solution was then neutralized with 6N NaOH and made up to 100 ml with distilled water.

2) Total Inorganic phosphorus (TIP) analysis

Total inorganic phosphorus (TIP) was determined according to [18]: 1 g of air dried sediment was ignited in a muffle furnace at a temperature of 550 ^{o}C for 1 hour, and dissolved in 25 ml of 1 M HCl solution and determined as total inorganic phosphorus according to Strickland and Parsons [19].

3) Total nitrogen analysis

Total Nitrogen was determined according to Hilal and Alhaija [20] as ammonia: 1 g of each air dried sediment sample was treated with 2 ml of sulphuric acid. The sample was heated on a hotplate for 2 hours. Aliquots of 50 ml of deionized water were added to each sample. The sample was filtrated through No. 41 Whatman filter paper. The filtrate of each sample was made up to 250 ml with deionized water and 55 ml of 1 M sodium hydroxide solution.

4) *Particle size analysis*

A determination of particle size distribution was done with sieving method; 240 g of air-dried sediments was transferred directly into a sieve column. The sieve separation column was shacked for 1 hour. Mass retained on each sieve was recorded and presented as percentage.

E. The culture of cyanobacteria of river sediments

In the laboratory the BG11 medium was prepared as per procedure of Krüger and Eloff [21]. Under sterile conditions the 1.0 g river sediments were transferred in to 250 ml Erlenmeyer flasks containing 200 ml of BG11 medium and were incubated for 30 days under continuous light (1100 lux) of white florescent lamps at a room temperature.

1) *The presence of cyanobacteria species in raw water and river sediments*

The sterile plastic containers were incubated at room temperature (30 to 38 ^{o}C) for period of 30 days under continuous light conditions (1076 ± 204 lux). Later after 30 days, the water samples were subjected to flow cytometric analysis. A bench top FlowCAM (Model VS IV) was used to determine the composition of algae and cyanobacteria species that were growing in the samples. The FlowCAM was equipped with a blue (488 nm) laser for florescent and particle detection. For the analysis of algal composition in natural field samples a flow cell (FC300) was used with 4X objective and a cell size range of 20 to 300 µm. The water samples were transferred to the funnel with a pipette. The fluorescent particle/cell was digitally acquired and archived by the FlowCAM for latter processing. This instrument will capture images which were then used to identify the cyanobacteria image by comparison to literature. A confirmatory analysis based on scanning electron microscope will also be used as per procedure of Gumbo and Cloete [22]. The captured images were identified by comparison with published images from literature.

F. *Data analysis*

The Microsoft excel software was used to calculate the mean, standard deviation and carry out statistical analysis with single factor ANOVA to assess any significance differences between microcystins concentrations across months, water tap and microcystin congeners at $P<0.05$ significance level.

III. Results and Discussions

A. The effects of physico-chemical parameters on cyanobacteria communities in the water samples

The water samples were then incubated at room temperature under continuous lighting to stimulate the growth of cyanobacteria. After incubation for 30 days, some of the plastic containers had a green colour (water tap 2) and others did not have a green colour (water tap 1). This may imply that the presence of nutrients, dissolved organic carbon and light may influence the growth of cyanobacteria in the raw water. The physical chemical analysis of raw water showed variation between the months from November to January (Table 2). The pH was slightly alkaline, with a range of 7.27 to 7.54 (water tap 1) and 7.12 to 7.73 (water tap 2). The alkaline pH is one of the factors that may promote the growth of cyanobacteria as shown by sample from water tap 2 [23].

TABLE II: The Physico-Chemical characteristics of Water Quality During The Study Period

Month		Nov 2012		Dec 2012		Jan 2013	
Sample point		WT1	WT2	WT1	WT2	WT1	WT2
Limpopo River flow		Zero*	Zero*	Moderate**	Moderate**	High ***	High ***
pH		7.54	7.73	7.57	7.34	7.27	7.12
Salinity mg/l		0.5	0.4	0.6	0.5	0.5	0.4
EC µS/cm		96.2	75.5	96.7	73.5	96.7	71.5
Nitrates mg/l		0.5	0.6	0.8	0.7	0.7	0.6
Phosphates mg/l		--	--	--	--	--	--
Absorbances	214 nm	0.495	0.196	2.287	0.248	2.295	1.798
	254 nm	0.134	0.106	0.155	0.151	0.160	0.104
	272 nm	0.114	0.093	0.132	0.136	0.136	0.093
	300 nm	0.083	0.071	0.099	0.111	0.101	0.074
DOC (ppm)		2.31	2.84	2.46	7.27	2.43	2.43
SUVA l/mg.M		5.81	3.73	6.30	2.08	5.85	4.28
Microcystin RR		--	--	--	--	--	$
Microcystin LR		6.60	46.78	21.27	20.53	14.47	$
Microcystin YR		--	27.26	9.77	--	--	$
Microcystin LY		--	--	--	--	--	$

*dry riverbed; **moderate flows; ***High floods; -- Not detected in the water samples; WT water tap; $ The water sample was lost during transit to the University of Johannesburg

The salinity results show that the salinity for each water taps 1 and tap 2 during the study period were high. The high salinity may promote the growth of cyanobacteria [23]. The levels of electrical conductivity (EC) and total dissolved solids (TDS) were found to be quite high with the range of 71.5 to 96.7 µS/cm and 476 to 587 mg/l respectfully. The high EC and TDS level may promote the growth of cyanobacteria [24]. A high nitrate level, ranging from 0.5 to 0.8 mg/L, this may provide nutritional food for cyanobacteria and promote their growth [25]. It was found that the phosphates were zero and this may imply that the phosphate is a limiting nutrient. Thus, only nitrogen fixing cyanobacteria may be available [26].