

River Index of Habitat Integrity (IHI) and riparian vegetation assessment for the proposed establishment of a measuring weir within the Caledon (Mohokare) River (Quaternary Drainage Region: D22D)

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1. Introduction

The aim of this investigation was to determine the habitat integrity status of a site in the Caledon (Mohokare) River that is considered for the establishment of a measuring weir. This investigation will aid in the determination of the sensitivity of the proposed site within the river.

A further discussion of the functioning of the riparian communities will be done. In understanding the functioning of the riparian communities the likely impacts that the proposed weir will have on the riparian vegetation can be explained with more certainty.

The method for determining the habitat integrity of the river was the EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity (Kleynhans, Louw & Graham 2008).

The proposed site is located within the Caledon (Mohokare) River near the town of Clocolan (Free State Province) and Peka (Lesotho). The coordinates of the site is S 29.005313° E 27.692680° (see attached locality map 1).

Modelling of the Index of Habitat Integrity (IHI) in terms of the instream- and riparian zone has rated the site as a D rating; largely modified with a large loss of natural habitat, biota and basic ecosystem function. This is a result of several severe impacts on the river and its catchment. Refer to the attached documents of the Index of Habitat Integrity (IHI) evaluation.

2. Discussion

2.1 Index of Habitat Integrity (IHI)

The site was rated as a D category in terms of the habitat integrity (refer to attached IHI documents). The rating of the habitat integrity is done according to the following rating scale (Kleynhans *et al.* 2008):

Table 1: Both the instream and riparian habitat integrity index values are generically interpreted accordingly.

Habitat Integrity Category	Description	Rating
		(% of Total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem function has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem function is extensive.	20-39
F	Critically/Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

The Index of Habitat Integrity (IHI) is approached from an instream and riparian zone perspective.

The rating is the result of several impacts on the river and its catchment. These impacts are discussed below.

The hydrology of the river is impacted on by several factors. There are currently no large dams situated within the river, however, a large amount of smaller dirt wall dams are situated within the catchment. These decrease the runoff into the river. The extensive crop cultivation and overgrazing decrease vegetation cover and increase runoff into the river. The inter basin transfers from the Katse water scheme into the Caledon River would also lead to a change in the hydrology of the river. Although the contributing factors are numerous it is not considered that this would lead to a large change in the hydrology of the Caledon River.

The catchment is utilised for extensive crop production. These include dryland as well as irrigated crops. This results in increased sediment runoff. This is further exacerbated by the topography, rainfall and erodability of the soil. Coupled with the agricultural activities is an increase in nutrient load (Nitrogen and Phosphorous fertilisers) and pesticides.

Bridges over the river upstream of the site increase the erosion of the riverbed. However, due to the low amount of bridges and the distance from the site this impact is not considered significant.

Extensive human settlement occurs in the catchment of the river and in close proximity to the river. These settlements include Ficksburg, Peka, Tsikoane, Hlotse, Mapotsoe and Butha Buthe. These settlements all contribute to increased runoff, pollutants and sediment. Industrial pollutants are an emerging but serious problem and most discharges from industry flows into the Caledon River (Motsamai, Keatimilwe & Pomela 2003).

It is known that the water in the Caledon (Mohokare) River is naturally of high turbidity and carries a concerning high sediment load. However, poor management practises result in high sediment yields. The slope as well as the erodability of the soils in the upper Caledon catchment leads to increased sediment deposition. Severe soil erosion, especially in the Caledon system, is a contributing factor. This amount of sediment that is mobilised due to poor range management is also exacerbated by many factors such as land use, topography, climate, erodability of soil, rainfall and runoff (ORASECOM 2007 & 2008). Therefore it must be clear that although the river has a naturally high sediment load the poor management of the catchment rangeland has significantly exacerbated the sediment impact on the Caledon River. The catchment and river bank itself is heavily overgrazed. Other impacts associated with human impacts and trampling by domestic stock also add to the degradation of the river banks. Overgrazing and trampling by domestic stock decrease the vegetation cover, this in turn leads to higher soil erosion, which in turn leads to a further decrease in vegetation cover. This forms a negative feedback loop. The above discussion is considered the highest impact on the river catchment and river itself.

2.2 Functioning of the Riparian Vegetation Communities

All river systems contain three distinct, lateral riparian zones, namely marginal, lower and upper zones (Figure 2). The zones are identified by a combination of the periodicity of the hydrological influence, marked changes in lateral elevation or moisture gradients, changes in geomorphic structure and changes in plant species distribution or community composition along lateral gradients.

It must be stated that all of the riparian zones on the Lesotho side of the river are severely degraded and although the different zones are present the riparian vegetation itself are severely transformed, unnatural and absent in many areas (Figure 1). The discussion as follows is based on the riparian communities on the South African side of the river.



Figure 1: Panorama of the Caledon River. Note the absence of vegetation on the Lesotho side of the river, some exotic weeds, grasses and isolated trees remain. Vegetation on the South African side contains grasses, herbs and a multitude of exotic trees.

The marginal zone is the lowest zone and is always present in river systems while the other two zones may not always be present. The zone is situated from the water level at low flow, if present, up to the features that are hydrologically activated for the most of the year (Figure 2). The marginal zone along this section of the river is relatively small and rarely extends for more than one meter from the waters edge. The marginal zone in this section does not contain a large amount of vegetation. This is primarily due to the sandy sediment and the constant

disturbance and deposition of sediment in the marginal zone. The marginal zone is also often eroded away by the river. This riparian community is currently in a degraded state.

The lower zone is characterised by seasonal features and extends from the marginal zone up to an area of marked elevation. This area may be accompanied by a change in species distribution patterns. The lower zone consists of geomorphic features that are activated on a seasonal basis (Figure 2). The lower zone along this section of the river contains a steep slope but is subjected to annual flooding. The riparian vegetation in this zone consists primarily of grasses and herbs. The lower zone is also encroached by exotic Poplar Trees (*Populus x canescens*) although these trees are annually removed by floods. Isolated specimens of exotic Weeping Willow (*Salix babylonica*) are also present in the lower zone though they do not invade and are adapted to the high moisture regime and annual floods. The lower zone is degraded to some extent and exotic species are common.

The upper zone is characterised by ephemeral features as well as the presence of both riparian and terrestrial species. The zone extends from the lower zone to the riparian corridor. The upper zone contains geomorphic features that are hydrologically activated on an ephemeral basis (Figure 2). The upper zone along this section of the river contains a steep slope that contains a marked decrease in lateral slope. The upper zone is dominated by exotic Poplar Trees (*Populus x canescens*). These trees form dense stands and exclude most other vegetation. The species has transformed the upper zone riparian vegetation. This zone is considered severely degraded.

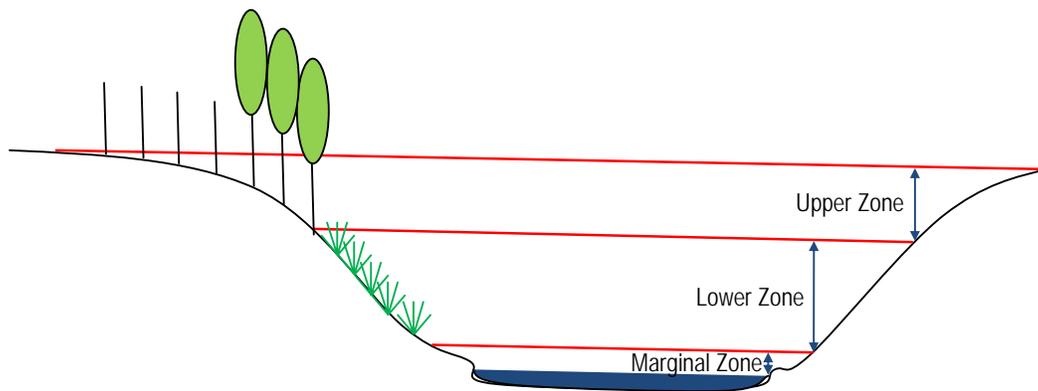


Figure 2: Illustration showing the different riparian zones of this section of the Caledon River.

The riparian zones on the Lesotho side of the river is severely degraded, transformed and the riparian vegetation is absent in many areas. The riparian zones on the South African side of the river are intact but degraded.

The river itself at low flow levels and the marginal zone will remain more or less inundated throughout the year. During the rainfall season floods occur annually within the Caledon River. During these annual floods the lower zone is inundated. The magnitude of the flood may alter the lower zone due to removal of vegetation and the deposition or scouring of sediments. It then follows that this zone experiences high levels of disturbance due to annual floods. The upper zone is ephemeral in nature and only floods during exceptional flooding events. It follows then that the upper zone experiences less flood disturbance. For this reasons large stands of exotic trees are able to infest the upper zone where floods are not as frequent. Overall the

riparian zones are not in a good condition and have been severely degraded (Refer to the Index of Habitat Integrity for explanation of this degraded state).

Although the river is in a degraded state it still constitutes a sensitive environment as it provides vital ecological services. Therefore any alteration in the hydrology and functioning of the river must be carefully assessed. The height of the obstruction formed by the weir is approximately 0.5m from the river bed. Due to the low height of the weir the effect of damming will not be significant but will still have a low effect on the riparian zones. As the weir causes an increase in low flow height the riparian zones will be shifted upwards as illustrated by Figure 3.

Due to the low height of the weir and the already degraded condition of the riparian zones this impact cannot be regarded as significant.

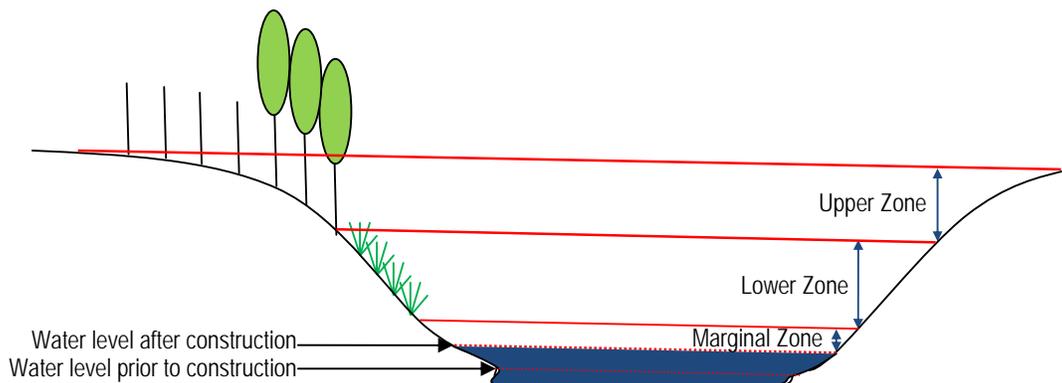


Figure 3: Illustration showing the effect that the weir will have on the riparian zones. Note that the water level will rise slightly as a result of the weir, this will result in an upward shift of the marginal zone, a small portion of the lower zone will be lost as the marginal zone moves upward and the upper zone will remain intact.

3. Conclusion

Due to the impacts associated with the increased sediment loads as well as other impacts as discussed above the Instream Index of Habitat Integrity is rated as a D rating: largely modified with a large loss of natural habitat, biota and basic ecosystem function. Refer to the attached River Index of Habitat Integrity for an exposition of the rating establishment.

Due to the impacts associated with overgrazing and trampling by domestic stock as well as agricultural activities and disturbance of the river bank the Riparian Index of Habitat Integrity is rated as a D rating: largely modified with a large loss of natural habitat, biota and basic ecosystem function. Refer to the attached River Index of Habitat Integrity for an exposition of the rating establishment.

Therefore, although the Caledon River remains a sensitive environment due to the ecological services it provides the condition of the instream and riparian habitats are severely degraded.

The obstruction formed by the weir would not be substantial since the height of the weir is relatively low. Therefore the impact of the weir on the riparian communities of the river would be relatively low. The increase in height of the low level water flow would lead to an upward

movement of the marginal zone. This would be a slight change in the riparian zones and is not regarded as a major impact on the riparian zone of the river.

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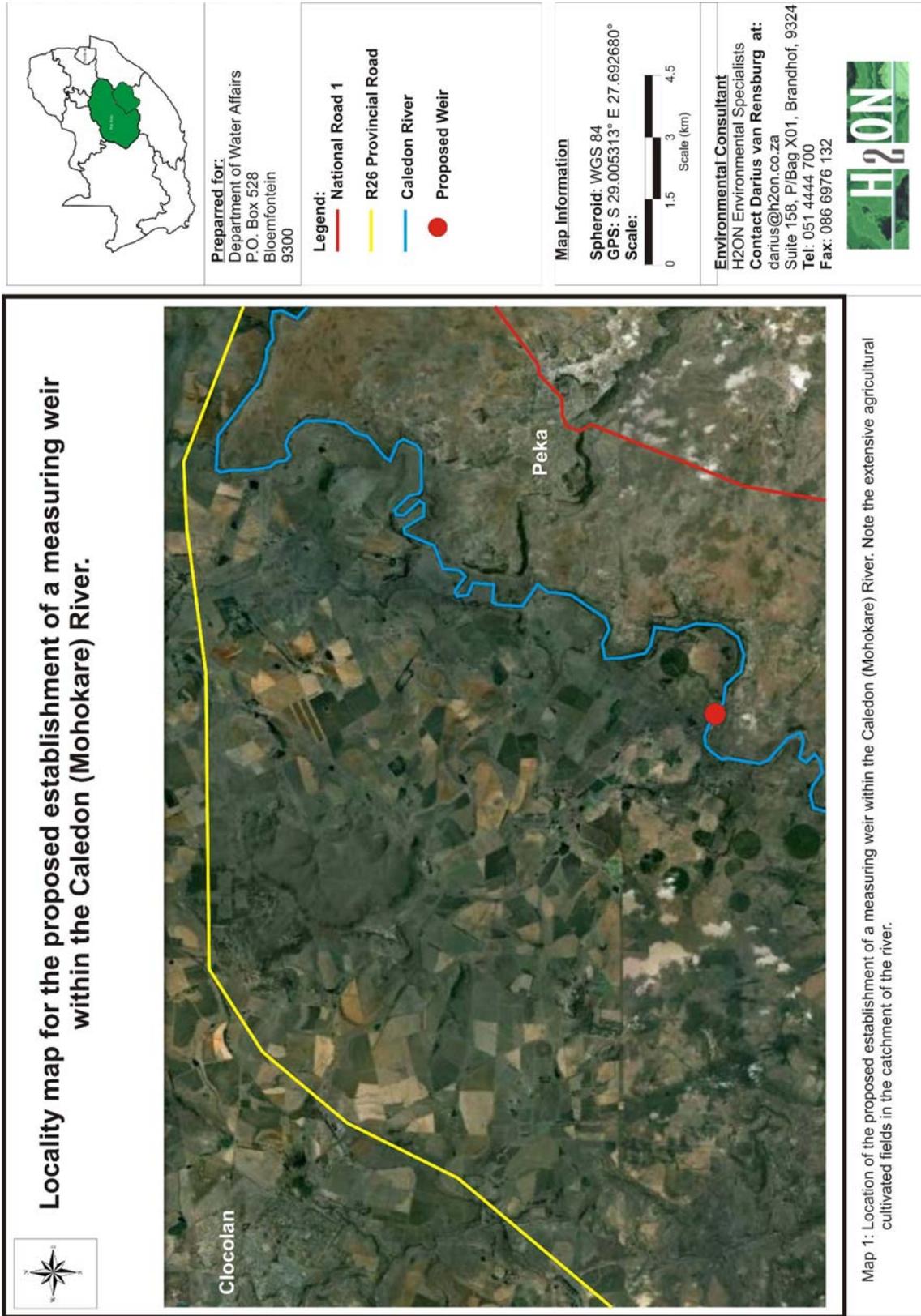
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Appendix A – Locality Map



Appendix B – Index of Habitat Integrity forms