1 JBS11 (EWR 11: BLESBOK (BLESBOKSPRUIT RIVER))

The information is summarised from DWA (2008a,b; 2009a; 2010a).

EWR 11 and OSAEH 11.8 have the same locality. During the Reserve assessment there was very low confidence in the hydrology and after personal communication with Ms Delana Louw it was decided to reassess this site which was undertaken during March 2011. The Reserve study allowed for good data availability and understanding of the site however the major issue at this site is that the PES baseline could have changed due to the uncertainties regarding the hydrology. Therefore the results provided below are mainly the results from the EWR study, and any significant changes in the condition of the biota observed during the 2011 assessment is included.

1.1 SITE DESCRIPTION

The whole Blesbokspruit River has been delineated as one MRU, MRU Bles A. The site morphology is generally representative of the reach, but impacts concentrated around the road/bridge access results in the banks being in a poorer condition than generally seen along the reach. There are approximately paired terraces on both banks and instream features are scoured out (probably due to increased flows and recent floods). Some channel manipulation from low and high-level bridges upstream was observed and there is up to 20% exotics in places. Fish habitat, flow-depth categories and cover is well represented at site. Non-flow related impacts may have negative impact on semi-rheophilic species (reduced water quality, extensive algal growth on substrate) which may reduce the ability of site to sustain these species. Macroinvertebrate habitat is poor.

Location	EWR 11	**Altitude**	1528 m
Longitude	28.42488	**Latitude**	-26.47892
EcoRegion	Highveld/Southern Central Kalahari 11.03	**Quaternary catchment**	C21F
Water Management Area	Upper Vaal	**Geomorphological zone**	Lower Foothills

EWR 11, Blesbokspruit, August 2008

1.2 PRESENT ECOLOGICAL STATE (PES)

Geom	Due to the large increases in base flows the active channel banks are cutting, and the competence[1] of the river has increased. Water quality is impacting the marginal vegetation, which is in turn would destabilize the banks as the vegetation dies off. Paired terraces occur on each bank and instream features have been scoured out due to increased flows and recent floods.
WQ	133Q01 and Rand Water C-B10 at Heidelberg on Blesbokspruit (2003 - 2008) with n = 227 was used for the physico-chemical PES assessment. The current water quality status of the Blesbokspruit is driven by the following: • Mine water decants (point sources) of saline water – some of which are being pre-treated and released above the wetland. This results in high salts as seen in electrical conductivity and sulphates measurements. • Diffuse runoff from mining activities on the Witwatersrand that are over 100 years old such as waste dumps and slimes dams. When it rains in the summer the salts are washed off the mine waste dumps and enter the surface and groundwater. In the winter months there are highly mobile particles that are blown around which have an effect on human health (respiratory). • Urban runoff originating from large numbers of formal and informal settlements which results in faecal contamination (potential water borne diseases) and high nutrients (mainly phosphates) from areas with poor or failing waste infrastructure. • Point source discharges from waste water treatment works. These treatment works are currently under capacitated and the final effluent discharged rarely meets the discharge requirements. • Point and source discharges from industries such as SAPPI. • Higher base flows due to higher surface area of impervious surfaces, return effluents from WWTW, mine water decants.
Fish	Most of the expected fish species have been altered within this Resource Unit. It is expected that *A. sclateri* has been lost from this reach as a result of the deteriorated water quality and substrate habitats. LCAP and *L. umbratus* have also most probably been lost as a result of water quality deterioration and especially loss of substrate quality. The loss of slow habitats influenced species such as *B. anoplus*, *B. pallidus*, *B. paludinosus* and *L. umbratus* and possibly also *C. gariepinus* with a preference for slow habitats. The presence of alien species *G. affinis* and *C. carpio* are also expected to have an impact on the indigenous species, especially regarding breeding (egg and larvae disturbance and predation). Migration barriers in the form of weirs also affect the fish assemblages of this reach to some extent.
Inverts	Aug 07: SASS5 score: 57 No of Taxa: 14 ASPT: 4.1 Apr 08: SASS5 score: 61 No of Taxa: 16 ASPT: 3.8 The composition of macroinvertebrates is highly modified from expected natural conditions, and extremely low in relation to the availability of biotopes. The only species of baetid mayfly recorded was *Baetis harrisoni,* which is well-known to be highly tolerant to water quality deterioration. Likewise, the only species of hydropsychid caddisfly was *Cheumatopsyche thomasetti,* while the only species of blackfly was *Simulium adersi*. Both these species are highly tolerant to water quality deterioration. The SASS Scores (57 and 61) were significantly lower than expected (164). Likewise, the ASPT (4.1 and 3.8) was significantly lower than expected (5.9). Notable taxa that were absent included those that are sensitive to water quality (e.g. Heptageniidae), as well as taxa that prefer slow-flowing water (e.g. Sphaeriidae, Leptophlebiidae and Caenidae). The absence of the latter taxa reflects the elevated base flows that occur at this site.
Rip veg	The site occurs within the Tsakane Clay Grassland vegetation unit, which has a conservation status of "Endangered", mainly because only 24% of this vegetation type remains, with only 1.5% under protection. **Marginal zone:** Has no sedges; these appear to be "drowned out", and only non-woody vegetation is present that is associated with sediment i.e. *Phragmites* and *Typha.* Woody vegetation is absent. **Lower zone:** Similarly is dominated by reeds and *Typha*, with *Schoenoplectus* spp. Indigenous woody species are also absent. Loss of indigenous species due to overgrazing. **Upper zone:** Characterised by grassland species, but indicative of overgrazing (*Stoebe* spp.) and woody species are minimal. Loss of indigenous species due to overgrazing.
Diatoms	Four diatom samples were taken at this site (August and December 2007 and January and April 2008). All four diatom samples indicate that pollution levels are extreme and that the Blesbokspruit River is of poor

[1] The maximum size or weight of material a river can transport. In times of flood, a river's competence will increase – it will be able to carry bigger particles (http://www.slideshare.net/jacksonthree/river-transportation-hjulstrom-curve).

		water quality. Organic pollution, metal contamination and salinity are a major concern and mine water decant and industrial effluent impact at critical levels. Oxygen and temperature are also variables of concern at this site. Due to the continual elevated flows the impacts are diluted constantly. The biological water quality was assessed as a C/D EC due to the dilution effect. It must however be noted that this is not a true reflection of prevailing conditions and that a slight reduction in flows will cause the biological water quality to deteriorate rapidly to a D or E category..

1.3 MAIN IMPACTS AT THE SITE

	PES	Causes	Sources	F/NF
WQ	D/E	High salinity levels.	Mine water decants and waste dump diffuse pollution. Some of which are being pretreated and released above Merriespruit wetland.	F
		Traces of metals such as arsenic and cyanide.	From mines, mine ground water discharges, and industrial discharges. Large surface area of wetlands, urban runoff as well as constant groundwater temperature releases.	
		Diurnal temperature changes.	High algal growth – rooted macrophytes, filamentous, exotic floating macrophytes (Water hyacinth) and single cell blooms. Can result in diurnal oxygen fluctuations that can cause fish kills.	
		Microbial contamination (potential water borne disease) and high nutrients.	Urban runoff from large number of formal and informal settlements as well as point source discharges from waste water treatment works.	NF
		Elevated water temperatures.	Large surface area of wetlands, urban runoff as well as constant groundwater temperature releases. .	
Geom	C	Increased transport capacity due to increased base flows.	Primarily dewatering from the mines; but also sewage return flows and runoff from urban areas.	F
		Morphological change: Cutting of the active channel banks; increased channel competency.	Increased base flows.	
		Increased sediment supply.	Erosion of the upstream tributaries and locally from eroding banks.	NF
		Slight reduction in connectivity.	Upstream small dams and weirs.	
Rip veg	D	Loss of marginal zone vegetation.	Increased flows.	F
		Loss of riparian habitat.	Erosion from bridge, localized effect.	
		Change in species composition.	Exotic species, but small influence.	NF
		Loss of indigenous species.	Overgrazing in lower and upper zones.	
Fish	D	Altered habitat composition (slow habitats transformed to fast habitats).	Increased flows / altered hydrological regime.	F
		Altered bottom substrate habitats result in loss of fish species diversity.	Increased filamentous algal growth related to increased nutrients.	NF
		Decreased overhanging vegetation as cover for fish.	Grazing, agriculture and water level fluctuations.	
		Increased sedimentation result in deterioration of substrate as habitat (clogging interstitial spaces, loss of important spawning habitats, etc.).	Bank erosion, residential areas and vegetation removal (grazing) contribute to increased sedimentation.	
		Decreased species diversity and abundance (especially small species) as result of presence of GAFF that preys on larvae.	Presence of aggressive alien predatory species (MSAL) and GAFF naturally spreading and introduced for recreation / angling.	
		Decreased bottom substrate quality.	Impact of bottom feeding alien CCAR and siltation.	
		Presence of migration barriers reduces migration success (breeding, feeding and dispersal) of some species.	Dams and various weirs. Also farm dams in tributaries reduce refuge areas..	
Macroinvertebrates	D/E	High baseflows.	Decanting mines, sewage treatment works and seepage from urban development.	F
		Water quality problems, particularly elevated salinity and bacteria.	Industries (Mines, Sappi) and urban stormwater.	NF

	PES	Causes	Sources	F/NF
		Benthic algae.	Elevated nutrients and clear water.	
		Sediment (sand).	Large amount of sand from general erosion in catchment and sand mining.	

1.4 RESULTS: PRESENT ECOLOGICAL STATE

Driver Components	PES	Trend
GEOMORPHOLOGY	C	Negative
WATER QUALITY	D/E	Negative
DIATOMS	C/D	
Response Components	**PES**	**Trend**
FISH	D	Stable
MACRO INVERTEBRATES	D/E	Stable
INSTREAM	D/E	
RIPARIAN VEGETATION	D	Negative
ECOSTATUS	D	

The site is in a D EcoStatus PES. Non-flow related impacts include increased base flows and floods due to mine water decants, urban runoff, agriculture and return flows from WWTW. Water quality is also heavily impacted due to these activities and erosion has increased. Alien fish species are present.

1.5 SUITABILITY AS FUTURE BIOMONITORING SITE

The site is severely impacted, especially biota, and therefore this site should be included to detect these impacts and to determine if the site improves when the planned water quality management plan for the Blesbokspruit is initiated which would include treatment of mine water decant.