

1 JBS24 (OSAEH 11.18: MODDER RIVER)

The Modder River is the main tributary of the Riet River and joins the Riet River just upstream of Ritchie. The Modder River has its source in the hills at the watershed near Dewetsdorp (1600m above mean sea level). The Krugersdrift Dam is located on the Modder River. Most of the natural runoff into the Modder River is from above the confluence of the Modder and Klein Modder Rivers. The rest of the Modder River catchment is very flat and very little runoff occurs. Current land use in the catchment is related agricultural activities (primarily irrigated crops), urbanisation and mining and industrial activities. Livestock watering also occurs, but to a lesser extent. The major urban centres in the catchment are Bloemfontein, Botshabelo and Thabu Nchu and the Modder River is a major source of water to these urban areas (DWA, 2009).

1.1 SITE DESCRIPTION

OSAEH 11.18 falls within MRU Riet C1 which is delineated from origin of Modder River to Krugerdrif Dam. Water in this reach is used to supply irrigation needs, urban centres and industrial activities. This site is bedrock-dominated with good marginal vegetation comprising sedges and overhanging vegetation. The river width varies from 2 m to 15 m in places. Some sedimentation is present with filamentous algae on the rocks at the river's edge. The instream habitat consists of pools, riffles and runs, with some boulders, cobbles, gravel and sand present. The site is approximately 13 km downstream of Rustfontein Dam. Instream weirs are prevalent in the river, impacting negatively on the movement of instream biota. Bank undercutting and root wads also occur at the site. The surrounding land use consists of natural fields for grazing and agriculture.

Location	OSAEH 11.18	Altitude	1346 m
Longitude	26.57194	Latitude	-29.16111
EcoRegion	Highveld 11.03	Quaternary catchment	C52B
Water Management Area	Upper Orange	Geomorphological zone	Foothill



OSAEH 11.18, Modder River – Riffle and run over bedrock.

1.2 SAMPLING CONDITIONS

The site, at the time of sampling, was dominated by extensive instream runs, with dense algal growth occurring on the substratum. Marginal vegetation was of excellent quality and quantity, with limited stones out of current biotope present. Very little sedimentation was present, with the water colour a light brown and slightly turbid. Some solid waste was observed. Cattle trampling was also observed. No exotic macrophytes were observed, as well as no exotic vegetation encroachment.

1.3 PRESENT ECOLOGICAL STATE

IIHI	The Instream Index of Habitat Integrity (IIHI) is a C (68.1%). This is mostly due to poor bed conditions, with elevated levels of sediment and benthic growth (also associated with elevated nutrients at the site due to close upstream proximity of weir and high density cattle), and altered flow regimes with reduced base flows and flooding. Longitudinal connectivity also scored poorly due to impoundments.
RIHI	The Riparian Index of Habitat Integrity (RIHI) is a C (66.7%) with the main impacts being poor bank conditions due to a high degree of erosion and substrate exposure, with trampling pressure exacerbating the situation. Reduced base flows and small floods facilitate an increase in marginal and lower zone vegetation.
Fish	All of the fish species (6 out of 6) expected under reference conditions are still expected to be present under the present conditions at this site. Note: Some species (<i>L. aeneus</i> and <i>L. capensis</i> P) were sampled at an increased/improved FROC from reference conditions as they were sampled in high densities at the site, indicating that habitat conditions are suitable for species with a preference for a variety of flow depth classes, and species which are moderately intolerant to no flow conditions. The FROC of <i>L. kimberleyensis</i> was reduced due to flow modification and lower base flows resulting in a loss of FD habitat. Good spawning habitat is present for spawning during high floods, and pools are present as refugia and nursery area, after floods. Reduced base flows and loss of longitudinal connectivity, due to the impacts as discussed in this document, are causes of concern for the fish population and their successful migration, spawning and recruitment. The presence of carp, which can prey on fish eggs and causes bio-turbation, may also negatively impact on the fish species present in the system. The FROC of <i>C. gariepinus</i> and <i>L. umbratus</i> (quiet water benthic species) is expected to be low due to the stream being dominantly bedrock with fast flow. EC: FRAI = C, FRAI% = 67.2%.
Inverts	Oct 2010: SASS5 score: 95 No of Taxa: 21 ASPT: 4.5 Key taxa expected but not observed were generally those that are sensitive to water quality changes, such as Hydropsychidae >2spp, Pyralidae, Tricorythidae, Leptophlebiidae, Philopotamidae and Chlorocyphidae. The MIRAI model generates a Present Ecological State for macroinvertebrates as a Category D (57.3%).
Rip veg	The site has a VEGRAI score of 82.3% (B EC) with a confidence of 2.9. Marginal Zone: Bedrock controlled with riffle/runs and pools; some cobble but mostly sheet rock. Some alluvial deposits (fine alluvium) and well vegetated. <i>Gomphostigma virgatum</i> , <i>C. marginatus</i> and <i>Cyclosorus interruptus</i> dominate the open and bedrock areas. <i>Salix mucronata</i> common with overgang, rooted where aluvia are consolidated. Lower Zone: As marginal zone, but with extensive high density and cover areas of <i>S. mucronata</i> along lateral consolidated alluvial bars. Upper Zone: Characterised by open sheet rock, highly exposed and eroded due to high grazing and trampling pressure and scour of sediments due to lack of vegetated cover. Alluvial terraces dominated by grasses with woody patches, mainly <i>Searsia pyroides</i> , <i>Acacia karoo</i> and <i>Lycium hirsutum</i> . MCB: Dominated by woody vegetation (as Upper zone) with terrestrial grasses in between.
Diatoms	The assessment is based on a single sample taken during the current assessment. The overall EC of this site is a C. This site was critically polluted with organic pollution levels being high and organically bound nitrogen levels being periodically elevated. From the diatom community it is evident that agricultural runoff and fertilizer use is impacting the site.

1.4 MAIN IMPACTS AT THE SITE

	PES	Causes	Sources	F/NF
Rip veg	B	Reduced cover of indigenous riparian obligate species.	Moderate to high trampling and grazing pressure with bank destabilization and erosion, also minimal wood cutting.	NF

	PES	Causes	Sources	F/NF	
		Altered species composition.	Small impact of alien vegetation (5% annuals, 5% perennial mainly <i>Eucalyptus camuldensis</i>).		
		Altered species composition.	Reduced maintenance flows and small floods promote and increase in woody vegetation and sedges in the marginal and lower zone, especially when coupled with high grazing pressure.	F	
Fish	C	Decreased species diversity and abundance due to presence of carp.	Presence of alien species (carp) introduced for aquaculture and angling.	NF	
		Enrichment.	Cattle farming, trampling – erosion and excrement upstream.		
		Presence of dams and weirs as migration barriers (breeding, feeding and dispersal), also causing loss of habitat of some species (inundation).	Dam and other smaller weirs in area.		
			Loss of mainly FD habitat and other flow depth classes to lesser extent as a result of flow modification (especially during naturally low flow periods).	Large dam, smaller weirs and water abstraction for farming and irrigation and urbanization upstream.	F
			Lower breeding success and recruitment for fish = lower FROC.	Lower, less and/or no natural flushes and smaller floods. Flow modification due to dam etc.	
			Loss of species diversity or numbers due to loss of habitat diversity due to lower flows.	Flow modification due to dam etc.	
			Loss of habitat with substrate (cobbles and rock) due to lower than natural flows.	Flow modification due to dam etc.	
Inverts	D	Increased sedimentation.	Agriculture.	F	
		Poor water quality and associated benthic growth.		NF	

1.5 BASELINE SURVEY RESULTS: PRESENT ECOLOGICAL STATE

Driver Components	PES	Trend
IHI: INSTREAM	C	
IHI: RIPARIAN	C	
DIATOMS (WQ)	C	
Response Components	PES	Trend
FISH	C	Stable
MACRO INVERTEBRATES	D	Stable
INSTREAM	C	
RIPARIAN VEGETATION	B	Stable
ECOSTATUS	C	

The PES EcoStatus for this site is a category C. Reasons for this include flow modification and resultant loss of instream habitat due to instream dams and weirs. Poor water quality and associated benthic growth also impact the site. Exotic fish species and altered riparian species composition and reduced cover of indigenous riparian obligate species are another reason for this EC.

1.6 SUITABILITY AS FUTURE MONITORING SITE

A diversity of flow velocities is present for SASS sampling. Biotopes present include SIC, marginal vegetation in- and out of current as well as GSM. The site is bedrock dominated which reduces the amount of instream habitat for macroinvertebrates. Sedimentation occurs as well as turbid waters. The river is perennial with good fish habitat diversity and cover. Bank undercutting, instream and marginal aquatic and overhanging riparian vegetation are abundant for fish cover. Pools occur frequently which serve as water column cover and refugia for fish. The FD fish habitat is rare or sparse at low base flows and will be more abundant during high base flows. Instream substrate, for example cobbles, is sparse. The site is situated downstream of a bridge and a weir. Trampling, overgrazing, urbanization, erosion and abstraction are some examples of local and catchment scale impacts. Riparian vegetation obligate species are present (rheophytes, heliophytes and bank species) and are also dominant at the site.

OSAEH 11.18 is located downstream of Botshabela and Thabu Nchu but upstream from Bloemfontein, and as this is the only OSAEH site situated in the upper reaches of the river, this site will be a good monitoring site to detect and monitor on-going impacts which include impacts from sewage works, interbasin transfer, and Rustfontein Dam upstream.
