. The Contractor shall liaise with the Engineer prior to the Commencement Date to fix a date and venue for the course. The Contractor shall provide a suitable venue with facilities and ensure that the specified employees attend the course.

No more than 20 people shall attend each course and the Contractor shall allow for sufficient sessions to train all personnel. Subsequent sessions shall be run for any new personnel coming onto site.

The environmental awareness training course shall be held in the morning during normal working hours. Any new employees coming on to site after the initial training course and the Contractor’s suppliers and subcontractors shall also attend the course. Provision should also be made for quarterly refreshers courses to be undertaken during the course of the Contract. The Contractor shall ensure that all attendees sign an attendance register, and shall provide the Engineer with a copy of the attendance register the day after each course.

9.5 Health and safety training

The following minimum levels of training are required with respect to health and safety:

- All workers and contractors must successfully complete phase 1 health and safety training.
- All project managers must successfully complete phase 2 health and safety training.

9.6 First aid training

Two first aid officers will be trained per team.

9.7 Training records

Training attendance records shall be kept by the implementer. The implementer will be responsible for obtaining all contractor and worker training information.

9.8 Fire fighting training

All workers shall receive basic fire fighting training in areas where this is appropriate

10 Environmental Control Measures

10.1 Control of working hours

Working hours for all operations shall be limited to between 08h00 and 17h00 on weekdays. No work shall take place on a Saturday, Sunday and or Public Holidays. Any deviations to these work hours shall be cleared with the ECO prior to implementation.

10.2 Control of runoff that could cause pollution

Pollution may result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage, wastewater containing organic kitchen waste, detergents, solid waste, litter and other such substances. The contractor shall ensure that rainwater does not run into areas containing cement, oil, diesel and other such substances as this could result in a pollution threat to sensitive environmental areas. Storage areas for these substances shall be placed on high lying ground and contain a bunded area in case of a spill. The bunded area shall be covered if deemed appropriate by the ECO.

Berms must be constructed to direct all runoff into the storm water system. The engineers shall prepare temporary storm water channels for unexpected rains during construction. Erosion control measures shall be placed in areas where runoff concentrates in order to detain the sediment load and slow down the runoff. Erosion controls shall be put in place on all drainage channels that drain into water resources. These measures shall include, but not be limited to, silt fences, brushwood and rows of sawdust-filled onion bags. No wastewater shall run freely into any of the surrounding environment. Runoff containing high sediment loads shall not to be released directly into natural or municipal drainage systems or nearby water resources. Should sediment occur in runoff, an attenuation pond shall be constructed to allow solids to settle out prior to leaving the site.

Runoff from the site itself shall be free from oil, waste and litter before joining the storm water system or streams. This shall be ensured by securing any hazardous substances containers in order to prevent runoff and by cleaning up any refuse and construction material from the site on a regular basis.

Litter management in the storm water system or channels that lead to streams and or wetland shall be implemented. It is outside the scope of this document to prescribe litter trap designs, but the important aspect is that it shall be incorporated into the design of the development. Litter traps shall prevent solid waste from entering the storm water system.

The contractor shall only be allowed to draw water from the source/s designated by the client and the ECO. The client shall ensure that the contractor is aware of the designated water sources, and the ECO shall ensure that this is adhered to. Personnel shall not use natural hydrological features for any purpose, including recreation. These areas shall be considered “no-go” areas.

In the event of any pollution entering an environmentally sensitive area and/or buffer zone as a result of the contractor’s actions, the contractor shall be responsible for all costs incurred to assist in pollution control and/or to clean up the polluted area. Damage to the wetland as a result of the project operations shall be for the contractor’s account. The responsibility of the remediation of the pollution/erosion event will ultimately lie with the contractor.

10.3 Pollution control

The contractor/s shall ensure that pollution of surface and/or groundwater does not occur as a result of site activities.

In the event of pollution caused as a result of construction activities, the contractor, according to Section 20 of the National Water Act (Act No. 36 of 1998), shall be responsible for all costs incurred by organisations called to assist in pollution control and/or to clean up polluted areas. The public shall not call upon any organisation to assist with clean-up activities before the matter has been discussed with the contractor. The ECO shall be notified immediately following any pollution event.

The ECO shall ensure that the contractors are aware that shallow groundwater is susceptible to contamination from spills. Therefore good management practices (in accordance with local bylaws) are required to reduce the impact of the waste generation potential.

Builders' rubble and other debris shall be confined to the building site and shall not be stored/discarded on any open space outside the development area. The status of the hydrological features on or near to the site shall be monitored by the ECO to ensure that pollution does not occur in these areas.

10.4 Erosion control

The contractor shall take reasonable measures (to the satisfaction of the ECO) to prevent erosion caused by work, operations and activities undertaken during excavation and construction activities. The contractor shall ensure that disturbance on steep slopes is kept to a minimum, thus reducing the potential for erosion. The contractor is responsible for rehabilitating all disturbed areas in such a way that no future erosion will occur.

Erosion may occur in the event of rain during the excavation and construction period. Any erosion that occurs during a heavy rainfall event shall be remediated at the expense of the project budget. This shall include clean-up of the silt deposited and filling up of erosion channels that may form. Construction in sensitive areas shall be undertaken during the dry season if possible.

10.5 Dust control

The contractor shall take into consideration that there may be residential areas surrounding the building site and that dust could be a major disturbance, especially during the dry season.

The contractor shall take appropriate and reasonable measures to minimise the generation of dust as a result of his/her works, operations and activities. Particular attention shall be given to preventing dust generation during excavation and stockpiling activities. The contractor shall be responsible for educating the employees to report any excessively dusty conditions to the contractor, the ECO or responsible representative.

Corrective and preventative measures shall include (but not be limited to) regular and effective treatment of working areas using water sprays and appropriate scheduling of dust-generating activities.

The contractor shall ensure that transported materials does not escape from the construction vehicles by providing adequate covering for all load beds.

10.6 Noise control

Probably the two most important concepts in the regulation of noise are those of *disturbing noise* and *noise nuisance*.

A disturbing noise is one that exceeds the zone sound level set by the local authority. A noise nuisance means any sound, which disturbs or impairs or may disturb or impair the convenience or peace of persons.

Some of the activities that could constitute a noise nuisance are power tools, driving, loading and hooters. All of

these elements could be connected with building activities.

Each province has its own noise regulations such as Gauteng Province promulgated new noise regulations in 1999 published in Provincial Notice 5479 of 1999 (Gauteng Noise Regulations). The contractor shall obtain and familiarise him/her with these regulations and ensure that he/she abides by these regulations at all times. The contractor shall familiarise him/herself with, and adhere to, any by-laws and regulations regarding the control of noise in their municipal areas.

Every effort shall be made to limit exceedingly noisy activities. Construction vehicles shall be in good working order such that they do not create a noise nuisance. Appropriate directional and intensity settings shall be maintained on all hooters and sirens, and the Contractor shall provide and use suitable and effective silencing devices for pneumatic tools and other plant. .

No amplified music shall be allowed on site. The use of radios, tape recorders, compact disc players, television sets etc shall not be permitted unless the volume is kept sufficiently low as to avoid any intrusion on members of the public within range. The Contractor shall not use sound amplification equipment on Site unless in emergency situations.

10.7 Hazardous materials control

All relevant national, regional and local legislation with regard to the transport, use and disposal of hazardous materials shall be strictly complied with. The contractor shall obtain the advice of the manufacturer (Material Data Sheets) with regard to the safe handling of hazardous materials.

The contractor shall ensure that there is an emergency procedure in place to deal with accidents and incidents (e.g. spills) arising from hazardous substances.

The contractor shall ensure that all personnel on site are properly trained concerning the proper use, handling and disposal of hazardous substances.

The contractor shall report incidents to the ECO immediately. Any spill incidents shall be cleaned up immediately in according with the emergency procedure.

The contractor shall supply the ECO with a list of all hazardous materials that would be present on site during the construction period. The same applies to any sub-contractor who shall provide the contractor with this information.

10.8 Blasting control

Any blasting required on site shall only occur during official working hours. Blasting shall only be undertaken where absolutely necessary.

In the event that excessive blasting is required the contractor shall ensure that potential claims from neighbouring properties in respect of damages to houses, towers and bridges (cracked walls, etc.) are valid. It is recommended that a survey be conducted to determine the pre-blasting condition of all houses in the area that could be affected by blasting activities.

The contractor shall distribute a list of dates (and times) during which blasting shall occur on site as well as place notices in appropriate areas. This shall ensure that the immediate surrounding residents are aware of the timing of blasting and thus would be in a position to prepare for the event. Emergency services shall be notified in writing, a minimum of 24 hours prior to blasting taking place. In the event that deviations from the original planned dates are perceived, the contractor shall notify the surrounding residents well in advance (a minimum of 24 hours).

Blasting activities shall only occur under controlled conditions, whereby safety precautions are adhered to, and only authorised personnel may take part in these activities. The contractor shall inform all construction workers of dates and times when blasting will take place and the necessary safety steps shall be taken to prevent any injuries.

11 Effluent and Stormwater Management

11.1 Introduction

Any effluent flowing out from the site shall be free from any pollution hazard, as this waste will invariably enter the surrounding environment. Section 10.2 and 10.4 outlines the procedures to follow in order to ensure that pollution and/or erosion resulting from construction activities do not result in damage to the surrounding areas.

All pipelines used on site shall be constructed of suitable materials such as wheolite, which reduces the risk of cracking from soil movements.

11.2 Storm water

Natural (storm water) runoff shall be diverted away from the construction area towards the storm water drains or channels. In addition, it shall be ensured that storm water is not allowed to collect to form ponds or excessively muddy conditions.

Special care shall be taken in areas susceptible to erosion, e.g. steep slopes. The contractor shall ensure that excessive quantities of sand, silt and silt-laden water do not enter the storm water system. Design of the storm water drainage system so as not to contaminate the natural drainage system is important. Appropriate measures, e.g. erection of silt traps, or drainage retention areas, to prevent silt and sand entering drainage lines or watercourses shall be taken.

The contractor shall clear any partial or complete blockage of the storm water drainage system as a result of construction activities at his own expense.

11.3 Discharge of construction water (effluent)

The contractor shall ensure that polluted runoff (excluding silt pollution) such as runoff from the construction camp where equipment is cleaned and/or serviced, is not discharged overland. Such runoff shall be directed into the local sewer main or suitable alternative agreed upon with the local authority.

Silt-laden water may be disposed overland. This water may be allowed to filter into the ground provided that this action does not cause a pollution or erosion threat.

Water from washing concrete-mixing equipment (mixers and the like) shall not be discharged overland. As describe in Section 11.2 above, such water shall be collected (possibly in conservatory tank) and removed from the site and disposed of at a registered waste disposal site. It is suggested that such water be reused for washing other concrete-mixing equipment to minimise the amount of wastewater requiring removal from site. Trucks delivering concrete shall not be washed or rinse their chutes on the site.

12 Site Rehabilitation

All working areas shall be rehabilitated once work has been completed and before the team leaves the site. This includes closure and rehabilitation of temporary access routes. All foreign material not utilised in the rehabilitation activities shall be removed from the site. Re-vegetation of all exposed soil shall be done before the team leaves the site. Any potential erosion risks shall be addressed before the team leaves the site

Any areas that the Engineer believes may have been impacted upon or disturbed, shall be rehabilitated to the satisfaction of the Engineer, which includes all areas where Topmaterial has been stripped. Once construction is complete the Contractor shall clear everything from the Site not forming part of the Permanent Works. The area to be rehabilitated shall first be landscaped to match the topography of the surrounding area as it was prior to construction. The composition of vegetation to be used for any rehabilitation shall be as specified in Section 5.12.

The Contractor shall not use herbicides, pesticides, fertilisers or other poisonous substances for the rehabilitation process unless otherwise agreed with the Engineer.

All rehabilitated areas shall be considered “no go” areas and the Contractor shall ensure that none of his staff or equipment enters these areas.

The Contractor shall undertake to remove all alien vegetation re-establishing on the area and shall implement the necessary temporary or permanent measures to combat soil erosion.

12.1 Removal of materials

After construction, any area cleared or disturbed (as a result of the activity) within and outside the boundaries of the construction site shall be rehabilitated to a state as agreed by the DEA and according to the specifications of the ECO.

All construction equipment and excess aggregate, gravel, stone, concrete, bricks, temporary fencing and the like shall be removed from the site upon completion of the work. No discarded materials of any nature shall be buried on the site, or on any vacant or open land in the area and shall only be disposed of at the appropriate registered waste disposal site.

12.2 Control of alien vegetation

Where project activities include the eradication of invasive alien plants, Working for Water guidelines and policies shall be adhered to. Any invasive alien plant clearing undertaken through Working for Wetlands projects shall be registered on the Working for Water Information Management System.

12.3 Landscaping and preparation for planting

Topmaterial that is disturbed or removed during construction and excavation shall be replaced, preferably using topsoil stockpiled prior to excavation activities, or with topsoil sourced from another reputable source. However, where possible, soils from different areas should not be mixed. Care shall be taken not to mix the topsoil with the subsoil during shaping operations.

Indigenous plants shall be used in the landscaping of the site. Plants that are proclaimed as problem plants or noxious weeds are to be excluded from the landscaping plan and these should be removed immediately, should they occur on site.

Species recommended for landscaping of the public areas include:

Trees and shrubs:

- *Buddleja saligna* (False olive)
- *Buddleja salviifolia* (Sagewood)
- *Celtis africana* (White stinkwood)
- *Diospyros lycoides* (Bluebush)
- *Dombeya rotundifolia* (Wild pear)
- *Gymnosporia buxifolia* (Common spike-thorn)
- *Olea europaea* (Wild olive)
- *Rhus lancea* (Karee)
- *Rhus leptodictya* (Mountain Karee)

Bulbs and forbs

- *Agapanthus* species (Agapanthus)
- *Albuca* species
- *Barleria obtusa*
- *Ceratotheca triloba* (Wild foxglove)
- *Chlorophytum* species
- *Crinum species* (Orange River Lily/Graslelie)
- *Felicia muricata*
- *Gazania krebsiana* (Botterblom)
- *Gerbera* species (Barberton Daisy)
- *Leonotis* species (Wild dagga)
- *Nemesia* species
- *Trachyandra* species
- *Watsonia* species (Watsonia)

The relevant landscaping contractors and excavation contractor shall be in consultation with each other and the ECO so as to prevent misunderstandings and therefore prevent potential negative environmental impacts.

An ecological approach to landscaping is recommended. Plants introduced into the project sites shall be guided by ecological rather than horticultural principles. For example ecological communities of indigenous plants provide more biodiversity and habitat opportunities and would blend with natural vegetation. This approach is also less costly to maintain and is sustainable in the long term.

13 Emergency Procedures

13.1 Introduction

The contractor shall ensure that all emergency procedures are in place prior to commencing work. Emergency procedures shall include, but are not limited to, fire, spills, contamination of the ground, accidents to employees, use of hazardous substances and materials, etc.

The contractor shall ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant and visible locations throughout the duration of the construction period.

13.2 Fire

The contractor shall take all reasonable measures to ensure that fires are not started as a result of construction activities on site, and shall also ensure that their operations comply with the Occupational Health and Safety Act (Act No. 85 of 1993). Open fires shall not be allowed on work sites and no exceptions should be made.

Basic functional fire fighting equipment shall be made available at each work site (1 back pack and at least 5 beaters), in forestry areas there must be 2 rake hoes per team.

Where fuels and machines are used on site, the prescribed fire extinguishers in working condition will be available.

Sparks generated during welding, cutting of metal or gas cutting can result in fires. Every possible precaution shall therefore be taken when working with this equipment near potential sources of combustion. Such precautions shall include having an approved fire extinguisher immediately available at the site of any such activities. The contractor shall ensure that there is basic fire fighting equipment available on site at all times. The contractor shall appoint a member of his staff to be responsible for the installation and inspection of this equipment. The contractor shall ensure that he/she has the contact details of the nearest fire station in case of an emergency.

Where projects fall within fire protection areas, the following will be applicable:

- The project will form part of the local Fire Protection Association
- The Project Manager will attend all FPA meetings
- The project will form part of the local FPA notification of the daily FOI (Fire Danger Index)
- In case of a red classification warning for the day extreme caution shall be applied.
- As soon as the actual FOI reaches a red classification all teams shall be withdrawn from affected areas.

13.3 Accidental leaks and spillages

The Contractor shall ensure that his employees are aware of the emergency procedure(s) to be followed for dealing with spills and leaks, which shall include notifying the Engineer and the relevant authorities. The Contractor shall ensure that the necessary materials and equipment for dealing with spills and leaks is available on Site at all times. Treatment and remediation of the spill areas shall be undertaken to the reasonable satisfaction of the Engineer.

In the event of a hydrocarbon spill, the source of the spillage shall be isolated, and the spillage contained. The area shall be cordoned off and secured. The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/ breakdown and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to handle a minimum of 200 ℓ of hydrocarbon liquid spill.

13.4 Safety

The contractor must ensure:

- Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993);
- That reasonable measures are taken to ensure the safety of all site staff;
- That all construction vehicles using public roads are in a roadworthy condition, that drivers adhere to the speed limits, that loads are secured and that all local, provincial and national regulations are adhered to; and
- That all accidents and incidents are recorded and reported to the ECO.

The contractor is to ensure that he/she has the contact details of the nearest emergency rooms (hospitals) to the site, of both private and public hospitals.

13.5 Communication

13.5.1 Community relations

The Contractor shall erect and maintain information boards in the position, quantity, design and dimensions specified. Such boards shall include contact details for complaints by members of the public in accordance with details provided by the Engineer.

The Contractor shall keep a "Complaints Register" on Site. The Register shall contain all contact details of the person who made the complaint, and information regarding the complaint itself.

13.5.2 Implementers forum

A representative from each implementer is required to attend quarterly meetings of the implementers' forum. The purpose of these meetings is to share information, develop links between projects and enhance communication between Working for Wetlands and its implementers. Venues for these meetings will rotate between projects. A national health and safety meeting will form part of this forum.

13.5.3 Working for Wetlands logo

Working for Wetlands encourages its implementers to use the programme's logo in promoting the programme and wetland conservation and sustainable use in general. However, written permission shall be obtained from the programme manager before the logo is used on anything other than the prescribed signage or workers' t-shirts.

13.5.4 Signage

Each project shall erect at least one gate board per property on which work is done and one billboard in a prominent position. The basic designs for this signage will be those prescribed by Working for Wetlands, with provision for the addition of project-specific information.

13.6 Hazard identification and risk assessment (HIRA)

In terms of the OHS Act, the HIRA document shall be available on site and be understood by every manager and contractor. An emergency evacuation plan shall be available for each work site.

13.7 Erosion and sedimentation control

As stipulated in Section 10.4 the Contractor shall take all reasonable measures to limit erosion and sedimentation due to the construction activities. Where erosion and/or sedimentation, whether on or off the site, occurs despite the Contractor complying with the foregoing, rectification shall be carried out in accordance with details specified by the Engineer. Where erosion and/or sedimentation occur due to the fault of the Contractor, rectification shall be carried out to the reasonable requirements of the Engineer.

Any runnels or erosion channels developed during construction or during the defects liability period shall be backfilled and compacted. Stabilisation of cleared areas to prevent and control erosion shall be actively managed. Consideration and provision shall be made for various methods, namely, brushcut packing, mulch or chip cover, straw stabilising (at a rate of one bale/ 20 m^2 and rotovated into the top 100 mm of the completed earthworks), watering, soil binders and anti-erosion compounds, mechanical cover or packing structures (e.g. Hessian cover).

Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised area shall be repaired and maintained to the satisfaction of the Engineer.

14 Social Development

14.1 Primary health

An HIV / Aids information session will be held with each team in conjunction with an approved institution at least once every six months. There will be a minimum of one HIV / Aids peer educator per team.

Measures aimed at reducing the spread of HIV / Aids, including condoms, literature and posters, should be available to all workers.

Access of workers to local clinics should be facilitated wherever possible. Training will, where possible, include other aspects of primary health, including nutrition, reproductive health and hygiene,

14.2 World wetlands day

World Wetlands Day should be celebrated in an appropriate way by each implementer and include all project personnel

14.3 Open day

Each project will hold at least one open day per year, targeting surrounding communities, stakeholders and project partners

14.4 Active employee and contractor participation in project management

Workers will have a formalised forum through which they can make inputs into the overall management of the

project (e.g. a workplace committee).

14.5 Active forums for public participation in projects (Advisory Committees)

Each project shall have a functional advisory committee, based on the guidelines provided by Working for Wetlands. Where possible and appropriate these committees shall form part of existing Working for Water advisory committees. Advisory committees shall represent all communities from which workers are drawn and in which work is being done.

Meetings will be run according to the Working for Wetlands guidelines for advisory committees. Minutes of advisory committee meetings will be made available to Working for Wetlands on request

Advisory committees will assist in the identification of potential contractors and target groups for employment. Community-based forums should participate in advisory committees in order to contribute to the prioritisation and implementation of social development activities

15 Management and Monitoring

This section focuses on the systems and procedures required to ensure that the environmental specifications contained in the CEMP are effectively implemented, monitored and recorded.

15.1 Location of the construction environmental management plan

All contractors on site shall at all times have a copy of the CEMP in their respective site office (located in the construction camp).

15.2 General monitoring and reporting

The ECO and contractors on site are responsible for ensuring compliance with the CEMP. Monthly site audits shall be undertaken by the ECO and a Project Inspection Report submitted to the SANBI for review prior to the following audit. Refer to Annexure B for the Project Inspection Report.

A Compliance Audit Report shall be submitted to the DEA collating the year's completed checklists. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified to the DEA.

Interested and Affected Parties must be allowed access to the CEMP document. They have the right to monitor specific aspects of the CEMP (e.g. noise regulations, working hours stipulated) in conjunction with the contractor in a reasonable and formal manner without unreasonably disrupting construction activities. However, no member of the public shall enter the building site without prior approval from the contractor.

The contractor shall keep a record of all complaints received from the community in a complaints register and communicate them to the ECO. These complaints shall be addressed and mitigated within reason. Records relating to the compliance/non-compliance with the conditions of the CEMP as well as audits reports, shall be kept in good order and shall be made available to the DEA within seven days after a written request has been received. It is suggested that all records be kept for at least two years following construction activities for reference purposes.

15.3 Fixed-point photography

Fixed-point photography monitoring information shall be undertaken by the project management for each problem site.

Locating photo-points

The following guidelines should be followed when locating photographic points across the wetland system for fixed-point photographs:

- photo-points should be selected at various locations throughout the rehabilitation site and at points that will be easily accessible at all times
- record the geographical co-ordinates of each point, with a mapping grade Global Positioning System (GPS), accurate to less than 2 metres. This provides any individual with the information required to navigate to the exact location of each photo point
- a permanent field marker must be placed in the ground at each point, to ensure that photos are always taken from exactly the same point. If possible the orientation of the photo at the point should be recorded on the marker

Fixed-point photographs

The following guidelines should be followed when implementing fixed-point photography for monitoring purposes:

- the orientation of the photographer should be recorded
- use the same camera, lens and zoom each time. If this is not possible, record the settings used. The camera should preferably be located on a tripod at a fixed height
- when the frequency of monitoring increases to an annual interval, photographs should be taken at roughly the same time of year and at the same time of the day, and under similar weather conditions. This would limit the variability of the wetland habitat associated with vegetative and hydrological changes linked to seasons
- a standard object, such as a soil auger or a metre rule should be included in the photograph as a reference for scale
- record relevant information about factors that may influence features in the photograph (e.g. a recent fire, late or early rains, etc.), especially those relating to the appearance of the site

15.4 Specific roles and responsibilities

The roles of the responsible people on site are included below:

The SANBI is the ultimate responsible party for the development and all aspects and phases thereof. The SANBI or an appointed representative shall communicate all issues raised in this CEMP with all personnel undertaking any work on the site. Should any non-compliance with this CEMP take place, SANBI shall ultimately be held liable. SANBI shall include the CEMP as a specific condition within any contract that is to be signed between him/her and any other party involved in the construction of the development. The SANBI is responsible for identifying which local / provincial environmental authority has jurisdiction over the project.

The Contractor is responsible for complying with the CEMP during the construction phase of the development. The Contractor is responsible for ensuring that his/her contractors, employees and sub-contractors appointed by him/her are familiar with the CEMP and that they abide by it. The Contractor shall be responsible for any non-compliance with the CEMP and shall pay for any remedial work that may result from non-compliance resulting directly from his/her negligence.

The ECO is responsible for communicating environmental issues associated with the site to the Contractor. Should any non-compliance with the CEMP take place, the ECO shall communicate this with the party responsible for the non-compliance as well as the Contractor and the SANBI. If the non-compliance continues after written request by the ECO to rectify the situation, the ECO must inform the DEA in writing. The ECO is responsible for the explanation of environmental issues contained in this CEMP to anyone working on the site. Should any issues arise on the site of an environmental nature or concern, the ECO shall be responsible for taking the appropriate action.

The Project Manager is responsible for communicating any issues or concerns of the surrounding community regarding the development to the SANBI PC or other responsible party and *visa-versa.*

The DEA is responsible for taking action against any non-compliance with the CEMP by the Contractor and or any of his/her subcontractors. The DEA may request a compliance audit to be undertaken on the site at any time during or after the construction phase of the project.

15.5 GUIDELINES

The following guidelines and recommended templates will be made available to all implementers:

1. Guidelines for completing Working for Wetlands business plans and project implementation plans
2. Working for Wetlands risk assessment framework
3. Project management tools:
    - Daily attendance register
    - Vehicle check sheet
    - Production sheet
    - Project manager's inspection sheet
    - Implementer's inspection sheet
    - Incident report for near misses
    - Format for toolbox talk minutes
- Receipt of goods
- Consumables used sheet
- Pay sheet
- Personnel update sheet
- Contractor's invoice
- Filing of information
- Safety plan and emergency numbers
- Tender document
- Contractor safety policy
- Risk assessment
- Registration form for Compensation for Occupational Injuries and Diseases Act
- OHS Act notification of construction work

- Construction supervisor appointment letter
- Health and safety construction representative appointment letter
- First aid officer appointment letter
- First aid kit contents
- Training matrix
- Record of completed training
- Grievance procedure and grievance form
- PPE matrix
- Record of PPE issued
- Disciplinary procedure
- Contractor and worker contracts

Annexure A

BASIC CONDITIONS OF EMPLOYMENT ACT, 1997: CODE OF GOOD PRACTICE FOR EMPLOYMENT AND CONDITIONS OF WORK FOR SPECIAL PUBLIC WORKS PROGRAMMES

DEPARTMENT OF LABOUR

No. R. 63
25 January 2002

BASIC CONDITIONS OF EMPLOYMENT ACT, 1997: MINISTERIAL DETERMINATION SPECIAL PUBLIC WORKS PROGRAMMES

I, Membathisi Mphumzi Shepherd Mdladlana, Minister of Labour, hereby in teens of section 50 of the Basic Conditions of Employment Act, 1997, make a Ministerial Determination establishing conditions of employment for employees in Special Public Works Programmes, South Africa, in the Schedule hereto and determine the second Monday after the date of publication of this notice as the date from which the provisions of the said Ministerial Determination shall become binding.

M.M.S. MDLADLANA
Minister of Labour

SCHEDULE

MINISTERIAL DETERMINATION NO: 3: SPECIAL PUBLIC WORKS PROGRAMMES

Index

1. Definitions

1.1 In this determination -

"special public works programme" means a programme to provide public assets through a short-term, non-permanent, labour intensive programme initiated by government and funded from public resources.

1.2 Without limiting subsection (1), the following programmes constitute special public works programmes:

(a) Working for Water

(b) Community based public works

(c) Coastal Care

(d) Sustainable Rural Development (DPLG)

(e) Landcare

(f) Community Water & Sanitation

(g) Arts & Culture poverty relief projects

2. Application

This Determination applies to all employers and employees engaged in public works programmes.

3. The following provisions of the Basic Conditions of Employment Act do not apply to public works programmes –

3.1 Section 10(2)	**Overtime rate**
3.2 Section 11	**Compressed working week**
3.3 Section 14(3)	**Remuneration required for meal intervals of longer than 75 minutes**
3.4 Section 16	**Pay for work on Sundays**
3.5 Section 17(1) & (2)	**Payment of night shift allowance and supply of transportation**
3.6 Section 20	**Annual leave**
3.7 Section 21	**Pay for annual leave**
3.8 Section 22	**Sick leave**
3.9 Section 25(2) & (3)	**Commencement of maternity leave and return to work**
3.10 Section 26(2)	**Alternative work for pregnant women**
3.11 Section 27	**Family responsibility leave**
3.12 Section 29(h) to (p)	**Written particulars of employment**
3.13 Section 30	**Display of employee's rights**
3.14 Section 33(1)(g)	**Information about remuneration**
3.15 Section 34(1)(a)	**Deduction by individual agreement**
3.16 Section 34(2) & (3)	**Deduction of damages caused by employee**
3.17 Section 37	**Notice of termination**
3.18 Section 38	**Payment instead of notice**
3.19 Section 39	**Notice for employees in employer supplied accommodation**
3.20 Section 40	**Payments of outstanding amounts on termination**

3.21 Section 41 **Severance pay**

3.22 Section 42(c) **Certificate of service**

3.23 Sections 51 - 58 **Sectoral Determinations**

3.24 Section 84 **Duration of employment**

4. Conditions

As set out in the ANNEXURE:

ANNEXURE

CONDITIONS OF EMPLOYMENT FOR SPECIAL PUBLIC WORKS PROGRAMMES

1. Introduction

1.1 This document contains the standard terms and conditions for workers employed in elementary occupations on a Special Public Works Programme (SPWP). These terms and conditions do NOT apply to persons employed in the supervision and management of a SPWP.

1.2 In this document -

(a) "department" means any department of the State, implementing agent or contractor;

(b) "employer" means any department, implementing agency-or contractor that hires workers to work in elementary occupations on a SPWP;

(c) "worker" means any person working in an elementary occupation on a SPWP;

(d) "elementary occupation" means any occupation involving unskilled or semi-skilled work;

(e) "management" means any person employed by a department or implementing agency to administer or execute an SPWP;

(f) "task" means a fixed quantity of work;

(g) "task-based work" means work in which a worker is paid a fixed rate for performing a task;

(h) "task-rated worker" means a worker paid- on the basis of the number of tasks completed;

(i) "time-rated worker" means a worker paid on the basis of the length of time worked.

2. Terms of Work

2.1 Workers on a SPWP are employed on a temporary basis:

2.2 A worker may NOT be employed for longer than 24 months in any five-year cycle on a SPWP.

2.3 Employment on a SPWP does not qualify as employment as a contributor for the purposes of the Unemployment Insurance Act 30 of 1966.

3. Normal Hours of Work

3.1 An employer may not set tasks or hours of work that require a worker to work

(a) more than forty hours in any week;

(b) on more than five days in any week; and

(c) for more than eight hours on any day.

3.2 An employer and worker may agree that a worker will work four days per week. The worker may then work up to ten hours per day.

3.3 A task-rated worker may not work more than a total of 55 hours in any week to complete the tasks allocated (based on a 40-hour week) to that worker.

4. Meal Breaks

4.1 A worker may not work for more than five hours without taking a meal break of at least thirty minutes duration.

4.2 An employer and worker may agree on longer meal breaks.

4.3 A worker may not work during a meal break. However, an employer may require a worker to perform duties during a meal break if those duties cannot be left unattended and cannot be performed by another worker. An employer must take reasonable steps to ensure that a worker is relieved of his or her duties during the meal break.

4.4 A worker is not entitled to payment for the period of a meal break. However, a worker who is paid on the basis of time worked must be paid if the worker is required to work or to be available for work during the meal break.

5. Special Conditions for Security Guards

5.1 A security guard may work up to 55 hours per week and up to eleven hours per day.

5.2 A security guard who works more than ten hours per day must have a meal break of at least one hour or two breaks of at least 30 minutes each.

6. Daily Rest Period

Every worker is entitled to a daily rest period of at least eight

consecutive hours. The daily rest period is measured from the time the worker ends work on one day until the time the worker starts work on the next day.

7. Weekly Rest Period

Every worker must have two days off every week. A worker may only work on their day off to perform work which must be done without delay and cannot be performed by workers during their ordinary hours of work ("emergency work").

8. Work on Sundays and Public Holidays

8.1 A worker may only work on a Sunday or public holiday to perform emergency or security work.

8.2 Work on Sundays is paid at the ordinary rate of pay.

8.3 A task-rated worker who works on a public holiday must be paid -

(a) the worker's daily task rate, if the worker works for less than four hours;

(b) double the worker's daily task rate, if the worker works for more than four hours.

8.4 A time-rated worker who works on a public holiday must be paid -

(a) the worker's daily rate of pay, if the worker works for less than four hours on the public holiday;

(b) double the worker's daily rate of pay, if the worker works for more than four hours on the public holiday.

9. Sick Leave

9.1 Only workers who work four or more days per week have the right to claim sick-pay in terms of this clause.

9.2 A worker who is unable to work on account of illness or injury is entitled to claim one day's paid sick leave for every full month that the worker has worked in terms of a contract.

9.3 A worker may accumulate a maximum of twelve days' sick leave in a year.

9.4 Accumulated sick-leave may not be transferred from one contract to another contract.

9.5 An employer must pay a task-rated worker the worker's daily task rate for a day's sick leave.

9.6 An employer must pay a time-rated worker the worker's daily rate of pay for a day's sick leave.

9.7 An employer must pay a worker sick pay on the worker's usual payday.

9.8 Before paying sick-pay, an employer may require a worker to produce a certificate stating that the worker was unable to work on account of sickness or injury if the worker is -

(a) absent from work for more than two consecutive days; or

(b) absent from work on more than two occasions in any eight-week period.

9.9 A medical certificate must be issued and signed by a medical practitioner, a qualified nurse or a clinic staff member authorised to issue medical certificates indicating the duration and reason for incapacity.

9.10 A worker is not entitled to paid sick-leave for a work-related injury or occupational disease for which the worker can claim compensation under the Compensation for Occupational Injuries and Diseases Act.

10. Maternity Leave

10.1 A worker may take up to four consecutive months' unpaid maternity leave.

10.2 A worker is not entitled to any payment or employment-related benefits during maternity leave.

10.3 A worker must give her employer reasonable notice of when she will start maternity leave and when she will return to work.

10.4 A worker is not required to take the full period of maternity leave. However, a worker may not work for four weeks before the expected date of birth of her child or for six weeks after the birth of her child, unless a medical practitioner, midwife or qualified nurse certifies that she is fit to do so.

10.5 A worker may begin maternity leave -

(a) four weeks before the expected date of birth; or

(b) on an earlier date

(i) if a medical practitioner, midwife or certified nurse certifies that it is necessary for the health of the worker or that of her unborn child; or

(ii) if agreed to between employer and worker; or

(c) on a later date, if a medical practitioner, midwife or certified nurse has certified that the worker is able to continue to work without endangering her health.

10.6 A worker who has a miscarriage during the third trimester of pregnancy or bears a stillborn child may take maternity leave for up to six weeks after the miscarriage or stillbirth.

10.7 A worker who returns to work after maternity leave, has the right to start a new cycle of twenty-four months employment, unless the SPWP on which she was employed has ended.

11. Family responsibility leave

11.1 Workers, who work for at least four days per week, are entitled to three days paid family responsibility leave each year in the following circumstances -

(a) when the employee's child is born;

(b) when the employee's child is sick,

(c) in the event of a death of

(i) the employee's spouse or life partner;

(ii) the employee's parent, adoptive parent, grandparent, child, adopted child, grandchild or sibling.

12. Statement of Conditions

12.1 An employer must give a worker a statement containing the following details at the start of employment -

(a) the employer's name and address and the name of the SPWP;

(b) the tasks or job that the worker is to perform; and

(c) the period for which the worker is hired or, if this is not certain, the expected duration of the contract;

(d) the worker's rate of pay and how this is to be calculated;

(e) the training that the worker will receive during the SPWP.

12.2 An employer must ensure that these terms are explained in a suitable language to any employee who is unable to read the statement.

12.3 An employer must supply each worker with a copy of these conditions of employment.

13. Keeping Records

13.1 Every employer must keep a written record of at least the following -

(a) the worker's name and position;

(b) in the case of a task-rated worker, the number of tasks completed by the worker;

(c) in the case of a time-rated worker, the time worked by the worker;

(d) payments made to each worker.

13.2 The employer must keep this record for a period of at least three years after the completion of the SPWP.

14. Payment

14.1 An employer must pay all wages at least monthly in cash or by cheque or into a bank account.

14.2 A task-rated worker will only be paid for tasks that have been completed.

14.3 An employer must pay a task-rated worker within five weeks of the work being completed and the work having been approved by the manager or the contractor having submitted an invoice to the employer.

14.4 A time-rated worker will be paid at the end of each month.

14.5 Payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.

14.6 Payment in cash or by cheque must take place

(a) at the workplace or at a place agreed to by the worker;

(b) during the worker's working hours or within fifteen minutes of the start or finish of work,

(c) in a sealed envelope which becomes the property of the worker.

14.7 An employer must give a worker the following information in writing

(a) the period for which payment is made;

(b) the numbers of tasks completed or hours worked;

(c) the worker's earnings;

(d) any money deducted from the payment;

(e) the actual amount paid to the worker.

14.8 If the worker is paid. in cash or by cheque, this information must be recorded on the envelope and the worker must acknowledge receipt of payment by signing for it.

14.9 If a worker's employment is terminated, the employer must pay all monies owing to that worker within one month of the termination of employment.

15. Deductions

15.1 An employer may not deduct money from a worker's payment unless the deduction is required in terms of a law.

15.2 An employer must deduct and pay to the SA Revenue Services any income tax that the worker is required to pay.

15.3 An employer who deducts money from a worker's-pay for payment to another person must pay the money to that person within the time period and other requirements specified in the-agreement law, court order or arbitration award concerned.

15.4 An employer may not require or allow a worker to -

(a) repay any payment except an overpayment previously made by the employer by mistake:

(b) state that the worker received a greater amount of money than the employer actually paid to the worker; or

(c) pay the employer or any-other person for having been employed.

16. Health and Safety

16.1 Employers must take all reasonable steps to ensure that the working environment Is healthy and safe.

16.2 A worker must -

(a) work in a way that does not endanger his/her health and safety or that of any other person;

(b) obey any health and safety instruction;

(c) obey all health and safety rules of the SPWP;

(d) use any personal protective equipment or clothing issued by the employer;

(e) report any accident, near-miss incident or dangerous behaviour by another person to their employer or manager.

17. Compensation for Injuries and Diseases

17.1 It is the responsibility of the employers (other than a contractor) to arrange for all persons employed on a SPWP to be covered in terms of the Compensation for Occupational Injuries and Diseases Act, 130 of 1993.

17.2 A worker must report any work-related injury or occupational disease to their employer or manager.

17.3 The employer must report the accident or disease to the Compensation Commissioner.

17.4 An employer must pay a worker who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer will be refunded this amount by the Compensation Commissioner. This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.

18. Termination

18.1 The employer may terminate the employment of a worker for good cause after following a fair procedure.

18.2 A worker will not receive severance pay on termination.

18.3 A worker is not required to give notice to terminate employment. However, a worker who wishes to resign should advise the employer in advance to allow the employer to find a replacement.

18.4 A worker who is absent for more than three consecutive days without informing the employer of an intention to return to work will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

18.5 A worker who does not attend required training events, without good reason, will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

19. Certificate of Service

19.1 On termination of employment, a worker is entitled to a certificate stating

(a) the worker's full name,

(b) the name and address of the employer;

(c) the SPWP on which the worker worked;

(d) the work performed by the worker;

(e) any training received by the worker as part of the SPWP;

(f) the period for which the worker worked on the SPWP;

(g) any other information agreed on by the employer and worker.

Annexure B

Project Inspection Report

Project Inspection Report

Jump to: Project Contact Person Conducting Inspection Reference Forms Used People Spoken To Financial Checks Fixed Assets Registers Progress: Deliverables Project Management Health and Safety Environmental Management Risk Management General Key Inspection Dates Problems and Proposed Solutions Author Details

dd/mm/yyyy

Valid date of report:

Project Manager	SANBI Ref No
Project	Project Inspection Report 1

Project Name

Project Period / Description

System Ref No:

Estimated Duration

	dd/mm/yyyy		dd/mm/yyyy		
Start Date		Completion Date		Estimated Duration:	

Note:*This Period will be used to generate the Cash Flow.*

Project Description (What are you going to do)

Project Group (Office Use Only)

Main Wetland

Province

District Municipality
Local Municipality

Wetland Name	Indicate if this wetland was visited during this inspection (Y/N)

Project Contact

PROJECT MANAGER

Contact Organization

Contact Person

Title: Surname: Initials: Position

PM Organization Address

Physical Address		**Postal Address** (if different from Physical)	
Email Address		Fax	
		Tel (Office)	

PM Person's Address			
Physical Address		**Postal Address** (if different from Physical)	
Email Address		Fax	
Cellular		Tel (Office)	

Person Conducting Inspection

Name and Contact			
Department / Firm / Organisation			
Contact Person			
Title: Surname:		Initials:	Position

Address			
Email Address			
Cellular		Tel (Office)	

Reference Forms Used

Date of Project Implementation Plan used	
Date	

Date of Project Progress Report used	
Date	

Remember to take copies of e.g. Business Plan, Cash Flow / Expenditure reports, Procurement procedures, previous Inspection Report

People Spoken To

List people spoken to, contact details and subjects discussed

Financial Checks

Is the expenditure according to cash flow?	Y/N	
Does the expenditure seem in line with milestones reached?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		

Fixed Assets

Are there or will there be fixed assets on this project?	Y/N	
Is the asset register available?	Yes / No / N/A	
Are assets registered in the name of the owning agency?	Yes / No / N/A	
Are assets kept safely when not in use?	Yes / No / N/A	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		

Registers

a. Wage Registers		
Does the project keep a wage register, worker's timesheets and proof of payment?	Y/N	

Are the wage registers, worker's timesheets and proof of payments up to date?	Y/N	
Are they keeping track of Women/Youth/Disabled/Local?	Y/N	
Are the workers present reflected in today's register?	Y/N	
What is the total person-days reflected in the Wage Register? Person-days		
What is the minimum daily wage reflected in the Wage Register? Minimum daily wage		
Does this information tally with the Progress Report?	Y/N	
Does expenditure on wages correspond with the number of person days reported?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		
b. Training Registers		
Does the project have a Training Register?	Y/N	
Is the Training Register up to date?	Y/N	
Does this information tally with the Progress Report?	Y/N	
Have induction, H&S and first aid training been completed?	Y/N	

Does expenditure on training correspond with the no. of training days reported?	Y/N	
Comment on Training (including accreditation) Comment		
If response is no, describe actions to ensure compliance (within 14 days) Comment		
c. SMME		
Are they keeping records of SMME's used?	Y/N	
How many SMME's are on record?	Number of SMMEs on record	
How many SMME's are being used at present?	Number currently being used	
Does this information tally with the Progress Report?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		

Progress: Deliverables

"In Compliance" means "Are the Deliverables in Compliance with the Rehabilitation Plan?"

Deliverable	Intervention Number	Description	% Complete	In Compliance Y/N

Is progress against Deliverables OK?	Y/N	
Do deliverables reported in the Project Progress Report correspond with actuals?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		

Project Management

a. Project Advisory Committee		
Is there a formally constituted and active Project Advisory Committee?	Y/N	
What was the date of the last meeting of the Project Advisory Committee?	dd/mm/yyyy	
Does composition of PAC comply with Best	Y/N	

Management Practices?		
Are there proper minutes of Project Advisory Committee meetings?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		
b. Project Implementation Plan		
Is the project achieving the intent of the Project Implementation Plan?	Y/N	
Are monthly Progress and Financial Reports being submitted? If not, why not?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		
c. Communication and Marketing		
Has communication with other stakeholders happened? Comment		
Is signage in place?	Is signage in place?	
If response is no, describe actions to ensure compliance (within 14 days) Comment		

Health and Safety

Is there a First Aid box present?	Y/N	
Is there a First Aid person present?	Y/N	
Are workers wearing the required personal protective equipment?	Y/N	
Are records of near misses / incidents kept?	Y/N	
Are there proper minutes of H & S meetings?	Y/N	
Are Toolbox Talks happening?	Y/N	
General comment on Health and Safety		
Comment		
Are workers wearing Working for Wetlands t-shirts?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		

Environmental Management

Has an environmental training course in compliance with the CEMP been undertaken?	Y/N	
Has the working area been clearly defined with danger tape or other clearly visible markers?	Y/N	
Has the topsoil (up to 30 cm) been cleared from site and stored separately? If not, why?	Y/N	
Comment:		
Are no-go areas being adhered to?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		
If the wetland is a peat wetland, are the specific requirements pertaining to working within peat areas being implemented and enforced?	Y/N/ N/A	
If response is no, describe actions to ensure compliance:		
Comment		

Does the project have effective sanitation arrangements?	Y/N
If response is no, describe actions to ensure compliance:	
Comment	
Have the following issues been addressed in compliance with the CEMP?	
• Contractor's camp in compliance with the site plan?	Y/N
• All stores and materials stockpiled adequately/ secured?	Y/N

• Waste Bins and other waste storage receptacles in place?	Y/N
• Fuel storage and management?	Y/N
• Hazardous material management?	Y/N
• Dust management?	Y/N
• Stormwater and erosion protection?	Y/N
• Batching facilities lined and runoff contained?	Y/N

Is on-site rehabilitation effective?	Y/N	

If response is no, describe actions to ensure compliance (within 14 days)		
Comment		
Has revegetation been undertaken, especially in exposed and unstable areas?	Y/N	
If response is no, describe actions to ensure compliance:		
General comments on environmental management and CEMP compliance:		
Comment		

Risk Management

Is fire fighting equipment present and in working order?	Y/N	

Are there adequate facilities for storage of materials and equipment?	Y/N	

If response is no, describe actions to ensure compliance (within 14 days)
Comment

General

a. Transport		
How many contractors vehicles are there on site?	Number	
How many project vehicles are there on site?	Number	
Do vehicles comply with the Best Management Practices standards and CEMP requirements?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		
b. Comments		
Does the Quality of Work appear acceptable? Substantiate your answer	Y/N	
Is the work in compliance with Best Management Practices?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		

Key Inspection Dates

Effective Date of this Inspection	
Effective Date	

Target Date for next Inspection	
Target Date (dd/mm/yy)	

Problems and Proposed Solutions

Categories: Financial Checks, Assets, Progress, Special Conditions, Management, General

Problem and Proposed Solution	Category	Initial Target Date	Revised / Actual Date	% Progress

Please take photos and email to HO with date, location and title

Author Details

Person completing this form

Department / Firm / Organization

Contact Person

Title: Surname: Initials: Position

Address

Email Address		Fax	
Cellular		Tel (Office)	

APPENDIX G – NATIONAL STAKEHOLDERS

TITLE	INITIAL/NAME	SURNAME	ORGANISATION	EMAIL
National stakeholders				
Ms	Jackie	Jay	Department of Water Affairs	jayj@dwa.gov.za
Mr	David	Kleyn	Department of Agriculture Forestry & Fisheries	DavidKL@nda.agric.za
Mr	Christo	Marais	Department of Water Affairs	chris@dwaf.gov.za
Ms	Kerryn	Morrison	Endangered Wildlife Trust	kerryn@ewt.org.za
Ms	Naomi	Fourie	Department of Water Affairs	FourieNaomi@dwaf.gov.za
Ms	Valerie	du Plessis	Department of Water Affairs	DuPlessisV@dwa.gov.za
Mr	Guy	Preston	Department of Water Affairs	GPreston@dwaf.gov.za
Mr	Ramogale	Sekwale	Department of Water Affairs	SekweleR@dwaf.gov.za
Ms	Wilma	Lutsch	Department of Environmental Affairs	wlutsch@deat.gov.za
Mr	Bonani	Madikizela	Water Research Commission	bonanim@wrc.org.za
Ms	Fatima	Rawjee	Department of Environmental Affairs: Directorate: Environmental Impact Evaluation	FRawjee@environment.gov.za
Ms	Linda	Poll-Jonker	Department of Environmental Affairs: Sensitive Environments	LPoll-Jonker@environment.gov.za

APPENDIX H – PROVINCIAL STAKEHOLDERS

TITLE	INITIAL/NAME	SURNAME	ORGANISATION	Area/site
Provincial authorities				
Ms	Gerda	Venter	DWA	All
Mr	Sam	Dywili	DWA	All
Mr	Tseliso	Ntili	Department of Water Affairs: Regional Manager (Chief Director)	All
	Oratile	Kumang	DAFF	All
Mr	Kierie	de Jager	DAFF	All
	The Provincial Manager		SAHRA	All
Mr	Nacelle	Collins	DETEA: wetland forum rep	All
Ms	Grace	Mkhosana	DETEA: EIM section	All
Mr	Kelvin	Legge	DWA: Integrated Environmental Engineering (Chief Engineer)	All
Aurecon Project team				
Ms	Tamara	North	Aurecon	All
Mr	Fareed	Nagdi	Aurecon	All
Dr	Jenny	Youthed	Aurecon	All
Mr	Junaid	Desai	Aurecon	All
Mr	Martin	Kleynhans	Aurecon	Mangaung
Mr	Doug	McCulloch	Wetlander	Maluti, Wilge, Golden Gate
Ms	Ina	Venter	Wetlander	Seekoievlei, Mangaung
Dr	Barry	Taylor	Bird specialist: UKZN	Seekoievlei
Landowners				
Maluti				

Mr	Johan	Ferreira	Landowner (Ferndale)	Maluti
Mr	Chris	van Niekerk	Landowner (Springvale)	Maluti
			Landowner (Tamworth)	Maluti
Wilge				
Mr	William	Spies	Landowner (Schoondraai)	Wilge
Mr	Martin Luther	Campher	Landowner (Scheurklip)	Wilge
Ms	Alison	Oates	Landowner (Oatesdale - cross her property to get to Schoondraai)	Wilge
Mr	Daniel	Cloete	Landowner (Berrysvale) ?Murphy's Rus	Wilge
Mr	HSS	Geel	Landowner (Pitcher's Rest)	Wilge
Ms	Ina	Steyn	Landowner (Fullerton)	Wilge
Mangaung				
Mr	Billy	Barnes	Representative of landowner (Mangaung LM)	Mangaung
Seekoeivlei				
Mr	Nacelle	Collins	Represenative of landowner (FS DTEEA)	Seekoeivlei
Mr	PPJ	Neetling	Landowner (The Loft Farming Company)	Seekoeivlei
Golden Gate				
Mr	Marius	Snyders	Representative of landowner (SANParks)	Golden Gate
Working for Wetlands				
Ms	Nonzukiso	Mbona	SANBI	All
Mr	Thilivhali	Nyambeni	SANBI: WfWet Provincial Coordinator	All
Mr	Eric	Munzhedzi	SANBI	All
Mr	Umesh	Bahadur	SANBI	All
Ms	Anika	Govender	SANBI	All

Mr	Richard	Phaiphai	Ndavha Environmental Development (implementer)	All
Mr	Johan	van der Schyff	Implementor (Wilge, Maluti)	Maluti Wilge
Municipal				
Mr	TM	Manyoni	Mangaung Local Municipality (acting MM)	Mangaung
Mr	M	Thithi	Maluti a Phofung Local Municipality (acting MM)	Maluti Wilge Golden Gate
Mr	Madoda	Besani	Phumelela Local Municipality (acting MM)	Seekoeivlei
Mr	SM	Selepe	Thabo Mofutsanyane District Municipality (MM)	All
Mr	Neo	Shapu	Mangaung Local Municipality (EHO)	Mangaung
Mr	Billy	Barnes	Mangaung Local Municipality (EHO boss)	Mangaung
Other/wetland forum attendees				
Mr	Mphadeni	Nthangeni	SANPARKS (Project Manager & implementor)	Golden Gate
Mr	Zebulon	Hlungwani	SANPARKS	Golden Gate
Mr	Johan	Taljaard	SANPARKS (Golden Gate Park Manager)	Golden Gate
Mr	Marius	Snyders	SANPARKS (Monitoring & Evaluation manager)	Golden Gate
Mr	Ernest	Daemane	SANPARKS: Monitoring & Evaluation	Golden Gate
Ms	Irene	Mojapelo	DAFF	All
Mr	Johan	Zeelie	DAFF	All
Ms	Neo	Leburu	DWA	All
Ms	Lindiwe	Sithole	DWA	All
Ms	Monita	Swart	DWA	All
Ms	Lebogang	Lekhu	Motheo	All
Ms	Suzan S	Mandla	SANBI	All
Mr	Zwakele	Ngwenya	SANBI	All
	Khambule		SANBI	All
	M.P	Gavhi	SANBI-FSNBG	All

	L D	Rambuwani	SANBI-FSNBG	All
Ms	Amelia	Motsitsi	University of Free State	All
Mr	Maitland	Seaman	University of Free State	All
Ms	Marie	Watson	University of Free State	All
Mr	Bornett	Mototo	WfW	All
Mr	Nditshedzeni Cedric	Singo	Working for Water rep	All
Mr	Vhalimavho	Khavhagali		All
	M	Pretorius		All
			Oaklands country manor	Wilge
Mr	Anesh	Madanlal	N3TC	All
Mr	Douglas	Judd	N3TC (Technical Manager)	All
Mr	Leon	Barkhuizen	WESSA rep: Free State	All