



# 1 JBS36 (OSAEH 28.5: SENDELINGSDRIFT (ORANGE RIVER))

## 1.1 SITE DESCRIPTION

The site is situated approximately 130 km downstream of Vioolsdrif Weir in the lower section of the Orange River (downstream of Augrabies Falls to the estuary) where the river flows through the Orange River Gorge EcoRegion. The site is located on the river's mainstem, at the exact point where it is joined by the south flowing Boom River. The Boom River was however dry at the time of sampling, and no pools or other surface water were evident. The river flows in a wide valley, with low-energy fluvial environment, and big boulders and rocks in the main channel. Sediment banks are present, mainly colonized by *Phragmites*. These islands are habitat to many bird species.

<b>Location</b>	Sendlingsdrif	<b>Altitude</b>	54 m
<b>Longitude</b>	17° 4.400	<b>Latitude</b>	28° 2.062
<b>EcoRegion</b>	Orange River Gorge 28.01	<b>Quaternary catchment</b>	D82K
<b>Water Management Area</b>	Lower Orange River	<b>Geomorphological zone</b>	Lowland River
			
<b>Rapids and Riffles at OSAEH 28.5, Lower Orange River</b>			
			
<b>Marginal vegetation at OSAEH 28.5, Lower Orange River</b>			

## 1.2 SAMPLING CONDITIONS

The site, at the time of sampling, was dominated by riffles and rapids with slower-flowing habitat occurring upstream and downstream of these. The macro-channel width was >100 m and the active channel and surface water width was 50 – 100 m. Various habitat types were available for macroinvertebrates at the site namely stones in current (rapids and riffles, marginal vegetation and gravel, sand and mud. The substratum was mostly bedrock, boulders, cobbles and pebbles and gravel, limited sand and mud. Some stones (especially

those in areas of lower flow) were covered with a thickish layer of diatoms and sediment. Flow at the site varied from low (0.03 m/s) to very high (0.85 m/s) in the rapid riffle section and low (0.1 m/s) to high (0.63 m/s) in the marginal vegetation. A small area of aquatic vegetation was present with a flow of 0.1 m/s (low). Flow in gravel/sand/mud biotope varied from 0.1 m/s (low) to 0.24 m/s (moderate).

### 1.3 PRESENT ECOLOGICAL STATE

IIIHI	Changes in bank and bed due to influence of irrigation upstream as well as change in hydrology and sediment load as a result of large dams (Gariep and Vanderkloof) in Upper Orange River and various weirs upstream.
RIHI	The main impact being added nutrients from irrigation upstream leading to increased growth of reeds etc. as well as change in hydrology affecting plant growth on banks. Some trampling (probably wildlife) was also seen at site.
Fish	The reference conditions set for the FROC-site, D8ORAN-SENDE (Kleynhans <i>et al.</i> , 2007), was used as a starting point for setting reference conditions for the present site. All eleven expected fish species were sampled of which three species are red data species. The majority of the expected fish species are still present although the FROC of some species have been reduced from reference conditions. The reference FROC of species preferring fast flow and substrate cover remained the same while A slight decrease in the reference FROC was however recorded for the majority of species associated with slower flowing habitats and overhanging vegetation cover. Habitats hosting overhanging and instream vegetation cover are however rare at the site and could to an extent explain the reduction in FROC for not only <i>M. brevianalis</i> , but also for <i>B. paludinosus</i> and <i>P. philander</i> . One exotic, <i>Cyprinus carpio</i> , and two introduced species, <i>Oreochromis mossambicus</i> and <i>T. rendalli</i> are known to occur between Violsdrif and the mouth and of these, <i>C. carpio</i> and <i>O. mossambicus</i> have been recorded during the recent surveys. Although very few <i>C. carpio</i> individuals were recorded, <i>O. mossambicus</i> were found to be widely distributed and more abundant. Concern has been expressed that this species is becoming increasingly more widespread and abundant in the lower Orange River.
Inverts	Nov 2010: SASS5 score: 150 No of Taxa: 26 ASPT: 6.3 Key taxa expected but not observed were generally those that prefer no to low flow and vegetation or water column namely Belostomatidae, Corixidae, Culicidae, Gerridae, Hydrophilidae, Hydroptilidae and Planorbinae. Flow at the site even in the vegetation was mostly moderate to high. Very few areas of low to no flow were present at the site. Aeshnidae that prefer any flow and cobbles or vegetation was also not sampled. This could be due to sampling error. The abundance of most macroinvertebrates at the site was as expected.
Rip veg	<b>Marginal zone:</b> Was dominated by <i>Cynodon dactylon</i> and <i>Salix mucronata</i> . <b>Lower zone:</b> Characterized by an increase in the abundance and cover of trees. The most dominant trees on this zone were: <i>Salix mucronata</i> , <i>Tamarix usneoides</i> , <i>Acacia karoo</i> and <i>Ziziphus mucronata</i> . The most abundant grass was <i>Cynodon dactylon</i> , with a few individual plants of <i>Gomphocarpus fruticosus</i> . <b>Upper zone:</b> Most of the annuals were dead, but some were blooming. However, it was eminent from the dead plants, that the non-woody cover was good. The rainy season had not started by the time the site visit was conducted. On the edge between the upper and terrestrial zone, <i>Lycium horridum</i> , <i>Sisymbrium sparteum</i> and <i>Euclea sedibensis</i> occurred. There was also a difference in the structure of <i>Tamarix usneoides</i> , as the distance increased from the river. The trees became smaller and their leaf colour also became more dull green. This could be explained by a possible decrease in soil moisture content, as the distance from the river increases.
Diatoms	Diatom results are based on samples taken during 2005, 2008 – 2010 at various sites situated in the

	reach below MRU F. The EC for this reach is a C. Nutrient levels are elevated at times with slight levels of pollution.
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#### 1.4 MAIN IMPACTS AT THE SITE

	PES	Causes	Sources	F/NF
Rip veg	B	Decrease in cover.	Animal grazing and trampling..	NF
		Increased sedge and reed cover.	Flow regulation and reduced flooding disturbance facilitates an increase in reed and sedge cover and density in the marginal and lower zone.	F
Fish	B/C	Loss of habitat (decreased SD and SS) diversity as a result of flow modification (especially during natural low flow periods).	River regulation has leveled out seasonal differences in the total annual flow and removed periods of intermittence in the lower Orange. Natural cessations of flow removed by regulation.	F
		Change in seasonality of the flow regime could influence spawning reproduction as well as natural community structures.		
		Decreased substrate quality related to increased benthic growth.	Return flows from irrigated agricultural areas.	
		Increased turbidity and disturbed bottom substrates.	Presence of bottom feeding alien CCAR.	
		Presence of migration barriers reduces migration success (breeding, feeding and dispersal) of some species.	The weir at Vioolsdrif, as well as the new gauging weir under construction nearby Sendelingsdrif. According to an official from Namibia, a fish ladder is to be built to allow fish migration.	
		Decrease in the condition of species moderately intolerant to modified water quality (e.g. BKIM).	Return flows from irrigated lands downstream of Vioolsdrif to the river.	
		Decrease in species diversity and abundance as a result of competition between TSPA, PPHI and OMOS.	The introduced OMOS is becoming increasingly more widespread and more abundant in the lower Orange.	
Inverts	B/C	Decreased flows during wet season and increased dry season flow as well as a change in the seasonality (winter and summer flows are not as distinct as before dams were built upstream).	Dams and weirs upstream.	F
		Loss of habitat due to decrease in flow.		
		Water quality and associated benthic growth.	Agriculture. Increase in nutrients as result of irrigation.	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	B/C	Negative (B/C)
MACRO INVERTEBRATES	B/C	Negative (B/C)
INSTREAM	B/C	
RIPARIAN VEGETATION	B	Stable
ECOSTATUS	B/C	

## 1.6 SUITABILITY AS A FUTURE BIOMONITORING SITE

Habitat at the site is good for SASS sampling and the biotope availability according to the SASS5 template indicates a good (B) category. All habitat and flow types were present at site. Marginal vegetation was however restricted (only small area available) as most of the bank was either mud or cobbles and pebbles. The riparian zones could be distinguished easily and all fish depth classes were available and could be sampled.

**Access** to site is easy – site is accessed from the Namibian side in the Ai Ais Richtersveld Transfrontier Park. Turn off from road at the Boom tributary and drive in dry river bed to site. If the Boom River is flowing access is still possible from the gravel road travelling from Noordoewer to Rosh Pinah.

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