RIVER HEALTH PROGRAMME

A BIOMONITORING SURVEY OF SELECTED SITES IN THE LETABA AND LUVUVHU RIVER SYSTEMS UNDERTAKEN DURING 2003.

A FOLLOW UP SURVEY TO THE 1999 SURVEY OF THE LUVUVHU RIVER CATCHMENT AND THE 2000 SURVEY OF THE LETABA RIVER CATCHMENT.

INCLUDING A SUMMARY REVIEW OF THE 1999 LUVUVHU CATCHMENT SURVEY AND THE 2000 LETABA CATCHMENT SURVEY.

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Executive Summary.

The Luvuvhu River Catchment was last surveyed in 1999 and the Letaba River Catchment surveyed in 2000. Results for these surveys were presented in the 2001 State of River Report. (SoRR)

In 2003, the Luvuvhu was surveyed between March and April and the Letaba surveyed between May and July. River flows during the survey period were low and it is a matter of record that 2003 became a severe drought year.

The 2003 surveys addressed fish and invertebrates only. Results were analyzed using the Fish Assemblage Integrity Index (FAII) and The South African Scoring System version 5. (SASS5)

Due to time constraints, full surveys of all previous monitoring sites could not be undertaken. Instead, a limited number of representative sites were selected for each catchment. In the Luvuvhu Catchment, 19 of the original 36 sites were surveyed while in the Letaba Catchment 11 of the original 36 sites were surveyed.

This report provides a reassessment of the 1999 Luvuvhu survey and the 2000 Letaba survey using up to date protocols. Confusing issues, the results for the 2003 invertebrate surveys were first calculated in SASS5, but then needed to be converted back to SASS4 for interpretive and comparative purposes.

This report therefore provides an accurate comparison of results, past and present.

These surveys have shown that there has been a consistent decline in the condition classes of fish for all river segments in both rivers. The fish populations of the Letaba River are considered to be in a Serious – Critical Class (Classes E-F). Reasons for the decline are discussed.

There is no clear change in the status of the invertebrate populations.

The time period of 3-4 years since the first survey has given cause for concern. Follow up surveys must be conducted on a more regular basis to keep track of catchment changes. The current survey results are alarming, but further surveys are needed to evaluate whether the reported status is a true reflection of the situation or whether seasonal, drought and flood factors are influencing results.

Many historical sites in the Luvuvhu were inaccessible or had weirs developed on them. There is a clear need to implement a monitoring site protection plan. Otherwise there will be no continuation of data and results will be affected. It is suggested that perhaps incentives can be developed for land owners to protect monitoring sites.

The Department of Water Affairs and Forestry (DWAF) must implement reserve flows in both catchments at the earliest opportunity. DWAF are currently busy with

a reserve assessment in the Letaba Catchment but no such programme exists in the Luvuvhu Catchment.

ISSUE	ACTION	RESPONSIBILITY
Urgent follow up surveys are required to assess whether reported trends are real.	**Conduct a reassessment of the Letaba and Luvuvhu Catchments in 2005**	**M.K.Angliss Biomonitoring team.**
The development of dams and weirs by DWAF without following due EIA processes.	**Follow up with DEAT and DWAF to ascertain what measures have been put in place to prevent this happening again.**	**EIA section. DWAF**
Restricted Access to monitoring sites by land owners.	**Engage with land owners to secure access in future surveys.**	**M.K.Angliss Biomonitoring team.**
Need for an incentive programme for site protection.	**Investigate budget and legal issues and liaise with RHP management.**	**Bio Management.**
Need for Reserve's to be set for both catchments.	**Contribute to Letaba Reserve Process. Urge DWAF to undertake similar study in the Luvuvhu Catchment.**	**M.K.Angliss Snr. Management. DWAF**
Publication of reports for public access.	**Arrange funding**	**Management Tender Board**
	Produce brochures/ posters or reports as required.	**M.K.Angliss Biomonitoring team**

1. Introduction:

In 1999, 43 sites in the Luvuvhu River Catchment were subjected to a systematic biomonitoring survey which followed established River Health Programme (RHP) protocols for fish, invertebrates, riparian vegetation and geomorphology. (RHP series)

In 2000, 45 sites in the Letaba River Catchment were also surveyed using the above RHP protocols.

The Luvuvhu survey was undertaken at a time of high river base flows, following the floods of 1996, while the Letaba survey was conducted after the high flood event of 2000. Both surveys were coordinated with monitoring programmes of the Kruger National Park (KNP). Both surveys were used as training exercises and had participants from the University of Venda (Univen), University of the North (UNIN) And Rand Afrikaans University (RAU)

The results of the above two catchment surveys were published in a single State of Rivers Report (2001). Although data for all of the monitoring indices was fully analyzed, a formal technical report for the work was never completed.

In line with an informal agreement, held between ourselves and the Kruger National Park, biomonitoring surveys of our Lowveld Rivers must be revisited at 3 yearly intervals. As such, both the Letaba and Luvuvhu River Catchments were re-visited during the course of 2003.

Due to time constraints and manpower constraints, the full number of sites surveyed in the first survey could not be revisited in 2003. Instead, a selected number of "representative sites" were revisited. In addition, only fish and invertebrates were reassessed during this survey.

This report therefore makes reference to data generated in the first surveys and attempts to make a reassessment of the status of the two catchments based upon the limited amount of data generated in 2003. The 2003 survey reported here, only addresses those sites lying within the Limpopo Province and excludes those sites falling within the KNP.

The vegetation component of the 1999 Luvuvhu survey was fully reported on at that time (Fouche 2001) and this component of the report will therefore not be duplicated in this report.

It should be noted that the various indices have developed since 1999 and it has therefore been necessary to re-interpret the early data so that realistic comparisons can be made between the earlier surveys and the latest survey.

2. THE LUVUVHU RIVER CATCHMENT 1999.

Table 1. Location of monitoring sites undertaken in the 1999 survey of the Luvuvhu River, (including sites in the KNP) RHP site codes, eco regions and site coordinates are also indicated. Eco regions From Kleynhans et al. (2002)

RIVER	SITE NAME	RHP SITE CODE	ECO REGION	DEG. S	DEG. E
Dzindi	Top Bridge	A91DZIN-TOPBR	2.01	22.989167	30.317833
Dzindi	Forest track below water fall	A91DZIN-WATER	2.01	22.984167	30.334167
Dzindi	Bridge by Crocodile Ventures	A91DZIN-CROCV	5.04	23.006333	30.4735
Latonyanda	Botha's Farm Bridge	A91LATO-BOTHA	5.04	23.051333	30.2345
Latonyanda	Cabbage Farm IFR site	A91LATO-CABBA	5.04	23.0745	30.321167
Sterkstroom	Above Albasini	A91STER-ALBAS	2.01	23.068	30.0675
Luvuvhu	Shefeera	A91LUVU-SHEFE	2.01	23.033333	30.083333
Luvuvhu	Beja Bridge	A91LUVU-BEJAB	5.04	23.091833	30.067167
Luvuvhu	Valdezia Weir	A91LUVU-VALDE	5.04	23.085	30.171333
Luvuvhu	Roberts Farm packhouse	A91LUVU-ROBER	5.04	23.103	30.340833
Luvuvhu	Guaging Weir A9h001	A91LUVU-9H001	5.04	23.1085	30.387667
Luvuvhu	Hasani Crossing	A91LUVU-HASAN	5.04	23.084	30.469333
Luvuvhu	Nandoni IFR site	A91LUVU-NANDO	5.04	22.9715	30.601667
Luvuvhu	Malamulele pump house weir	A91LUVU-MALAM	5.03	22.9525	30.649
Luvuvhu	Tshifudi Bridge	A91LUVU-TSHIF	5.04	22.842833	30.7515
Luvuvhu	Botsoleni	A91LUVU-BOTSO	5.04	22.7875	30.8485
Luvuvhu	Mhinga broken pump station	A91LUVU-MHING	5.04	22.753	30.889167
Luvuvhu	Lambani	A91LUVU-LAMBA	5.04	22.7365	30.882167
Luvuvhu	Dongodziva	A91LUVU-DONGO	2.01	22.709167	30.889167
Luvuvhu	Shidzivani IFR SITE 1	A91LUVU-SHIDZ	2.01	23.6355	30.958333
Luvuvhu	Madzaringwa	A91LUVU-MADZA	1.02	22.498333	31.0595
Luvuvhu	Mutale Bend	A91LUVU-MUTAL	1.02	22.4445	31.076
Luvuvhu	Mangala IFR SITE 2	A91LUVU-MANGA	1.01	22.427	31.1745
Luvuvhu	Bobomene camp	A91LUVU-BOBOM	1.01	22.416667	31.208333
Luvuvhu	Crooks corner	A91LUVU-CROOK	1.01	22.425	31.3
Mukhase	Mphaphaula Cycad reserve	A91MUKH-CYCAD	5.04	22.810333	30.647833
Mbwedi	Damani Dam pump station	A91MBWE-DAMAN	2.01	22.843	30.518333
Mbwedi	Bridge above Mutsh. confluence	A91MBWE-BRIDG	5.04	22.834833	30.657167
Mutshindudi	Phiphidi Forest Resrve & falls	A91MUTS-PHIPI	2.01	22.943333	30.4
Mutshindudi	Phiphidi hydro bridge (gorge)	A91MUTS-HYDRO	2.01	22.936833	30.400667
Mutshindudi	Tshivhulani	A91MUTS-TSHIV	5.04	22.909	30.486333
Mutshindudi	School turn and waterfall	A91MUTS-SCHOO	2.01	22.886167	30.586833
Mutshindudi	Malavuhe bridge	A91MUTS-MALAV	2.01	22.856667	30.6395
Mutshindudi	New guaging weir	A91MUTS-GUAGI	2.01	22.853333	30.6855

RIVER	SITE NAME	RHP SITE CODE	ECO REGION	DEG. S	DEG. E
Tshiombedi	Old bridge	A92TCHI-BRIDG	5.04	22.757167	30.475
Sambandou	Bridge above Mutale confluence	A92SAMB-BRIDG	5.04	22.718333	30.6505
Mutale	Tshirovha confluence	A92TSHI-MUTAL	2.01	22.809167	30.391167
Mutale	Narrow roadside	A92MUTA-ROADS	2.01	22.804167	30.416667
Mutale	Whboneni School bridge	A92MUTA-WHBON	2.01	22.789	30.442667
Mutale	Mutale Bridge below Sambandou	A92MUTA-SAMBA	5.04	22.700667	30.639
Mutale	Tshikundamalema ,Top of gorge	A92MUTA-TSHIK	2.01	22.671333	30.7015
Mutale	Guyuni Pools	A92MUTA-GUYUN	2.01	22.586	30.805333
Mutale	Mutale/Tshikondeni Bridge	A92MUTA-MUTAL	1.02	22.474	30.8805

Table 2. Geomorphological zonation of river channels (after Rowntree and Wadeson, 1999).

Longitudinal Zone	Macro-reach characteristics			Characteristic channel features
	Valley form	Gradient class	Zone class	
A. Zonation associated with a "normal" profile.				
Source zone	V10	not specified	S	Low gradient, upland plateau or upland basin able to store water. Spongy or peaty hydromorphic soils.
Mountain headwater stream	V1, V3	>0.1	A	A very steep gradient stream dominated by vertical flow over bedrock with waterfalls and plunge pools. Normally first or second order. Reach types include bedrock fall and cascades.
Mountain stream	V1, V3	0.04 - 0.99	B	Steep gradient stream dominated by bedrock and boulders, locally cobble or coarse gravel in pools. Reach types include cascades, bedrock fall, step-pool. Approximate equal distribution of "vertical" and "horizontal" flow components.
Transitional	V2, V3, V4, V6	0.02 - 0.039	C	Moderately steep stream dominated by bedrock or boulder. Reach types include plain-bed, pool-rapid or pool-riffle. Confined or semi-confined valley floor with limited flood plain development.
Upper foothills	V4, V6	0.005 - 0.019	D	Moderately steep, cobble-bed or mixed bedrock-cobble bed channel, with plain-bed, pool-riffle or pool-rapid reach types. Length of pools and riffles/rapids similar. Narrow flood plain of sand, gravel or cobble often present.
Lower foothills	V8, V10	0.001 - 0.005	E	Lower gradient mixed bed alluvial channel with sand and gravel dominating the bed, locally may be bedrock controlled. Reach types typically include pool-riffle or pool-rapid, sand bars common in pools. Pools of significantly greater extent than rapids or riffles. Flood plain often present.
Lowland river	V4, V8, V10	0.0001 - 0.001	F	Low gradient alluvial fine bed channel, typically regime reach type. May be confined, but fully developed meandering pattern within a distinct flood plain develops in unconfined reaches where there is an increased silt content in bed or banks.
B. Additional zones associated with a rejuvenated profile.				

Longitudinal Zone	Macro-reach characteristics			Characteristic channel features
	Valley form	Gradient class	Zone class	
Rejuvenated bedrock fall/ cascades	V1, V4	>0.02	A/B/Cr	Moderate to steep gradient, confined channel (gorge) resulting from uplift in the middle to lower reaches of the long profile, limited lateral development of alluvial features, reach types include bedrock fall, cascades and pool rapid.
Rejuvenated foothills	V2, V3, V4, V6	0.001 - 0.02	D/Er	Steepened section within middle reaches of the river caused by uplift, often within or downstream of a gorge. Characteristics similar to foothills (gravel/cobble-bed rivers with pool-riffle / pool-rapid morphology) but of a higher order. A compound channel is often present with an active channel contained within a macro-channel activated only during infrequent flood events. A limited flood plain may be present between the active and macro-channel
Upland flood plain	V8, V10	<0.005	Fr	An upland low gradient channel, often associated with uplift plateau areas as occur beneath the eastern escarpment.

Table 3. River gradient, Geomorphological Zone Class and Valley Form. Of the 1999 Luvuvhu River biomonitoring sites (After Rowntree and Wadeson 1999)

RHP SITE CODE	ECO REGION	GRADIENT	ZONE CLASS	VALLEY FORM
		m/m		
A91DZIN-TOPBR	2.01	0.025	C	V2
A91DZIN-WATER	2.01	0.025	C	V2
A91DZIN-CROCV	5.04	0.0058	D	V4
A91LATO-BOTHA	5.04	N/A	N/A	N/A
A91LATO-CABBA	5.04	N/A	N/A	N/A
A91STER-ALBAS	2.01	N/A	N/A	N/A
A91LUVU-SHEFE	2.01	N/A	N/A	N/A
A91LUVU-BEJAB	5.04	N/A	N/A	N/A
A91LUVU-VALDE	5.04	N/A	N/A	N/A
A91LUVU-ROBER	5.04	N/A	N/A	N/A
A91LUVU-9H001	5.04	N/A	N/A	N/A
A91LUVU-HASAN	5.04	N/A	N/A	N/A
A91LUVU-NANDO	5.04	0.0012	D/Er	V4
A91LUVU-MALAM	5.03	0.0012	D/Er	V4
A91LUVU-TSHIF	5.04	0.0011	D/Er	V4
A91LUVU-BOTSO	5.04	0.0011	D/Er	V4
A91LUVU-MHING	5.04	0.0015	D/Er	V4
A91LUVU-LAMBA	5.04	0.0015	D/Er	V4
A91LUVU-DONGO	2.01	0.0016	D/Er	V4
A91LUVU-SHIDZ	2.01	0.0012	D/Er	V4
A91LUVU-MADZA	1.02	0.0025	D/Er	V4
A91LUVU-MUTAL	1.02	0.0019	D/Er	V4
A91LUVU-MANGA	1.01	0.0009	F	V4
A91LUVU-BOBOM	1.01	0.0009	F	V4

RHP SITE CODE	ECO REGION	GRADIENT	ZONE CLASS	VALLEY FORM
A91LUVU-CROOK	1.01	0.0007	F	V4
A91MUKH-CYCAD	5.04	0.051	B	V3
A91MBWE-DAMAN	2.01	0.0076	D	V4
A91MBWE-BRIDG	5.04	0.0046	D/Er	V4
A91MUTS-PHIPI	2.01	0.04	B	V3
A91MUTS-HYDRO	2.01	0.04	B	V3
A91MUTS-TSHIV	5.04	0.0059	D	V4
A91MUTS-SCHOO	2.01	0.003	D/Er	V4
A91MUTS-MALAV	2.01	0.002	D/Er	V4
A91MUTS-GUAGI	2.01	0.002	D/Er	V4
A92TCHI-BRIDG	5.04	0.04	B	V3
A92SAMB-BRIDG	5.04	0.0054	D	V4
A92TSHI-MUTAL	2.01	0.0169	D	V4
A92MUTA-ROADS	2.01	0.0058	D	V4
A92MUTA-WHBON	2.01	0.0064	D/Er	V4
A92MUTA-SAMBA	5.04	0.0015	D/Er	V4
A92MUTA-TSHIK	2.01	0.0063	D/Er	V4
A92MUTA-GUYUN	2.01	0.0018	D/Er	V4
A92MUTA-MUTAL	1.02	0.0032	D/Er	V4

SUMMARY OF THE 1999 FISH SURVEY AND APPLICATION OF THE FISH ASSEMBLAGE INTEGRITY INDEX FAII

Table 4. FAII assessment classes. (From Kleynhans; 1997)

Class	Description of Generally Expected Conditions	FAII Score (Percent of total)
A	Unmodified, or approximates natural conditions closely.	90 - 100
B	Largely natural with few modifications. A change in community characteristics may have taken place but species richness and presence of intolerant species indicate little modification.	80 - 89
C	Moderately modified. A lower than expected species richness and presence of most intolerant species. Some impairment of health may be evident at the lower end of this scale.	60 - 79
D	Largely modified. A clearly lower than expected species richness and absence or much lowered presence of intolerant and moderately intolerant species. Impairment of health may become more evident at the lower end of this class.	40 - 59
E	Seriously modified. A strikingly lower than expected species richness and general absence of intolerant and moderately intolerant species. Impairment of health may become very evident.	20 - 39
F	Critically modified. An extremely lowered species richness and an absence of intolerant and moderately intolerant species. Only tolerant species may be present with a complete loss of species at the lower end of the class. Impairment of health generally very evident.	0 - 19

Table 5. A descriptive template for the Ecological Management Classes (EMC) of river systems. (From Kleynhans; 1997)

CLASS: MANAGEMENT CLASSES:	MANAGEMENT CLASSES: DESCRIPTION OF PERCEIVED CONDITIONS
WITHIN DESIRED RANGE	
A: UNMODIFIED OR LARGELY NATURAL.	The natural abiotic template should not be modified. The characteristics of the resource should be determined by unmodified natural disturbance regimes. There should be no human induced risks to the abiotic and biotic maintenance of the resource. The supply capacity of the resource will not be used.
B: LARGELY NATURAL WITH FEW MODIFICATIONS	Only a small risk of modifying the natural abiotic template and exceeding the resource base should be allowed. Although the risk to the well being and survival of especially intolerant biota (depending on the nature of the disturbance) at a very limited number of localities may be slightly higher than expected under natural conditions, the resilience and adaptability of the biota must not be compromised. The impact of acute disturbances must be totally mitigated by the presence of sufficient refuge areas.
C: MODERATELY MODIFIED	A moderate risk of modifying the abiotic template and exceeding the resource base may be allowed. Risks to the well-being and survival of intolerant biota (depending on the nature of the disturbance) may generally be increased with some reduction of resilience and adaptability at a small number of localities. However, the impact of local and acute disturbances must at least partly be mitigated by the presence of sufficient refuge areas.
D: LARGELY MODIFIED	A large risk of modifying the abiotic template and exceeding the resource base may be allowed. Risks to the well-being and survival of intolerant biota (depending on the nature of the disturbance) may be allowed to generally increase substantially with resulting low abundances and frequency of occurrence, and a reduction of resilience and adaptability at a large number of localities. However, the associated increase in abundance of tolerant species must not be allowed to assume pest proportions. The impact of local and acute disturbances must at least to some extent be mitigated by refuge areas.
OUTSIDE DESIRED RANGE	
E: SERIOUSLY MODIFIED	The losses of natural habitats and basic ecosystem functions are extensive.
F: CRITICALLY MODIFIED	Modifications have reached a critical level and the system has been modified completely, with an almost complete loss of natural habitats

Table 6. English names, scientific names and abbreviations of fish species expected to occur in the Luvuvhu River Catchment. Names from Skelton (2001 and 2002) and Abbreviations from Skelton (1993).

SPECIES	ABREV.	ENGLISH COMMON NAME
Amphilius uranoscopus	Aura	Common mountain catfish
Anguilla mossambica	Amos	Longfin eel
Anguilla bicolor bicolor	Abic	Shortfin eel
Anguilla bengalensis labiata	Aben	African mottled eel
Anguilla marmorata	Amar	Madagascar mottled eel
Barbus afrohamiltoni	Bafr	Hamilton's barb
Barbus annectens	Bann	Broadstriped barb
Barbus eutaenia	Beut	Orangefin barb
Barbus lineomaculatus	Blin	Line-spotted barb
Barbus mattozi	Bmat	Papermouth
Barbus neefi	Bnee	Sidespot barb
Barbus paludinosus	Bpau	Straightfin barb
Barbus radiatus	Brad	Beira barb
Barbus toppini	Btop	East coast barb
Barbus trimaculatus	Btri	Threespot barb
Barbus unitaeniatus	Buni	Longbeard barb
Barbus viviparus	Bviv	Bowstripe barb
Brycinus imberi	Bimb	Imberi
Chiloglanis paratus	Cpar	Sawfin rock catlet
Chiloglanis pretoriae	Cpre	Shortspine rock catlet
Chiloglanis swierstrai	Cswi	Lowveld rock catlet
Clarias gariepinus	Cgar	Sharptooth catfish
Glossogobius callidus	Gcal	River goby
Glossogobius giuris	Ggiu	Tank goby
Hydrocynus vittatus	Hvit	Tigerfish
Labeo congoro	Lcon	Purple labeo
Labeo cylindricus	Lcyl	Redeye labeo
Labeo molybdinus	Lmol	Leaden labeo
Labeo rosae	Lros	Rednose labeo
Labeo ruddi	Lrud	Silver labeo
Labeobarbus marequensis	Lmar	Largescale yellowfish
Marcusenius macrolepidotus	Mmac	Bulldog
Mesobola brevianalis	Mbre	River sardine
Micralestes acutidens	Macu	Silver robber
Opsaridium peringueyi	Oper	Southern barred minnow
Oreochromis mossambicus	Omos	Mozambique tilapia
Petrocephalus wesselsi	Pwes	Churchill
Pseudocrenilabrus philander	Pphi	Southern mouthbrooder
Schilbe intermedius	Sint	Silver catfish
Synodontis zambezensis	Szam	Brown squeaker
Tilapia rendalli	Tren	Redbreast tilapia
Tilapia sparrmanii	Tspa	Banded tilapia

Table 7. Alien fish species recorded in the Luvuvhu River Catchment.

SPECIES	ABREV.	ENGLISH COMMON NAME
Cyprinus carpio	Ccar	Carp
Lepomis macrochirus	Lmac	Bluegill sunfish
Micropterus dolomieu	Mdol	Smallmouth bass
Micropterus salmoides	Msal	Largemouth bass
Oncorhynchus mykiss	Omyk	Rainbow trout
Oreochromis niloticus	Onil	Nile tilapia

Table 8. Fish segments and corresponding ecoregions, which provided for the interpretation of RHP indices in the 1999 survey. (Excluding KNP sites)

SEGMENT	RIVER	ECOREGION
Segment 1	Luvuvhu	2.01
Segment 2	Sterkstroom	2.01
Segment 3	Lat & Luv	5.04A
Segment 4	Lat	5.04B
Segment 5	Dzindi	2.01
Segment 6	Dzindi	2.01B
Segment 7	Dzin & Luv	5.04
Segment 8	Mutsh	2.01A
Segment 9	Mutsh	2.01B
Segment 10	Mutsh	2.01C and 5.04
Segment 11	Mukhasa	5.04
Segment 12	Mbwedi	2.01
Segment 13	Mutale	2.01
Segment 14	Tchiombedi	5.04
Segment 15	Samb & Mutale	2.01B and 5,04
Segment 16	Mutale	2.01C & 1.02

Table 9. **List of species expected and recorded (highlighted) in each of the 16 Fish Segments analyzed in the 1999 survey of the Luvuvhu River Catchment.**

FISH SPECIES EXPECTED PER FISH HABITAT SEGMENT															
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
AURA	AURA	AURA	AURA	AURA	AURA	AURA	ARUA	AURA	AURA	AURA	AURA	AURA	AURA	AURA	ABEN
AMOS	AMOS	AMOS	AMOS	AMOS	AMOS	AMAR	BEUT	AMOS	AMOS	AMOS	AMOS	AMOS	AMOS	AMOS	AMOS
BEUT	BEUT	BEUT	BEUT	BEUT	BEUT	AMOS	BLIN	BEUT	BEUT	BEUT	BEUT	BEUT	BEUT	BANN	BANN
BLIN	BLIN	BLIN	BLIN	BLIN	BLIN	BANN	LMAR	BLIN	BLIN	BLIN	BLIN	BLIN	BLIN	BEUT	BEUT
LMAR	LMAR	LMAR	LMAR	BNEE	LMAR	BEUT	BNEE	LMAR	LMAR	LMAR	LMAR	LMAR	LMAR	BLIN	LMAR
BNEE	BNEE	BNEE	BNEE	BPAU	BNEE	BLIN	BTRI	BNEE	BNEE	BNEE	BNEE	BNEE	BNEE	LMAR	BMAT
BPAU	BPAU	BPAU	BPAU	BTRI	BPAU	LMAR	BUNI	BPAU	BPAU	BPAU	BPAU	BPAU	BPAU	BNEE	BNEE
BTOP	BTRI	BTOP	BTRI	OPER	BTRI	BNEE	BVIV	BTRI	BTOP	BTRI	BTRI	BTRI	BTRI	BPAU	BRAD
BTRI	CPRE	BTRI	BVIV	TSPA	BUNI	BPAU	CPRE	BUNI	BTRI	BUNI	BUNI	BUNI	BVIV	BRAD	BTRI
BUNI	MMAC	BUNI	CPRE		BVIV	BTOP	CGAR	BVIV	BUNI	BVIV	BVIV	BVIV	CPRE	BTRI	BUNI
BVIV	OPER	BVIV	LCYL		CPRE	BTRI	LCYL	CPRE	BVIV	CPRE	CPRE	CPRE	CGAR	BUNI	BVIV
CPRE	TSPA	CPRE	LMOL		CGAR	BUNI	MMAC	CGAR	CPAR	LCYL	CGAR	CGAR	LCYL	BVIV	CPAR
CGAR		CGAR	MMAC		LCYL	BVIV	OPER	LCYL	CPRE	LMOL	LCYL	LCYL	LMOL	CPRE	CPRE
LCYL		LCYL	MACO		LMOL	CPAR	OMOS	LMOL	CGAR	MMAC	LMOL	LMOL	MMAC	CGAR	CGAR
LMOL		LMOL	OPER		MMAC	CPRE	TSPA	MMAC	GCAL	MACU	MMAC	MMAC	MACU	LCON	LCON
MMAC		LROS	OMOS		MACU	CSWI		MACU	GGIU	OPER	MACU	MACU	OPER	LCYL	LCYL
MACU		MMAC	PWES		OPER	CGAR		OPER	LCYL	OMOS	OPER	OPER	PWES	LMOL	LMOL
OPER		MBRE	PPHI		OMOS	GCAL		OMOS	LMOL	PWES	OMOS	PWES	PPHI	LROS	LROS
OMOS		MACU	TREN		PWES	GGIU		PWES	LROS	PPHI	PWES	PPHI	TSPA	MMAC	MMAC
PWES		OPER	TSPA		PPHI	LCYL		PPHI	MMAC	TSPA	PPHI	TSPA		MACU	MACU
PPHI		OMOS			TREN	LMOL		SINT	MBRE		TSPA			OPER	OMOS
TREN		PWES			TSPA	LROS		TSPA	MACU					OMOS	PWES
TSPA		PPHI				MMAC			OPER					PWES	PPHI

FISH SPECIES EXPECTED PER FISH HABITAT SEGMENT															
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
		SINT				MBRE			OMOS					PPHI	SINT
		TREN				MACU			PWES					SINT	TREN
		TSPA				OPER			PPHI					TREN	
						OMOS			SINT					TSPA	
						PWES			TREN						
						PPHI			TSPA						
						SINT									
						TREN									
						TSPA									

Table 10. Summarized results of the 1999 fish survey of the Luvuvhu River Catchment. Results of the Fish Assemblage Integrity Index based upon various components of the index. (Intolerance, Frequency of occurrence, Abundance and Fish Health) Numbers of species expected and recorded are also shown.

FISH SEGMENT NO.	TYPE A: INTOLERANCE, ABUNDANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE B: INTOLERANCE, ABUNDANCE & HEALTH		TYPE C: INTOLERANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE D: INTOLERANCE ONLY		SPECIES RICHNESS	
	TYPE A: RELATIVE FAII SCORES (%)	TYPE A: RELATIVE FAII CLASSES	TYPE B: RELATIVE FAII SCORES (%)	TYPE B: RELATIVE FAII CLASSES	TYPE C: RELATIVE FAII SCORES (%)	TYPE C: RELATIVE FAII CLASSES	TYPE D: RELATIVE FAII SCORES (%)	TYPE D: RELATIVE FAII CLASSES	NO OF SPECIES EXPECTED PER FHS	NO OF SPECIES CAUGHT PER FHS
1	51	D	48	D	51	D	48	D	23	12
2	29	E	21	E	28	E	21	E	12	2
3	63	C	62	C	63	C	62	C	26	15
4	35	E	26	E	35	E	26	E	20	5
5	49	D	38	E	45	D	38	E	9	3
6	44	D	35	E	44	D	35	E	22	6
7	72	C	77	C	72	C	77	C	32	25
8	51	D	38	E	51	D	38	E	15	4
9	59	D	52	D	59	D	52	D	22	10
10	73	C	86	B	73	C	86	B	29	23
11	33	E	31	E	39	E	31	E	20	5
12	39	E	33	E	39	E	33	E	21	6
13	59	D	57	D	59	D	57	D	20	11
14	22	E	18	F	22	E	18	F	19	3
15	80	B	80	B	82	B	80	B	27	21
16	46	D	42	D	46	D	42	D	25	10

3. SUMMARY OF THE 1999 INVERTEBRATE SURVEY OF THE LUVUVHU RIVER CATCHMENT. APPLICATION OF THE SOUTH AFRICAN SCORING SYSTEM VERSION 4.

Table 11. Guideline SASS4 Scores and ASPT values for the interpretation of invertebrate classes. (Adapted from Thirion 2000 and from Angliss, 2003)

ECOREGION	SASS4 RANGE	ASPT RANGE	CONDITION	CLASS
LOWVELD AND LEBOMBO MOUNTAINS	141-160; >160	>7; >6	EXCELLENT	A
LOWVELD AND LEBOMBO MOUNTAINS	106-140; 106-160; 131-160	>7; 6-7; 5-6	VERY GOOD	B
LOWVELD AND LEBOMBO MOUNTAINS	76-105; 106-130	>5; 5-6	GOOD	C
LOWVELD AND LEBOMBO MOUNTAINS	61-75	4-6	FAIR	D
LOWVELD AND LEBOMBO MOUNTAINS	30-60	VARIABLE	POOR	E
LOWVELD AND LEBOMBO MOUNTAINS	<30	VARIABLE	VERY POOR	F
GREAT ESCARPMENT MOUNTAINS	161-180; >180	>7; >6	EXCELLENT	A
GREAT ESCARPMENT MOUNTAINS	141-160; 161-180	>6; 6-7	VERY GOOD	B
GREAT ESCARPMENT MOUNTAINS	91-140	>5.5	GOOD	C
GREAT ESCARPMENT MOUNTAINS	61-90	<6	FAIR	D
GREAT ESCARPMENT MOUNTAINS	30-60	VARIABLE	POOR	E
GREAT ESCARPMENT MOUNTAINS	<30	VARIABLE	VERY POOR	F
CENTRAL HIGHLANDS	161-170; >170	>7; >6	EXCELLENT	A
CENTRAL HIGHLANDS	121-160; 141-170	>7; 5-7	VERY GOOD	B
CENTRAL HIGHLANDS	91-120; 121-140	<7.5; <7	GOOD	C
CENTRAL HIGHLANDS	61-90	<6	FAIR	D
CENTRAL HIGHLANDS	30-60	VARIABLE	POOR	E
CENTRAL HIGHLANDS	<30	VARIABLE	VERY POOR	F
LIMPOPO PLAIN	>165	Variable	EXCELLENT	A
LIMPOPO PLAIN	125 - 164	Variable	VERY GOOD	B
LIMPOPO PLAIN	80 - 124	Variable	GOOD	C
LIMPOPO PLAIN	60 - 79	Variable	FAIR	D
LIMPOPO PLAIN	40 - 59	Variable	POOR	E
LIMPOPO PLAIN	<40	Variable	VERY POOR	F

Table 12. SASS4 Condition Classes, Scores, ASPT, IHAS and HQI ratings for the invertebrate survey of the Luvuvhu River Catchment 1999.

RHP SITE CODE	ECO REGION	SASS4	ASPT	IHAS	HQI	CLASS
A91DZIN-TOPBR	2.01	184	8	78	115	**A**
A91DZIN-WATER	2.01	160	6.95	66	105	**B**
A91DZIN-CROCV	5.04	133	8.31	58	98	**B**
A91LATO-BOTHA	5.04	123	6.83	80	105	**B**
A91LATO-CABBA	5.04	132	6.94	60	110	**B**
A91STER-ALBAS	2.01	230	7.66	69	83	**A**
A91LUVU-SHEFE	2.01	165	7.17	54	89	**B**
A91LUVU-BEJAB	5.04	137	6.85	64	97	**B**
A91LUVU-VALDE	5.04	117	5.57	59	83	**C**
A91LUVU-ROBER	5.04	146	8.1	65	99	**A**
A91LUVU-9H001	5.04	169	7.04	76	119	**A**
A91LUVU-HASAN	5.04	167	6.95	77	104	**A**
A91LUVU-NANDO	5.04	107	6.68	71	86	**B**
A91LUVU-MALAM	5.03	129	6.14	68	111	**B**
A91LUVU-TSHIF	5.04	169	6.76	80	112	**A**
A91LUVU-BOTSO	5.04	179	6.88	75	112	**A**
A91LUVU-MHING	5.04	173	6.92	74	102	**A**
A91LUVU-LAMBA	5.04	153	6.95	71	113	**B**
A91LUVU-DONGO	2.01	172	6.37	80	100	**A**
A91LUVU-SHIDZ	2.01	174	6.21	70	118	**A**
A91LUVU-MADZA	1.02	176	6.76	74	112	**A**
A91LUVU-MUTAL	1.02	199	6.86	71	106	**A**
A91LUVU-MANGA	1.01	156	7.09	67	81	**A**
A91LUVU-BOBOM	1.01	203	7.51	65	104	**A**
A91LUVU-CROOK	1.01	N/A	N/A	N/A	N/A	**N/A**
A91MUKH-CYCAD	5.04	140	7.36	79	109	**A**
A91MBWE-DAMAN	2.01	77	5.13	76	93	**D**
A91MBWE-BRIDG	5.04	137	6.85	76	108	**B**
A91MUTS-PHIPI	2.01	115	6.38	66	113	**C**
A91MUTS-HYDRO	2.01	144	7.2	70	101	**B**
A91MUTS-TSHIV	5.04	153	7.65	74	116	**A**
A91MUTS-SCHOO	2.01	117	6.5	68	99	**C**
A91MUTS-MALAV	2.01	146	6.34	65	97	**B**
A91MUTS-GUAGI	2.01	179	6.39	68	97	**A**
A92TCHI-BRIDG	5.04	145	7.63	71	83	**A**
A92SAMB-BRIDG	5.04	99	5.8	62	103	**C**
A92TSHI-MUTAL	2.01	206	7.9	85	118	**A**
A92MUTA-ROADS	2.01	189	7.27	85	117	**A**
A92MUTA-WHBON	2.01	157	6.82	70	111	**B**
A92MUTA-SAMBA	5.04	138	6.9	65	113	**B**
A92MUTA-TSHIK	2.01	127	7.47	68	106	**B**
A92MUTA-GUYUN	2.01	183	7.62	71	107	**A**
A92MUTA-MUTAL	1.02	125	6.94	67	106	**C**

Table 13. Summarized SASS4 Condition Classes equating to fish segments of the Luvuvhu River Catchment based upon the 1999 survey. (Excluding KNP sites)

SEGMENT	RIVER	ECOREGION	SASS4 CLASS
Segment 1	Luvuvhu	2.01	**B**
Segment 2	Sterkstroom	2.01	**A**
Segment 3	Lat & Luv	5.04A	**C**
Segment 4	Lat	5.04B	**B**
Segment 5	Dzindi	2.01	**A**
Segment 6	Dzindi	2.01B	**B**
Segment 7	Dzin & Luv	5.04	**B**
Segment 8	Mutsh	2.01A	**C**
Segment 9	Mutsh	2.01B	**B**
Segment 10	Mutsh	2.01C and 5.04	**B**
Segment 11	Mukhasa	5.04	**A**
Segment 12	Mbwedi	2.01	**D**
Segment 13	Mutale	2.01	**A**
Segment 14	Tchiombedi	5.04	**A**
Segment 15	Samb & Mutale	2.01B and 5,04	**B**
Segment 16	Mutale	2.01C & 1.02	**C**

4. THE LETABA RIVER CATCHMENT 2000.

Table 14. Location of monitoring sites undertaken in the 1999 survey of the Luvuvhu River. (excluding sites in the KNP) RHP site codes, eco regions and site coordinates are also indicated. Eco regions From Kleynhans et. al. (2002)

RIVER	SITE NAME	RHP SITE CODE	ECO-REGION	DEG. S	DEG. E
Thabina	Bridge below Ramodike Dam	B81THAB-RAMOD	4.03	24.0255	30.169167
Letsitele	Craighead Estate	B81LETS-CRAIG	4.04	23.974167	30.165833
Letsitele	Tank Bridge IFR sight	B81LETS-TANKB	5.05	23.883333	30.266667
Politsi	Kingfisher	B81POLI-KINGf	5.05	23.8205	30.06
Debengeni	Dokolewa pools	B81DEBE-DOKOL	5.05	23.806	30.021
Debengeni	Wagtail	B81DEBE-WAGTA	5.05	23.8125	30.040333
Politsi	Rana	B81POLI-RANA	2.15	23.882167	30.017167
Broederstroom	Bridge	B81BROE-BRIDG	5.05	23.824167	30.008
Groot Letaba	Mtumi	B81GLET-MTUMI	2.15	23.914167	30.051383
Groot Letaba	Appel bridge	B81GLET-APPEL	2.15	23.914933	30.052183
Groot Letaba	Vergelegen	B81GLET-VERGE	2.15	23.887083	30.077033
Groot Letaba	Nkowankowa bridge	B81GLET-NKOWA	5.05	23.872667	30.2715
Groot Letaba	Junction Weir	B81GLET-JUNCT	5.05	23.858333	30.391667
Groot Letaba	Nagude	B81GLET-NAGUD	5.02	23.791667	30.466667
Groot Letaba	Prieska Weir	B81GLET-PRIES	5.02	23.647667	30.716833
Groot Letaba	Nondweni Weir	B81GLET-NONDW	5.02	23.6875	30.867167
Groot Letaba	Slab Weir and road bridge	B81GLET-SLABW	5.02	23.658333	30.983333
Groot Letaba	Letaba Ranch camp 3	B81GLET-LETR3	5.02	23.65	31.041667
Groot Letaba	Letaba Ranch IFR site	B81GLET-IFR16	5.02	23.679167	31.1
Nsama	Giyani - Punda Bridge	B82NSAM-BRIDG	5.03	23.2025	30.663333
Nsama	Homu banana plantation	B82NSAM-BANAN	5.02	23.289167	30.824167
Nsama	Near youth camp	B82NSAM-YOUTH	5.02	23.355167	30.915167
Klein Letaba	Majosi sewage outflow	B82KLET-MAJOS	5.03	23.230667	30.279333
Klein Letaba	Giyani - Elim road bridge	B82KLET-BRIDG	5.03	23.26	30.3705
Klein Letaba	Canal IFR	B82KLET-CANAL	5.03	23.2495	30.494667
Klein Letaba	Hlaneki Weir	B82KLET-HLAN	5.03	23.2805	30.543167
Klein Letaba	Bends Scheme	B82KLET-BENDS	5.03	23.295667	30.622
Klein Letaba	Kremetart Big Tree	B82KLET-KREME	5.03	23.3195	30.673333
Klein Letaba	Below Giyani sewage works (stadium crossing)	B82KLET-GIYAN	5.02	23.3495	30.736833
Klein Letaba	Vuhehli village crossing	B82KLET-VUHEL	5.02	23.4275	30.876667
Klein Letaba	Soutini	B82KLET-SOUTI	5.02	23.417833	30.916167
Klein Letaba	Singlepoort	B82KLET-SINGL	5.02	23.486667	31.043833
Molototsi	Below Modjadji Dam	B82MOLO-MODJA	5.03	23.599167	30.334167
Molototsi	Giyani - Modjadji bridge	B82MOLO-BRIDG	5.03	23.511667	30.416667
Molototsi	Sekhiming bridge	B82MOLO-SEKH	5.03	23.437667	30.546667
Molototsi	Dzumeri Weir	B82MOLO-DZUME	5.02	23.570833	30.748333

Table 15. River gradient, Geomorphological Zone Class and Valley Form. Of the 2000 Letaba Catchment biomonitoring sites (After Rowntree and Wadeson 1999)

RHP SITE CODE	ECO-REGION	GRADIENT	ZONE CLASS	VALLEY FORM
		m/m		
B81THAB-RAMOD	4.03	0.0156	D	V4
B81LETS-CRAIG	4.04	0.0098	D	V4
B81LETS-TANKB	5.05	0.0023	E	V4
B81POLI-KINGf	5.05			
B81DEBE-DOKOL	5.05			
B81DEBE-WAGTA	5.05			
B81POLI-RANA	2.15			
B81BROE-BRIDG	5.05			
B81GLET-MTUMI	2.15			
B81GLET-APPEL	2.15			
B81GLET-VERGE	2.15			
B81GLET-NKOWA	5.05	0.0042	D/ER	V4
B81GLET-JUNCT	5.05	0.0025	D/ER	V4
B81GLET-NAGUD	5.02	0.0014	D/ER	V4
B81GLET-PRIES	5.02	0.0027	D/ER	V4
B81GLET-NONDW	5.02	0.0016	D/ER	V4
B81GLET-SLABW	5.02	0.0011	D/ER	V4
B81GLET-LETR3	5.02	0.0018	D/ER	V4
B81GLET-IFR16	5.02	0.0018	D/ER	V4
B82NSAM-BRIDG	5.03	0.0015	D/ER	V4
B82NSAM-BANAN	5.02	0.0018	D/ER	V4
B82NSAM-YOUTH	5.02	0.0029	D/ER	V4
B82KLET-MAJOS	5.03	0.001	D/ER	V4
B82KLET-BRIDG	5.03	0.002	D/ER	V4
B82KLET-CANAL	5.03	0.0014	D/ER	V4
B82KLET-HLAN	5.03	0.0013	D/ER	V4
B82KLET-BENDS	5.03	0.0013	D/ER	V4
B82KLET-KREME	5.03	0.0015	D/ER	V4
B82KLET-GIYAN	5.02	0.0015	D/ER	V4
B82KLET-VUHEL	5.02	0.0012	D/ER	V4
B82KLET-SOUTI	5.02	0.0012	D/ER	V4
B82KLET-SINGL	5.02	0.0013	D/ER	V4
B82MOLO-MODJA	5.03	0.007	D/ER	V3
B82MOLO-BRIDG	5.03	0.0035	D/ER	V4
B82MOLO-SEKH	5.03	0.0019	D/ER	V4
B82MOLO-DZUME	5.02	0.0019	D/ER	V4

5. SUMMARY OF THE 1999 FISH SURVEY AND APPLICATION OF THE FISH ASSEMBLAGE INTEGRITY INDEX FAII

Table 16. English names, scientific names and abbreviations of fish species expected to occur in the Letaba River Catchment. Names from Skelton (2001 and 2002) and Abbreviations from Skelton (1993).

SPECIES	ABREV.	ENGLISH COMMON NAME
Amphilius uranoscopus	Aura	Common mountain catfish
Anguilla mossambica	Amos	Longfin eel
Anguilla bicolor bicolor	Abic	Shortfin eel
Anguilla bengalensis labiata	Aben	African mottled eel
Anguilla marmorata	Amar	Madagascar mottled eel
Barbus afrohamiltoni	Bafr	Hamilton's barb
Barbus annectens	Bann	Broadstriped barb
Barbus bifrenatus	Bbif	Hyphen barb
Barbus eutaenia	Beut	Orangefin barb
Barbus lineomaculatus	Blin	Line-spotted barb
Barbus mattozi	Bmat	Papermouth
Barbus neefi	Bnee	Sidespot barb
Barbus pallidus	Bpal	Goldie barb
Barbus paludinosus	Bpau	Straightfin barb
Barbus radiatus	Brad	Beira barb
Barbus toppini	Btop	East coast barb
Barbus trimaculatus	Btri	Threespot barb
Barbus unitaeniatus	Buni	Longbeard barb
Barbus viviparus	Bviv	Bowstripe barb
Brycinus imberi	Bimb	Imberi
Chetia flaviventris	Cfla	Canary kurper
Chiloglanis anoterus	Cano	Pennant-tailed rock catlet
Chiloglanis paratus	Cpar	Sawfin rock catlet
Chiloglanis pretoriae	Cpre	Shortspine rock catlet
Chiloglanis swierstrai	Cswi	Lowveld rock catlet
Clarias gariepinus	Cgar	Sharptooth catfish
Clarias theodorae	Cthe	Snake catfish
Glossogobius callidus	Gcal	River goby
Glossogobius giuris	Ggiu	Tank goby
Hydrocynus vittatus	Hvit	Tigerfish
Labeo congoro	Lcon	Purple labeo
Labeo cylindricus	Lcyl	Redeye labeo
Labeo molybdinus	Lmol	Leaden labeo
Labeo rosae	Lros	Rednose labeo
Labeo ruddi	Lrud	Silver labeo
Labeobarbus marequensis	Lmar	Largescale yellowfish
Labeobarbus polylepis	Lpol	Smallscale yellowfish
Marcusenius macrolepidotus	Mmac	Bulldog
Mesobola brevianalis	Mbre	River sardine
Micralestes acutidens	Macu	Silver robber

SPECIES	ABREV.	ENGLISH COMMON NAME
Opsaridium peringueyi	Oper	Southern barred minnow
Oreochromis mossambicus	Omos	Mozambique tilapia
Petrocephalus wesselsi	Pwes	Churchill
Pseudocrenilabrus philander	Pphi	Southern mouthbrooder
Schilbe intermedius	Sint	Silver catfish
Synodontis zambezensis	Szam	Brown squeaker
Tilapia rendalli	Tren	Redbreast tilapia
Tilapia sparrmanii	Tspa	Banded tilapia

Table 17. Alien (indigenous and exotic) fish species occurring in the Letaba River Catchment.

SPECIES	ABREV.	ENGLISH COMMON NAME
Cyprinus carpio	Ccar	Carp
Hypophthalmychthys molitrix	Hmol	Silver carp
Lepomis macrochirus	Lmac	Bluegill sunfish
Micropterus dolomieu	Mdol	Smallmouth bass
Micropterus punctulatus	Mpun	Spotted bass
Micropterus salmoides	Msal	Largemouth bass
Oncorhynchus mykiss	Omyk	Rainbow trout
Oreochromis niloticus	Onil	Nile tilapia
Salmo trutta	Stru	Brown trout
Serranochromis meridianus	Smer	Lowveld largemouth

Table 18. Fish segments and corresponding ecoregions, which provided for the interpretation of RHP indices in the 2000 survey. (Excluding KNP sites)

SEGMENT NO.	RIVER	ECOREGION
Segment 1	Politsi	2.15
Segment 2	Politsi	5.05
Segment 3	Broederstroom	5.05
Segment 4	Debengeni	5.05
Segment 5	Groot Letaba	2.15
Segment 6	Groot Letaba	5.05
Segment 7	Groot Letaba	5.02A
Segment 8	Groot Letaba	5.02B
Segment 9	Nsama	5.02
Segment 10	Klein Letaba	5.03
Segment 11	Klein Letaba	5.02
Segment 12	Molototsi	5.03
Segment 13	Molototsi	5.02
Segment 14	Letsitele	4.04
Segment 15	Letsitele	5.05
Segment 16	Thabina	4.03

Table 19. List of species expected and recorded (highlighted) in each of the 16 Fish Segments analyzed in the 2000 survey of the Letaba River Catchment.

FISH SPECIES EXPECTED PER FISH HABITAT SEGMENT															
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
AURA	AURA	AURA	AURA	AURA	AMAR	AMAR	ABEN	AMOS	AMOS	AURA	AMOS	AMOS	AURA	AMAR	AURA
AMAR	AMAR	AMAR	AMAR	AMAR	AMOS	AMOS	AMAR	BAFR	BAFR	AMAR	BAFR	BAFR	AMOS	AMOS	AMOS
AMOS	AMOS	AMOS	AMOS	AMOS	AURA	BAFR	AMOS	BANN	BANN	AMOS	BANN	BANN	BEUT	AURA	BEUT
BEUT	BEUT	BEUT	BEUT	BEUT	BANN	BANN	BAFR	BPAU	BLIN	BAFR	BLIN	BMAT	BLIN	BANN	BLIN
BLIN	BLIN	BLIN	BLIN	BLIN	BEUT	BEUT	BANN	BRAD	BPAU	BANN	BPAU	BPAU	BNEE	BEUT	BNEE
BNEE	BNEE	BNEE	BNEE	BNEE	BLIN	BIMB	BIMB	BTOP	BRAD	BIM	BTOP	BRAD	BPAU	BLIN	BPAU
BPAU	BPAU	BPAU	BPAU	BPAU	BNEE	BLIN	BMAT	BTRI	BTOP	BMAT	BTRI	BTOP	BTRI	BNEE	BTRI
BTRI	BTRI	TSPA	BTRI	BTRI	BPAU	BMAT	BPAU	BUNI	BTRI	BPAU	BUNI	BTRI	BUNI	BPAU	BUNI
BUNI	BUNI		BUNI	BUNI	BTOP	BPAU	BRAD	BVIV	BUNI	BRAD	BVIV	BUNI	BVIV	BTOP	BVIV
BVIV	BVIV		BVIV	BVIV	BTRI	BRAD	BTOP	CGAR	BVIV	BTOP	CGAR	BVIV	CGAR	BTRI	CGAR
CPRE	CGAR		CPRE	CGAR	BUNI	BTOP	BTRI	CPAR	CGAR	BTRI	CPAR	CGAR	CPRE	BUNI	CPRE
LCYL	CPRE		LCYL	CPRE	BVIV	BTRI	BUNI	CPRE	CPAR	BUNI	CPRE	CPAR	LCYL	BVIV	LCYL
LMAR	LCYL		LMAR	LCYL	CGAR	BUNI	BVIV	GCAL	CPRE	BVIV	CSWI	CPRE	LMAR	CGAR	LMAR
LMOL	LMAR		LMOL	LMAR	CPAR	BVIV	CGAR	LCYL	CSWI	CGAR	GCAL	CSWI	LMOL	CPAR	LMOL
MACU	LMOL		MACU	LMOL	CPRE	CGAR	CPAR	LMAR	GCAL	CPAR	LCYL	GCAL	MACU	CPRE	MACU
MMAC	MACU		MMAC	MACU	GCAL	CPAR	CPRE	LMOL	GGIU	CPRE	LMAR	GGIU	MMAC	GCAL	MMAC
OPER	MBRE		OPER	MBRE	GGIU	CPRE	CSWI	LROS	LCYL	CSWI	LMOL	LCYL	OMOS	GGIU	OMOS
PPHI	MMAC		PPHI	MMAC	LCYL	CSWI	GCAL	LRUD	LMAR	GCAL	LROS	LMAR	OPER	LCYL	OPER
PWES	OMOS		PWES	OMOS	LMAR	GCAL	GGIU	MACU	LMOL	GGIU	LRUD	LMOL	PPHI	LMAR	PPHI
TSPA	OPER		TSPA	OPER	LMOL	GGIU	HVIT	MBRE	LROS	HVIT	MACU	LROS	PWES	LMOL	PWES
	PPHI			PPHI	LROS	LCYL	LCON	MMAC	LRUD	LCYL	MBRE	LRUD	TREN	LROS	TREN
	PWES			PWES	LRUD	LMAR	LCYL	OMOS	MACU	LMAR	MMAC	MACU	TSPA	LRUD	TSPA

FISH SPECIES EXPECTED PER FISH HABITAT SEGMENT															
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
	TSPA			TSPA	MACU	LMOL	LMAR	PPHI	MBRE	LMOL	OMOS	MBRE		MACU	
					MBRE	LROS	LMOL	PWES	MMAC	LROS	PPHI	MMAC		MBRE	
					MMAC	LRUD	LROS	SINT	OMOS	LRUD	PWES	OMOS		MMAC	
					OMOS	MACU	LRUD	SZAM	PPHI	MACU	SINT	PPHI		OMOS	
					OPER	MBRE	MACU	TREN	PWES	MBRE	SZAM	PWES		OPER	
					PPHI	MMAC	MBRE		SINT	MMAC	TREN	SINT		PPHI	
					PWES	OMOS	MMAC		SZAM	OMOS		SZAM		PWES	
					SINT	OPER	OMOS		TREN	PPHI		TREN		SINT	
					SZAM	PPHI	PPHI			PWES				SZAM	
					TREN	PWES	PWES			SINT				TREN	
					TSPA	SINT	SINT			SZAM				TSPA	
						SZAM	SZAM			TREN					
						TREN	TREN								

Table 20. Summarized results of the 2000 fish survey of the Letaba River Catchment. Results of the Fish Assemblage Integrity Index based upon various components of the index. (Intolerance, Frequency of occurrence, Abundance and Fish Health) Numbers of species expected and recorded are also shown.

FISH SEGMENT No.	TYPE A: INTOLERANCE, ABUNDANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE B: INTOLERANCE, ABUNDANCE & HEALTH		TYPE C:INTOLERANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE D: INTOLERANCE ONLY		SPECIES RICHNESS	
	TYPE A: RELATIVE FAII SCORES (%)	TYPE A: RELATIVE FAII CLASSES	TYPE B: RELATIVE FAII SCORES (%)	TYPE B: RELATIVE FAII CLASSES	TYPE C: RELATIVE FAII SCORES (%)	TYPE C: RELATIVE FAII CLASSES	TYPE D: RELATIVE FAII SCORES (%)	TYPE D: RELATIVE FAII CLASSES	NO OF SPECIES EXPECTED PER FHS	NO OF SPECIES CAUGHT PER FHS
1	10	F	8	F	10	F	49	D	20	1
2	55	D	48	D	54	D	48	D	23	2
3	0	F	0	F	0	F	0	F	8	0
4	8	F	8	F	8	F	8	F	20	1
5	64	C	53	D	61	C	52	D	23	9
6	36	E	33	E	36	E	33	E	33	12
7	49	D	48	D	49	D	48	D	35	17
8	43	D	47	D	43	D	47	D	35	17
9	29	E	26	E	29	E	26	E	27	8
10	45	D	47	D	45	D	47	D	30	17
11	44	D	39	E	44	D	45	D	34	16
12	29	E	24	E	29	E	29	E	28	1
13	48	D	42	D	48	D	42	D	22	7
14	34	E	29	E	34	E	29	E	33	11
15	56	D	51	D	56	D	51	D	22	10

6. SUMMARY OF THE 1999 INVERTEBRATE SURVEY OF THE LETABA RIVER CATCHMENT. APPLICATION OF THE SOUTH AFRICAN SCORING SYSTEM VERSION 4.

Table 21. SASS4 Condition Classes, Scores, ASPT, IHAS and HQI ratings for the invertebrate survey of the Letaba River Catchment 2000.

RHP SITE CODE	ECO-REGION	SASS4	ASPT	IHAS	HQI	CLASS
B81LETS-CRAIG	4.04	173	6.65	73	118	B
B81LETS-TANKB	5.05	161	7	67	113	A
B81THAB-RAMOD	4.03	133	6.33	62	102	C
B81DEBE-DOKOL	5.05	145	7.6	N/A	N/A	A
B81DEBE-WAGTA	5.05	173	8.2	N/A	N/A	A
B81POLI-RANA	2.15	165	7.17	N/A	N/A	A
B81POLI-KINGf	5.05	191	6.8	N/A	N/A	A
B81BROE-BRIDG	5.05	82	6.3	N/A	N/A	C
B81GLET-MTUMI	2.15	155	6.7	N/A	N/A	B
B81GLET-APPEL	2.15	N/A	N/A	N/A	N/A	N/A
B81GLET-VERGE	2.15	N/A	N/A	N/A	N/A	N/A
B81GLET-NKOWA	5.05	95	6.3	71	82	C
B81GLET-JUNCT	5.05	93	6.4	65	71	C
B81GLET-NAGUD	5.02	151	6.56	63	109	B
B81GLET-PRIES	5.02	168	6.46	63	94	A
B81GLET-NONDW	5.02	103	5.72	48	93	C
B81GLET-SLABW	5.02	155	7.4	66	105	A
B81GLET-LETR3	5.02	143	6.5	65	104	B
B81GLET-IFR16	5.02	134	6.38	75	107	B
B82NSAM-BRIDG	5.03	N/A	N/A	N/A	N/A	N/A
B82NSAM-BANAN	5.02	116	5.8	62	78	C
B82NSAM-YOUTH	5.02	125	6.25	66	115	B
B82KLET-MAJOS	5.03	108	6	60	63	C-B
B82KLET-BRIDG	5.03	70	5.8	59	81	D
B82KLET-CANAL	5.03	109	6.41	61	90	B
B82KLET-HLAN	5.03	99	5.5	71	97	C
B82KLET-BENDS	5.03	117	6.5	55	66	B
B82KLET-KREME	5.03	95	5.94	66	95	C
B82KLET-GIYAN	5.02	92	6.57	55	70	C
B82KLET-VUHEL	5.02	116	6.1	71	102	B
B82KLET-SOUTI	5.02	113	5.65	81	106	C
B82KLET-SINGL	5.02	103	5.72	76	95	C
B82MOLO-MODJA	5.03	106	6.62	66	98	B
B82MOLO-BRIDG	5.03	70	5.8	42	67	D
B82MOLO-SEKH	5.03	103	5.72	96	61	C
B82MOLO-DZUME	5.02	114	5.7	73	95	C

Note: Site B82NSAM-BRIDG on the Nsama River was dry at the time of the SASS survey. Upper catchment sites were assessed by UNIN students and some data is missing.

Table 22. Summarized SASS4 Condition Classes equating to fish segments of the Letaba River Catchment based upon the 2000 survey. (Excluding KNP sites)

SEGMENT NO.	RIVER	ECOREGION	SASS4 CLASS
Segment 1	Politsi	2.15	**A**
Segment 2	Politsi	5.05	**A**
Segment 3	Broederstroom	5.05	**C**
Segment 4	Debengeni	5.05	**A**
Segment 5	Groot Letaba	2.15	**B**
Segment 6	Groot Letaba	5.05	**C**
Segment 7	Groot Letaba	5.02A	**B**
Segment 8	Groot Letaba	5.02B	**B**
Segment 9	Nsama	5.02	**C**
Segment 10	Klein Letaba	5.03	**C**
Segment 11	Klein Letaba	5.02	**C**
Segment 12	Molototsi	5.03	**D**
Segment 13	Molototsi	5.02	**C**
Segment 14	Letsitele	5.05	**A**
Segment 15	Thabina	4.03	**C**

7. THE 2003 SURVEY OF THE LUVUVHU CATCHMENT.

The 2003 survey addressed 19 of the original 36 sites surveyed in 1999. These sites represented 10 of the original 16 segments occurring outside of the KNP. Sites were selected in those areas where environmental conditions were most likely to fluctuate. Sites which occurred in areas such as forestry plantations were considered to be more stable and were thus not considered as a priority for this follow up survey.

The 2003 survey was conducted during March and April of 2003 in a period of moderate flows. 2003 would later be recorded as a year of severe drought. Additional data was collected for two sites in January 2004.

A number of the original sites could not be surveyed. Reasons for this are given per site where this occurred.

A91LUVU-VALDE A new, albeit low, gauging weir had been erected across the site.

A91LUVU-BOTSO An informal agricultural plot had been fenced off, restricting access to the site.

A92SAMB-BRIDG An informal agricultural plot had been fenced off, restricting access to the site.

A92MUTA-TSHIK The 2000 floods had eroded both river banks and access roads restricting access. Access through alternative routes was restricted by informal agricultural plots.

A further new weir was being erected by DWAF at Mutale Agricultural estates. No EIA was done and this was subsequently discussed with both DWAF and DEAT officials on site.

A further new weir was found in the Latonyanda. Again DWAF were consulted on site. The new structure has included a fishladder, but the design appears to be both impractical and ineffective since there is already a similar structure 200m downstream.

Maintenance of Malamulele Weir was also taking place and site A91LUVU-MALAM was basically a construction site. Backfill from the weir had been deposited into the river channel.

Results of the 2003 Luvuvhu survey are summarized in tables 23 – 26.

A comparison of the 1999 FAII results (table 10) to the 2003 results (table 24), shows that the ecological class has dropped. Reasons contributing to this apparent decline may include the following.

- The limited number of sites surveyed may have influenced the results. Multiple sites in a segment improve the mathematical chances of capturing the expected species.
- The 1999 survey was conducted in a period where strong river flows had occurred for over 3 years, following the 1996 flood. The 1999 survey could be considered to have occurred at a time when the best conditions have existed in the past decade.
- The 2003 survey was conducted in very low base flows, as the region extended into drought.

Irrespective of the above, the following can be noted.

- Only 1 specimen of the red data fish *Opsaridium peringueyi* was recorded in the middle reaches of the Mutale River. In 1999 this fish was abundant in four river segments.
- In 1999, the highly flow dependent *Amphilius uranoscopus* was abundant in all 15 of the segments, where it was expected , while in 2003, the fish was only recorded in 6 of the 9 segments where the fish is expected.
- In 1999, the highly flow dependent *Barbus eutaenia* was abundant in 8 of the 16 segments surveyed, while in 2003, the fish was only recorded in 3 of the 10 segments surveyed.
- In 1999, the migratory eels *Anguilla spp.* were recorded in 6 of the 16 segments surveyed, while in 2003, no fish were recorded at all.
- In 1999, the "provincially scarce" *Barbus lineomaculatus* was recorded in 5 of the 16 segments surveyed, while in 2003, the fish was not recorded at all.
- Abundances of all fish species were lower in 2003 than in 1999.

In noting the decline in these key indicator species, it is clear that further surveys should be conducted to reliably ascertain the true status of the river and to establish whether there is a downward trend in the status of the fish assemblages.

A review of the invertebrate results depicted in table 26, shows that there is no clear trend in the status of invertebrate populations. Three segments showed a downward movement in status while two segments improved. The remainder were unchanged.

For the 2003 SASS survey, it was necessary to manually convert the SASS5 scores back to SASS4 scores for interpretive and comparative purposes. In this process, the scores changed very little. However, some data which is collected in SASS5 and later converted back to SASS4 was not recorded in the old SASS4 forms. For example, the migratory prawn *Machrobranchium lepidactylus* was recorded at three sites in 2003 and although abundant in 2001, there are no detailed records because the prawns were not differentiated from shrimps on the old SASS4 form.

A comparison of the habitat scores indicated in table 12 and table 25, shows a marked decline from 1999 to 2003. This is a clear reflection in the changing flow regime over the two survey periods.

Table 23. List of species expected and recorded (highlighted yellow) in each of the 16 Fish Segments analyzed in the 2003 survey of the Luvuvhu River Catchment. Segments 1,4,6,8,11 and 15 were not surveyed.

FISH SPECIES EXPECTED PER FISH HABITAT SEGMENT															
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
aura	Aura	aura	aura	Aura	aura	aura	arua	aura	aura	aura	aura	aura	aura	aura	aben
amos	amos	amos	amos	Amos	amos	amar	beut	amos	amos	amos	amos	amos	amos	amos	amos
beut	beut	beut	beut	beut	beut	amos	blin	beut	beut	beut	beut	beut	beut	bann	bann
blin	blin	blin	blin	blin	blin	bann	lmar	blin	blin	blin	blin	blin	blin	beut	beut
lmar	lmar	lmar	lmar	bnee	lmar	beut	bnee	lmar	lmar	lmar	lmar	lmar	lmar	blin	lmar
bnee	bnee	bnee	bnee	bpau	bnee	blin	btri	bnee	bnee	bnee	bnee	bnee	bnee	lmar	bmat
bpau	bpau	bpau	bpau	btri	bpau	lmar	buni	bpau	bpau	bpau	bpau	bpau	bpau	bnee	bnee
btop	btri	btop	btri	oper	btri	bnee	bviv	btri	btop	btri	btri	btri	btri	bpau	brad
btri	cpre	btri	bviv	tspa	buni	bpau	cpre	buni	btri	buni	buni	buni	bviv	brad	btri
buni	mmac	buni	cpre		bviv	btop	cgar	bviv	buni	bviv	bviv	bviv	cpre	btri	buni
bviv	oper	bviv	lcyl		cpre	btri	lcyl	cpre	bviv	cpre	cpre	cpre	cgar	buni	bviv
cpre	tspa	cpre	lmol		cgar	buni	mmac	cgar	cpar	lcyl	cgar	cgar	lcyl	bviv	cpar
cgar		cgar	mmac		lcyl	bviv	oper	lcyl	cpre	lmol	lcyl	lcyl	lmol	cpre	cpre
lcyl		lcyl	maco		lmol	cpar	omos	lmol	cgar	mmac	lmol	lmol	mmac	cgar	cgar
lmol		lmol	oper		mmac	cpre	tspa	mmac	gcal	macu	mmac	mmac	macu	lcon	lcon
mmac		lros	omos		macu	cswi		macu	ggiu	oper	macu	macu	oper	lcyl	lcyl
macu		mmac	pwes		oper	cgar		oper	lcyl	omos	oper	oper	pwes	lmol	lmol
oper		mbre	pphi		omos	gcal		omos	lmol	pwes	omos	pwes	pphi	lros	lros
omos		macu	tren		pwes	ggiu		pwes	lros	pphi	pwes	pphi	tspa	mmac	mmac
pwes		oper	tspa		pphi	lcyl		pphi	mmac	tspa	pphi	tspa		macu	macu
pphi		omos			tren	lmol		sint	mbre		tspa			oper	omos
tren		pwes			tspa	lros		tspa	macu					omos	pwes
tspa		pphi				mmac			oper					pwes	pphi

FISH SPECIES EXPECTED PER FISH HABITAT SEGMENT															
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
		sint				mbre			omos					pphi	sint
		tren				macu			pwes					sint	tren
		tspa				oper			pphi					tren	
						omos			sint					tspa	
						pwes			tren						
						pphi			tspa						
						sint									
						tren									
						tspa									

Table 24. **Summarized results of the 2003 fish survey of the prioritized sites in the Luvuvhu River Catchment. Results of the Fish Assemblage Integrity Index based upon various components of the index. (Intolerance, Frequency of occurrence, Abundance and Fish Health) Numbers of species expected and recorded are also shown.**

FHS	TYPE A: INTOLERANCE, ABUNDANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE B: INTOLERANCE, ABUNDANCE & HEALTH		TYPE C:INTOLERANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE D: INTOLERANCE ONLY		SPECIES RICHNESS	
	TYPE A: RELATIVE FAII SCORES (%)	TYPE A: RELATIVE FAII CLASSES	TYPE B: RELATIVE FAII SCORES (%)	TYPE B: RELATIVE FAII CLASSES	TYPE C: RELATIVE FAII SCORES (%)	TYPE C: RELATIVE FAII CLASSES	TYPE D: RELATIVE FAII SCORES (%)	TYPE D: RELATIVE FAII CLASSES	NO OF SPECIES EXPECTED PER FHS	NO OF SPECIES CAUGHT PER FHS
S1										
S2	29	E	21	E	28	E	21	E	12	2
S3	62	C	52	D	62	C	52	D	26	14
S5	37	E	29	E	34	E	29	E	9	2
S7	28	E	22	E	28	E	22	E	32	7
S9	46	D	40	D	46	D	40	D	22	9
S10	41	D	36	E	41	D	36	E	29	11
S12	27	E	23	E	27	E	23	E	21	5
S13	67	C	61	C	67	C	61	C	20	12

FHS	TYPE A: INTOLERANCE, ABUNDANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE B: INTOLERANCE, ABUNDANCE & HEALTH		TYPE C:INTOLERANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE D: INTOLERANCE ONLY		SPECIES RICHNESS	
	TYPE A: RELATIVE FAII SCORES (%)	TYPE A: RELATIVE FAII CLASSES	TYPE B: RELATIVE FAII SCORES (%)	TYPE B: RELATIVE FAII CLASSES	TYPE C: RELATIVE FAII SCORES (%)	TYPE C: RELATIVE FAII CLASSES	TYPE D: RELATIVE FAII SCORES (%)	TYPE D: RELATIVE FAII CLASSES	NO OF SPECIES EXPECTED PER FHS	NO OF SPECIES CAUGHT PER FHS
S14	17	F	14	F	17	F	14	F	19	2
S15	0	NA	0	NA	0	NA	0	NA	27	0
S16	41	E	31	E	38	E	31	E	25	8

Table 25. SASS4 Condition Classes, Scores, ASPT, IHAS and HQI ratings for the invertebrate survey of prioritized sites in the Luvuvhu River Catchment 2003.

RHP SITE CODE	ECO REGION	SASS4	ASPT	IHAS	HQI	CLASS
A91DZIN-TOPBR	2.01	144	6.54	99	122	**B**
A91DZIN-WATER	2.01					
A91DZIN-CROCV	5.04					
A91LATO-BOTHA	5.04					
A91LATO-CABBA	5.04	92	6.13	72	99	**C**
A91STER-ALBAS	2.01	100	5.55	85	95	**C**
A91LUVU-SHEFE	2.01					
A91LUVU-BEJAB	5.04					
A91LUVU-VALDE	5.04					
A91LUVU-ROBER	5.04					
A91LUVU-9H001	5.04	150	5.76	80	111	**B**
A91LUVU-HASAN	5.04	91	5.68	73	99	**C**
A91LUVU-NANDO	5.04					
A91LUVU-MALAM	5.03					
A91LUVU-TSHIF	5.04	112	5.89	75	100	**C**
A91LUVU-BOTSO	5.04					
A91LUVU-MHING	5.04	158	5.85	71	104	**B**
A91LUVU-LAMBA	5.04	187	6.23	87	111	**A**
A91MUKH-CYCAD	5.04					
A91MBWE-DAMAN	2.01	69	4.6	64	81	**D**
A91MBWE-BRIDG	5.04	141	5.64	93	122	**B**
A91MUTS-PHIPI	2.01					
A91MUTS-HYDRO	2.01					
A91MUTS-TSHIV	5.04	183	6.53	80	108	**A**
A91MUTS-SCHOO	2.01					
A91MUTS-MALAV	2.01					
A91MUTS-GUAGI	2.01					
A92TCHI-BRIDG	5.04	131	5.69	87	106	**B**
A92SAMB-BRIDG	5.04					
A92TSHI-MUTAL	2.01	150	6.52	97	120	**B**
A92MUTA-ROADS	2.01					
A92MUTA-WHBON	2.01	174	6.21	87	117	**A**
A92MUTA-SAMBA	5.04					
A92MUTA-TSHIK	2.01					
A92MUTA-GUYUN	2.01	143	5.72	92	119	**B**
A92MUTA-MUTAL	1.02	195	5.87	80	103	**A**

Table 26. Summarized SASS4 Condition Classes for 1999 and 2003, equating to fish segments of the Luvuvhu River. (Excluding KNP sites)

SEGMENT NO.	RIVER	ECO - REGION	1999 SASS4 CLASS	2003 SASS4 CLASS
Segment 1	Luvuvhu	2.01	**B**	**N/A**
Segment 2	Sterkstroom	2.01	**A**	**C**
Segment 3	Lat & Luv	5.04A	**C**	**C**
Segment 4	Lat	5.04B	**B**	**N/A**
Segment 5	Dzindi	2.01	**A**	**B**
Segment 6	Dzindi	2.01B	**B**	**N/A**
Segment 7	Dzin & Luv	5.04	**B**	**B**
Segment 10	Mutsh	2.01A	**C**	**N/A**
Segment 11	Mutsh	2.01B	**B**	**N/A**
Segment 12	Mutsh	2.01C and 5.04	**B**	**A**
Segment 13	Mukhasa	5.04	**A**	**N/A**
Segment 14	Mbwedi	2.01	**D**	**D**
Segment 15	Mutale	2.01	**A**	**A**
Segment 16	Tchiombedi	5.04	**A**	**B**
Segment 17	Samb & Mutale	2.01B and 5.04	**B**	**N/A**
Segment 18	Mutale	2.01C & 1.02	**C**	**B**

8. THE 2003 SURVEY OF THE LETABA CATCHMENT.

11 of the original 36 sites were surveyed in 2003. These sites represented 8 of the original 16 river segments.

The Letaba survey was conducted between May and July 2003 and river flows were very low due to the impending drought.

During the survey period, the Thabina River, the Molototsi River and the Nsama River were completely dry. The Klein Letaba had very flows in its middle reaches, while the lower river was restricted to a few surface pools. The Letsitele River was also flowing weakly.

The lack of flow in the Thabina River was entirely attributed to the Thabina (Ramodike) Dam. No water was being released into the river.

The Groot Letaba was flowing between Ebenezerdam and Vergelegen, but an irrigation weir and canal system then extracted 100 percent of the flow. There was consequently no flow in the river between Apel and the Tzaneen Dam. Tzaneen Dam continued to release water throughout the survey period.

Results for the Letaba Survey are attached in tables 27 - 30

Once again the FAII results reflect a general decrease in the status of the river, with most segments showing FAII assessment Classes E and F (Seriously and critically modified)

While the results for the FAII in the Letaba Catchment may be adversely influenced by the drought, (affecting both flow and water quality) the following points can be noted.

- In 2000, the highly flow dependent *Amphilius uranoscopus* was present in 7 of the 10 segments where it is expected, whereas in 2003, the fish was only recorded in 2 segments.
- In 2000, the highly flow dependent *Barbus eutaenia* was abundant in 7 of the 10 segments where it is expected segments surveyed, while in 2003, the fish was only recorded in 2 segments.
- In 2000, the migratory eels *Anguilla* spp. were recorded in 6 of the 16 segments surveyed, while in 2003, no fish were recorded at all.
- In 2000, the "provincially scarce" *Barbus lineomaculatus* was recorded in 5 of the 15 segments surveyed, while in 2003, the fish was only recorded in one segment.
- No specimens of the red data fish *Opsaridium peringueyi* were recorded in either survey.
- Abundances of all fish species were lower in 2003 than in 1999.

A review of the SASS results in table 30 gives an indication that the invertebrate assemblages are in a good Condition Class. There are no discernable trends which can be identified at this time. Two segments have improved while a single segment has deteriorated since 2000. The remainder of the segments have not changed class.

No migratory prawns were recorded in the Letaba River in 2003.

Once again, a review of the habitat data in tables 21 and 29 reveals that habitat availability has decreased due to the reduction in flow.

Table 27. List of species expected and recorded (highlighted in yellow) in each of the 16 Fish Segments analyzed in the 2003 survey of the Letaba River Catchment. Segments 1, 2, 3, 4, 9, 12, 13 and 16 were not surveyed.

FISH SPECIES EXPECTED PER FISH HABITAT SEGMENT															
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
AURA	AURA	AURA	AURA	AURA	AMAR	AMAR	ABEN	AMOS	AMOS	AURA	AMOS	AMOS	AURA	AMAR	AURA
AMAR	AMAR	AMAR	AMAR	AMAR	AMOS	AMOS	AMAR	BAFR	BAFR	AMAR	BAFR	BAFR	AMOS	AMOS	AMOS
AMOS	AMOS	AMOS	AMOS	AMOS	AURA	BAFR	AMOS	BANN	BANN	AMOS	BANN	BANN	BEUT	AURA	BEUT
BEUT	BEUT	BEUT	BEUT	BEUT	BANN	BANN	BAFR	BPAU	BLIN	BAFR	BLIN	BMAT	BLIN	BANN	BLIN
BLIN	BLIN	BLIN	BLIN	BLIN	BEUT	BEUT	BANN	BRAD	BPAU	BANN	BPAU	BPAU	BNEE	BEUT	BNEE
BNEE	BNEE	BNEE	BNEE	BNEE	BLIN	BIMB	BIMB	BTOP	BRAD	BIM	BTOP	BRAD	BPAU	BLIN	BPAU
BPAU	BPAU	BPAU	BPAU	BPAU	BNEE	BLIN	BMAT	BTRI	BTOP	BMAT	BTRI	BTOP	BTRI	BNEE	BTRI
BTRI	BTRI	TSPA	BTRI	BTRI	BPAU	BMAT	BPAU	BUNI	BTRI	BPAU	BUNI	BTRI	BUNI	BPAU	BUNI
BUNI	BUNI		BUNI	BUNI	BTOP	BPAU	BRAD	BVIV	BUNI	BRAD	BVIV	BUNI	BVIV	BTOP	BVIV
BVIV	BVIV		BVIV	BVIV	BTRI	BRAD	BTOP	CGAR	BVIV	BTOP	CGAR	BVIV	CGAR	BTRI	CGAR
CPRE	CGAR		CPRE	CGAR	BUNI	BTOP	BTRI	CPAR	CGAR	BTRI	CPAR	CGAR	CPRE	BUNI	CPRE
LCYL	CPRE		LCYL	CPRE	BVIV	BTRI	BUNI	CPRE	CPAR	BUNI	CPRE	CPAR	LCYL	BVIV	LCYL
LMAR	LCYL		LMAR	LCYL	CGAR	BUNI	BVIV	GCAL	CPRE	BVIV	CSWI	CPRE	LMAR	CGAR	LMAR
LMOL	LMAR		LMOL	LMAR	CPAR	BVIV	CGAR	LCYL	CSWI	CGAR	GCAL	CSWI	LMOL	CPAR	LMOL
MACU	LMOL		MACU	LMOL	CPRE	CGAR	CPAR	LMAR	GCAL	CPAR	LCYL	GCAL	MACU	CPRE	MACU
MMAC	MACU		MMAC	MACU	GCAL	CPAR	CPRE	LMOL	GGIU	CPRE	LMAR	GGIU	MMAC	GCAL	MMAC
OPER	MBRE		OPER	MBRE	GGIU	CPRE	CSWI	LROS	LCYL	CSWI	LMOL	LCYL	OMOS	GGIU	OMOS
PPHI	MMAC		PPHI	MMAC	LCYL	CSWI	GCAL	LRUD	LMAR	GCAL	LROS	LMAR	OPER	LCYL	OPER
PWES	OMOS		PWES	OMOS	LMAR	GCAL	GGIU	MACU	LMOL	GGIU	LRUD	LMOL	PPHI	LMAR	PPHI
TSPA	OPER		TSPA	OPER	LMOL	GGIU	HVIT	MBRE	LROS	HVIT	MACU	LROS	PWES	LMOL	PWES
	PPHI			PPHI	LROS	LCYL	LCON	MMAC	LRUD	LCYL	MBRE	LRUD	TREN	LROS	TREN
	PWES			PWES	LRUD	LMAR	LCYL	OMOS	MACU	LMAR	MMAC	MACU	TSPA	LRUD	TSPA
	TSPA			TSPA	MACU	LMOL	LMAR	PPHI	MBRE	LMOL	OMOS	MBRE		MACU	

FISH SPECIES EXPECTED PER FISH HABITAT SEGMENT															
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
					MBRE	LROS	LMOL	PWES	MMAC	LROS	PPHI	MMAC		MBRE	
					MMAC	LRUD	LROS	SINT	OMOS	LRUD	PWES	OMOS		MMAC	
					OMOS	MACU	LRUD	SZAM	PPHI	MACU	SINT	PPHI		OMOS	
					OPER	MBRE	MACU	TREN	PWES	MBRE	SZAM	PWES		OPER	
					PPHI	MMAC	MBRE		SINT	MMAC	TREN	SINT		PPHI	
					PWES	OMOS	MMAC		SZAM	OMOS		SZAM		PWES	
					SINT	OPER	OMOS		TREN	PPHI		TREN		SINT	
					SZAM	PPHI	PPHI			PWES				SZAM	
					TREN	PWES	PWES			SINT				TREN	
					TSPA	SINT	SINT			SZAM				TSPA	
						SZAM	SZAM			TREN					
						TREN	TREN								

Table 28. **Summarized results of the 2003 fish survey of prioritized sites of the Letaba River Catchment. Results of the Fish Assemblage Integrity Index based upon various components of the index. (Intolerance, Frequency of occurrence, Abundance and Fish Health) Numbers of species expected and recorded are also shown.**

FHS	TYPE A: INTOLERANCE, ABUNDANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE B: INTOLERANCE, ABUNDANCE & HEALTH		TYPE C:INTOLERANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE D: INTOLERANCE ONLY		SPECIES RICHNESS	
	TYPE A: RELATIVE FAII SCORES (%)	TYPE A: RELATIVE FAII CLASSES	TYPE B: RELATIVE FAII SCORES (%)	TYPE B: RELATIVE FAII CLASSES	TYPE C: RELATIVE FAII SCORES (%)	TYPE C: RELATIVE FAII CLASSES	TYPE D: RELATIVE FAII SCORES (%)	TYPE D: RELATIVE FAII CLASSES	NO OF SPECIES EXPECTED PER FHS	NO OF SPECIES CAUGHT PER FHS
S1										
S2										
S3										
S4										
S5	56	D	48	D	54	D	48	D	23	10
S6	36	E	31	E	36	E	31	E	33	10
S7	44	D	39	E	44	D	39	E	35	15
S8										
S9										
S10	19	F	15	F	19	F	15	F	30	7
S11	36	E	27	E	36	E	27	E	34	12
S12										

FHS	TYPE A: INTOLERANCE, ABUNDANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE B: INTOLERANCE, ABUNDANCE & HEALTH		TYPE C:INTOLERANCE, FREQUENCY OF OCCURRENCE & HEALTH		TYPE D: INTOLERANCE ONLY		SPECIES RICHNESS	
	TYPE A: RELATIVE FAII SCORES (%)	TYPE A: RELATIVE FAII CLASSES	TYPE B: RELATIVE FAII SCORES (%)	TYPE B: RELATIVE FAII CLASSES	TYPE C: RELATIVE FAII SCORES (%)	TYPE C: RELATIVE FAII CLASSES	TYPE D: RELATIVE FAII SCORES (%)	TYPE D: RELATIVE FAII CLASSES	NO OF SPECIES EXPECTED PER FHS	NO OF SPECIES CAUGHT PER FHS
S13	51	D	45	D	51	D	55	D	22	12
S14	18	F	15	F	18	F	15	F	33	6
s16										

Table 29. SASS4 Condition Classes, Scores, ASPT, IHAS and HQI ratings for the invertebrate survey of prioritized sites of the Letaba River Catchment 2003.

RHP SITE CODE	ECO-REGION	SASS4	ASPT	IHAS	HQI	CLASS
B81LETS-CRAIG	4.04	172	6.61	94	118	B
B81LETS-TANKB	5.05	106	5.30	70	83	C
B81THAB-RAMOD	4.03					
B81DEBE-DOKOL	5.05					
B81DEBE-WAGTA	5.05					
B81POLI-RANA	2.15					
B81POLI-KINGf	5.05					
B81BROE-BRIDG	5.05					
B81GLET-MTUMI	2.15					
B81GLET-APPEL	2.15					
B81GLET-VERGE	2.15	175	6.73	90	118	A
B81GLET-NKOWA	5.05	178	6.14	86	93	A
B81GLET-JUNCT	5.05					
B81GLET-NAGUD	5.02	176	5.86	88	109	A
B81GLET-PRIES	5.02	162	5.58	78	75	B
B81GLET-NONDW	5.02					
B81GLET-SLABW	5.02	145	5.00	70	88	B
B81GLET-LETR3	5.02					
B81GLET-IFR16	5.02	149	5.32	89	111	B
B82NSAM-BRIDG	5.03					
B82NSAM-BANAN	5.02					
B82NSAM-YOUTH	5.02					
B82KLET-MAJOS	5.03					
B82KLET-BRIDG	5.03					
B82KLET-CANAL	5.03	137	5.70	87	95	B
B82KLET-HLAN	5.03					
B82KLET-BENDS	5.03	121	5.50	62	86	C
B82KLET-KREME	5.03					
B82KLET-GIYAN	5.02					
B82KLET-VUHEL	5.02					
B82KLET-SOUTI	5.02	121	5.50	82	93	C
B82KLET-SINGL	5.02					
B82MOLO-MODJA	5.03					
B82MOLO-BRIDG	5.03					
B82MOLO-SEKH	5.03					
B82MOLO-DZUME	5.02					

Table 30. Summarized SASS4 Condition Classes for both 2001 and 2003, equating to fish segments of the Letaba River Catchment. (Excluding KNP sites)

SEGMENT NO.	RIVER	ECO - REGION	2001 SASS4 CLASS	2003 SASS4 CLASS
Segment 1	Politsi	2.15	**A**	**N/A**
Segment 2	Politsi	5.05	**A**	**N/A**
Segment 3	Broederstroom	5.05	**C**	**N/A**
Segment 4	Debengeni	5.05	**A**	**N/A**
Segment 5	Groot Letaba	2.15	**B**	**A**
Segment 6	Groot Letaba	5.05	**C**	**A**
Segment 7	Groot Letaba	5.02A	**B**	**B**
Segment 8	Groot Letaba	5.02B	**B**	**B**
Segment 9	Nsama	5.02	**C**	**N/A**
Segment 10	Klein Letaba	5.03	**C**	**C**
Segment 11	Klein Letaba	5.02	**C**	**C**
Segment 12	Molototsi	5.03	**D**	**N/A**
Segment 13	Molototsi	5.02	**C**	**N/A**
Segment 14	Letsitele	5.05	**A**	**C**
Segment 15	Thabina	4.03	**C**	**N/A**

9. CONCLUSIONS.

Prior to the analysis of the 2003 data for both catchments, the 1999 data for the Luvuvhu and the 2000 data for the Letaba Catchment needed to be reworked, to allow comparison with the current protocols for the FAII and SASS. This had some impact on the initial assessments and in some cases the river condition was lowered one or more condition classes than had previously been perceived and reported.

The 2003 survey has subsequently shown that the status of the fish populations for both catchments has declined since the first survey of 1999/2000. In particular, the Letaba Cathment has slipped into a serious – critically modified condition class.

The status of the invertebrate populations has shown no clear overall trend for either river, with some segments improving in condition class while others have declined.

The time period of 3 – 4 years between surveys is problematic. It is essential that follow up surveys be conducted as soon as possible to determine whether the declines are in fact a true reflection of the status of these rivers or whether the declines are temporary and could for example be a reflection of the 2000 flood, drought or seasonal variation. It is not acceptable that a further 3 – 4 year period be allowed to lapse before the systems are revisited. The trends need to be identified at the earliest opportunity to enable any remedial measures to be implemented.

The long delay in returning to the river has another factor which is equally important to consider and that is the fact that several of our historical sites are no longer

accessible or have been irreparably impacted by the placement of weirs over the interim period. This has serious consequences to the monitoring programme because there will be no continuation of data for these sites. The return period for monitoring is not likely to improve in the short term and we must therefore look at ways in protecting our sites and securing access.

In the instances where weirs were built, no EIAs were done. The weirs were not reported by the region or the developers. Although later discussions with DWAF and DEAT (the lead agent for DWAF projects) were held and concerns raised, the situation cannot be reversed and we have irreparably lost some of our sites. Clearly, had an EIA been done as is required by law, we could have indicated our desire to maintain these sites form monitoring purposes. We could also have adequately addressed the need for fish ladders.

While informal agriculture has for the interim restricted our access to other sites, it should be possible to negotiate access for future surveys. The monitoring team has not yet had problems with access to sites falling on formal agricultural land. Nevertheless, incentives for the protection of our sites could prove a valuable strategy for the long term monitoring programme.

During 2003, DWAF started with a Comprehensive Reserve Determination Study for the Letaba Catchment. It is imperative that reserve flows be finalized and the system managed for the benefit of the ecology.

Despite IFRs being conducted and refined twice in the Luvuvhu (main stem) no reserve determination study has been undertaken for the Luvuvhu River Catchment. This must be considered a high priority now that Nandoni Dam is impounded and the Luvuvhu Bulk Water Supply Scheme is on line. The Luvuvhu is the Provinces least fragmented system and there is still a viable migration route to the sea.

It is recommended that a return survey be conducted no later than 2005.

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