



SHIXINI RIVER ASSESSMENT – AUGUST 2010

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Prepared for:

**Department of Water Affairs
East London Region
Eastern Cape**

INTRODUCTION

Chief Dumalisile, at Willowvale in the former Transkei, in the Eastern Cape Province, South Africa, intends to do a water supply to the villages under his jurisdiction. This water supply is mainly for irrigation purposes. His approach is to construct an in-stream dam or a gauging weir, where water will be abstracted for the said water use; hence the Regional Department of Water Affairs (DWA) office was involved in the process. The rivers where the proposed water use will take place is either Shixini, Jujura or Mgadla, depending on water availability, and these streams run through quaternary catchment T90C. These are all coastal rivers and empty directly into the ocean. The former will be the main point of focus, as it is bigger than the rest and is perennial.

The results of the survey would serve as an input (where necessary) to the National Aquatic Environmental Health Monitoring Programme (River Health Programme), Reserve determination for Resource Directed Measures, EcoStatus model Index of Habitat Integrity.

TEAM: RESOURCE PROTECTION (DWA).

Mr. N. Tshedu, Mr. L. Gaulana and Mr. E. Weni conducted the survey and river assessment, simultaneously, on the 13th – 14th of August 2010.

STUDY AREA

The Shixini River starts from an altitude of approximately 700 meters above sea level. The rivers run in between highly dissected hills with both concave and convex slopes (GIS coverage: RQS). Sedimentary rocks of the Adelaide Formation determine sediment characteristic deposited on the river. The major tributary of Shixini River is KuQakazana, of which there is no access due to rough terrain. No well known major tributaries of the Shixini River, except some non-perennial streams that might flow during summer times of high floods. The whole system from the upper reaches to the lower reaches is dominated by bedrock material. Such formation is a characteristic of rejuvenated river.

The potential natural vegetation comprises the Eastern Thorn Bushveld in the upper reaches, the Valley Thicket in the middle reaches and the Coastal Grassland in the lower reaches of which all are within the Savanna biome (Low and Rebelo, 2006; Rutheford, 1998).

Geology and soils of the catchment are dominated by mudstones and sandstones of the Adelaide Formation. Small proportion of the upper reaches of the catchment consists of basalt, tuff, breccia and rhyolite within the Zuurberg, Drakensberg, Lebombo Formation (GIS coverage: DWA).

This report provides the results of the biomonitoring survey that was undertaken in the Shixini River system in August 2010 (Spring survey). Data collection was done using geomorphological assessment field sheet, of which such data would be applied to Geomorphological Assessment Index (GAI). The data collected includes diversity of catchment processes associated with causing major impacts on river. Thus the report provides information on the Present Ecological State of the Shixini River system in early spring (period of base flows).

MAJOR LAND USE ACTIVITIES

Observed on the study area are markedly different units of landuse activities which include the following:

- Animal husbandry: cattle, sheep, and goats
- Subsistence crop production (maize and vegetables).
- Rural settlements.

It could be noticed that most of the land in the catchment is unimproved and degraded grassland.

AIMS

The main objectives of this survey are to:

- Determine the present ecological state of the Shixini River, and
- Spot the relatively suitable segment of the river where the proposed dam or weir can be constructed, and then present the recommendations thereof.

SITE DESCRIPTIONS AND RESULTS

Site 1: Shixini at upper reaches

This site is situated between Idutywa and Willowvale towns, at these geographical coordinate points: S32°10'23.5" and E 28°26'10.4" with elevation of 569 m above sea level (masl). There is an existing low water bridge, over which the river flows. The bedrock and scattered pools dominate this site. Upstream of the sampling point are mealie fields and livestock (cattle and sheep). Water surface was covered by filamentous algae, *Spirogyra*, symbolical of pollution resulting from eutrophication. Empty soap boxes are indicative that this site is a laundry point as well. With the exception of the Amphipod, there were no invertebrate high scorers (sensitive to pollution). SASS 5 results indicate that this site is in Fair, close to Good condition, with good species diversity (28), despite of pollution (Figure 1). The flows were medium.

Geomorphological assessment shows that the site is located in an incised channel with flood benches and therefore minimal colluviums can be trapped before reaching the channel. The site is at the upper foothills geomorphological zone. It is a single thread, straight, pool-rapid system dominated by bedrock. Small stretch of the channel is braided immediately below the low water bridge. This shows increased sedimentation rate due to the material from the hill slope. The Geomorphological Assessment Index shows that the site is at B/C class in terms of its PES, suggesting moderate negative impacts of hill slope and in-channel processes.

Site 2: Shixini at middle reaches

This site is situated at the outskirts of Willowvale town, at these geographical coordinate points: 32 14 16.9S and 28 35 16.5E at an altitude of 253 masl. There are two existing bridges, although one has collapsed. The loose stones, a high cliff (approximately 80 m high) on the left bank and scattered pools characterize this site. The flows were medium. Upstream of the sampling point are mealie fields and livestock (cattle and sheep). Water surface was covered by filamentous algae, *Spirogyra*, symbolical of pollution resulting from eutrophication.

The loose stones trapped the algae, and the water color was clear upstream of the bridges, but again the algae accumulated and covered the surface under and near the bridge. Empty soap boxes are indicative that this site is a laundry point as well. With the exception of the Amphipod, there were no invertebrate high scorers (sensitive to pollution). SASS 5 results indicate that this site is in Good condition (Figure 1). There was highest (34) species diversity in this site, with notable sensitive species such as Perlid, Heptageniid, Chlorocyphid, Leptophlebid, Athericids, Psephenidae and Philopotamids. This site shows that the river has the assimilation potential (ability to clean itself after pollutants are introduced into it). Also noted in this site was a shoal of juvenile indigenous *Barbus anoplus* fish.

Geomorphological assessment shows that the site is located on a reach where the valley is confined on one side at upper foothills geomorphological zone. It is a single thread, straight, pool-riffle dominated by boulders. Variety of such substrates includes those that are irregular in shape as are directly from the vertical cliff, while the regular ones are from upstream of the reach. Braided channel upstream consists of bars with grasses that act as a cleanser or purifier of the water from far upstream. The Geomorphological Assessment Index shows that the site is at A class in terms of its PES, and thus in a near natural condition.

Site 3: Shixini at lower reaches

This site situated at the outskirts of Willowvale town, before the estuary, at these geographical coordinate points: S32°19'33.4" and E 28° 40'20.8" with elevation of 106 masl. There is existing bridges below the sampling point. The bedrock, loose stones and widening (although with confined channel due to dry season) are the features of this site. The flows were very slow and low. Upstream of the sampling point are mealie fields and livestock (cattle and sheep). Water surface under and nearby the bridge was covered by filamentous algae, *Spirogyra*, symbolical of pollution resulting from eutrophication. The loose stones trapped the algae, and the water color was clear upstream of the bridge. With the exception of the Amphipod, there were no invertebrate high scorers (sensitive to pollution). SASS 5 results indicate that this site is in Good condition (Figure 1). There was highest (34) species diversity in this site, with notable sensitive species such as Heptageniid, Chlorocyphid, Leptophlebid, Athericid, Psephenidae and Philopotamids. This site shows that the river has the assimilation potential (ability to clean itself after pollutants are introduced into it). Also noted in this site was the fresh water shrimp (*Atyid*), typical of nearby estuary, as in site 2, was a shoal of juvenile indigenous *Barbus anoplus* fish. There is an abstraction pipe below the bridge, at this site.

Geomorphological assessment shows that the site is located upstream of the estuary on a lowland river geomorphological zone. It is a single thread, straight mixed channel dominated by bedrock; hence rejuvenation could have taken place. The site is located where the valley is confined on one side, so that the colluviums from the hillslope can be trapped alternatively on the left and the right side of the river. Minimal alien invasive plants on a river bed's vegetated island and the river banks could be identified. These invasive aliens include the lantana and cocoa peanut butter. The Geomorphological Assessment Index shows that the site is at A class in terms of its PES, and thus in a near natural condition.

RESULTS OF THE SURVEY

The results of SASS and water quality will be shown in the form of graphs (histograms).

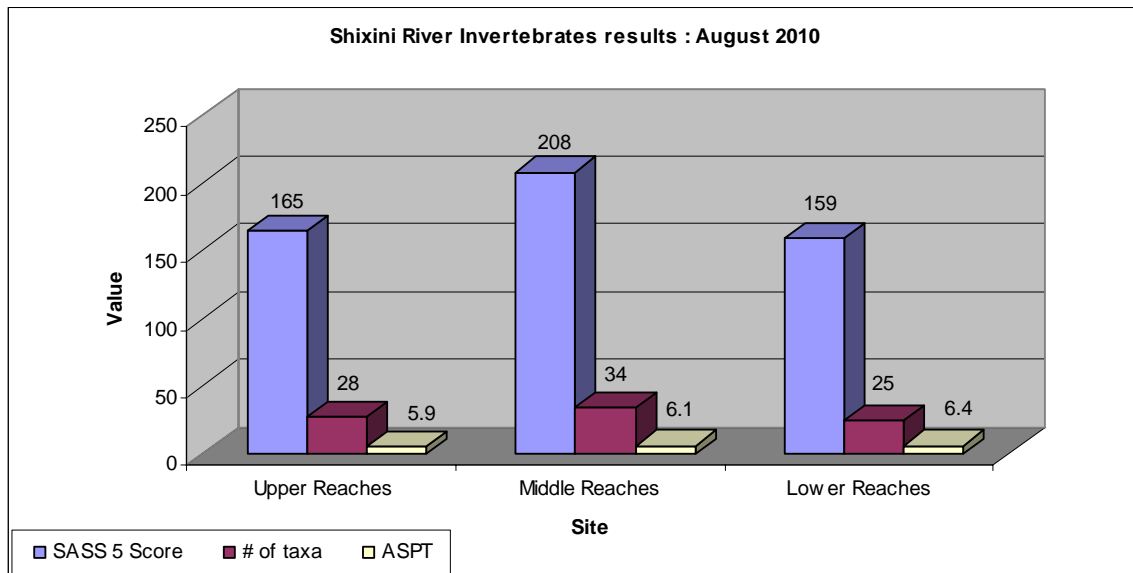


Figure 1: SASS 5 results of the Shixini River.

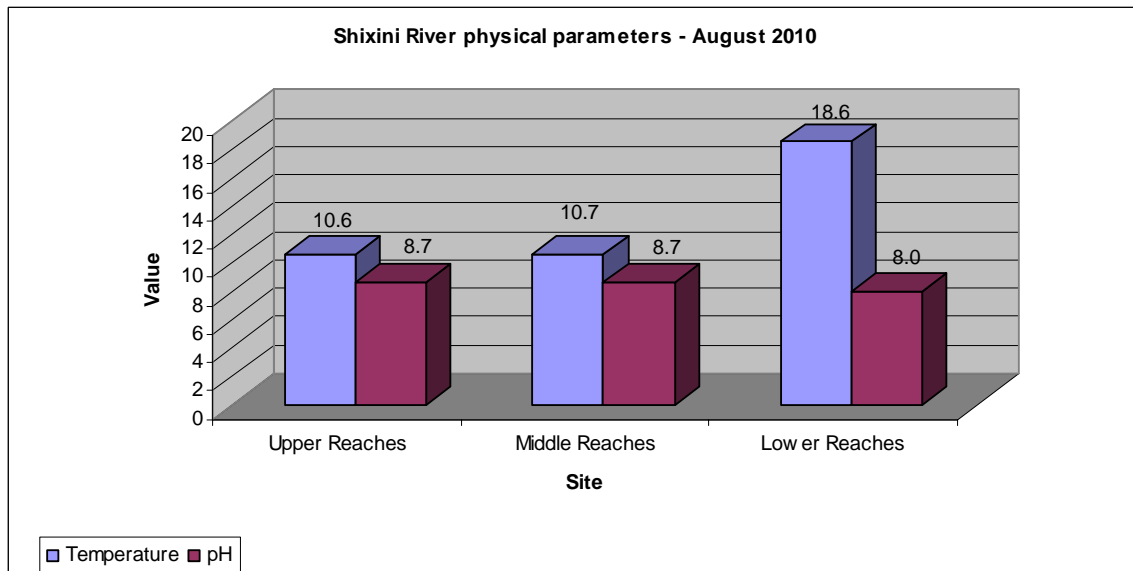


Figure 2: Physical parameter results of Shixini River

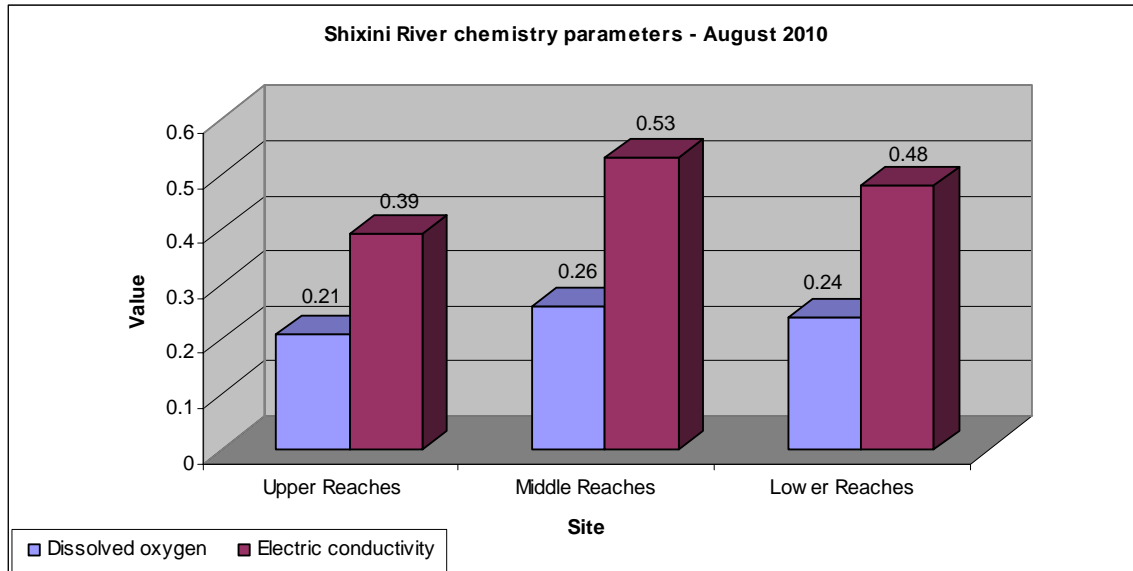


Figure 3: Chemistry parameters at Shixini River

DISCUSSION AND RECOMMENDATION

Shixini river is not a massive stream, although it empties directly into the ocean. Generally, the flows were basic, as this was winter season. Temperature increased as the river approaches lower reaches while the opposite is true for the pH. Both Dissolved oxygen and electric conductivity (indicator of dissolved salts in the river) fluctuated, with peak values in the middle reaches (Figure 2 and 3). Conclusively, this river is in a good health condition. This is evidenced by the presence of indigenous fish and high scoring invertebrates. This means it must be protected and used in a sustainable manner. Most of the present algae, although helps to filter and clean the water, needs to be flushed down into the ocean, as it negatively impacts on water quality and entangles the aquatic species, thereby denying their free movement in the river. This means that the flows must not be disturbed in any manner in the upper and middle reaches.

The proposed dam or abstraction weir can be constructed at the lower reaches, where there is already dominating bedrock, abstraction pipe and pools. Due to the small size of the river, it can be recommended that the proposed weir wall be not too high, in order for the water overflow for environmental purposes. Its foundation can be dug deep. More information can be required from the Hydrology and Construction and design section.

In addition the following should be taken into account to meet the requirements for proper management and monitoring of the entire catchment:

- Hydrology data and assessment is required as one of the vital drivers of the ecosystem, mainly environmental flows.
- Environmental education to the local communities, especially on the upper parts of the catchment.
- Qwaninga and Nqabara rivers can be used (hopefully) to find reference condition for Shixini River as they are in the same ecoregion, i.e. the 31 Eastern Coastal Belt Level I ecoregion, alternatively, use of the aerial photographs of the earliest decades for reference condition. This data can be meaningful only for geomorphology and the riparian vegetation.
- Rehabilitation measures on affected areas could serve as an advantage. For example, revegetation of areas with high vegetation removal and elimination of alien plants...
- Community Based Natural Resource Management (for the interested and Affected Parties).
- Environmental Impact Assessments (where development strategies are the priority along a river reach, e.g. where the dam/weir need to be built). This would be an assessment of the possible impact (positive or negative) that a proposed project may have on the natural environment. The purpose of the assessment could be to ensure the decision makers to decide whether to proceed with the project and to apply the Environmental Management Class in a sustainable manner in accordance to Rio Earth Summit.
- Creation of buffer zones on the riparian zone and most sensitive areas. Geographic Information Systems could serve as a tool to support this by targeting areas with potential risks.

SUMMARY OF SHIXINI RIVER SPRING SURVEY

Figure 4 below shows the summary of Shixini River spring survey (Geomorphology).

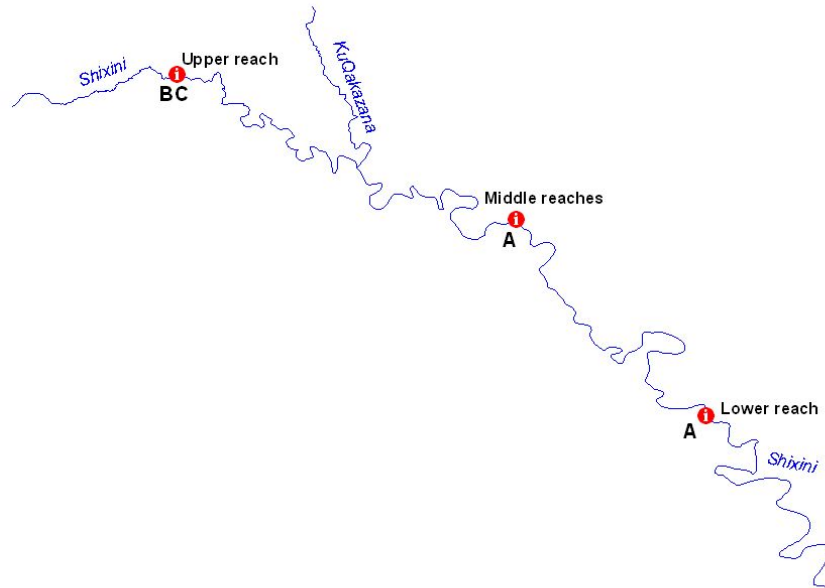


Figure 4. General overview of the Shixini River catchment, showing sites surveyed and geomorphological classes (Adapted from WRI500: DWA and Wadeson 1999 & Rowntree, 2003 respectively)

REFERENCES

Chief Directorate: Surveys and Mapping, Department of Land Affairs. 1: 50 000 toposheets.

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Google Earth images.

Kleynhans, CJ, Thirion, C and Moolman, J (2005). A Level I River Ecoregion Classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, DWA Pretoria, South Africa.

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