



SUSTAINABLE DEVELOPMENT PROJECTS cc

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PRELIMINARY ECOLOGICAL ASSESSMENT

**THE MOOI RIVER AND ASSOCIATED RIPARIAN AREAS ON THE
FARM 'COLDSTREAM' ABOVE INCHBRAKIE FALLS AND
PROPOSED FISH BARRIER.**

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PRELIMINARY ECOLOGICAL ASSESSMENT OF THE PROPOSED FISH BARRIER ON THE MOOI RIVER ABOVE INCHBRAKIE FALLS AT 'COLDSTREAM'

1. Introduction and Background

With the progression of the Mooi-Mgeni Transfer Scheme and the imminent building of the Spring Grove Dam near Rosetta on the Mooi River, the need has become apparent to prevent the movement of small mouth bass *Micropterus dolomieu* into the upper Mooi River above Inchbrakie Falls. Since the introduction of *M. dolomieu* into the lower section of the river in the 1930's, the Inchbrakie Falls has formed an insurmountable barrier and hence prevented further infestation of this species upstream.

The Mooi River above the falls is inhabited by a self sustaining population of brown trout *Salmo trutta* which were introduced in the 1890's and today support an ever increasing, fly - fishing industry. With the creation of Spring Grove Dam and the inundation of water up to Inchbrakie Falls, the Department of Water Affairs and Forestry (DWAFF) in collaboration with Umgeni Water began investigating the possibility of erecting a fish barrier above Inchbrakie Falls. The aim of the proposed fish barrier is to prevent the spread of *M. dolomieu* to the headwaters, protecting both the brown trout and its associated flyfishing industry.

This assessment has been undertaken as part of the Environmental Scoping Report (ESR) to identify ecological issues on site and to address the potential changes in the ecology of the inundated areas if such a barrier is to be built.

2. Methodology

This task was undertaken to assess the following baseline information associated with the site in question and to provide a basic understanding of the surrounding ecology. Such an understanding of the local ecology is important when considering mitigatory factors, and therefore potentially minimising the risk of serious ecological impacts. Baseline information considered of importance in assessing the site included:

Vegetative assessment – general review of botanical species present on site, including the establishment of two transects: Transect 1. Site 4A drill hole S 29°20'41,2" E 029°53'44,1" to the river bank S 29°20'40,8" E 029°53'44,0" and Transect 2. S 29°20'40,5" E 029°53'41,3" to S 29°20'42,0" E 029°53'41,5". Using such transects, cover (in a 1m² area), species composition and the change in species composition relative to the distance from the river were assessed.

Terrestrial Fauna Assessment - a general review of the vertebrates and invertebrates, which do or could inhabit the site and nearby areas. Sightings, comments from local property owners and a short literature review were used to gather relevant information.

Aquatic Habitat Assessment – a general assessment of the status of the river and its riparian zones with regard to the number of different habitats it affords. This was done by visual assessment using the habitat assessment score sheet provided in Barbour *et al.* (1999) and involved scoring aspects such as bank stability and size of substrate.

Aquatic Fauna Assessment – a general assessment of aquatic invertebrates was done using the South African Scoring System (SASS) protocol (Annexure B) in a smaller channel of the river (S 29°20'40,4" E 029°53'42,7") which was easily accessible and provided a range of different habitats similar to the main channel. A short literature review regarding the ichthyofauna of the upper Mooi River was also done. This focused on the smaller fish species that occur, may occur, or used to occur in the upper Mooi River.

The above mentioned assessments were carried out during a single site visit on the 28th of April 2006. Information provided by Nemaï Consulting included a background information document. Mrs J. Clements provided minutes of the dedicated stakeholders meeting including the slide shows presented.



Fig 1. A view of the site looking up river from an elevated point. The typical view of the proposed development using lines indicate the general area where the barrier is set to be placed. The turquoise arrow indicates the direction of flow.



Fig 2. View of the affected site from the Coldstream house. The red arrow indicates the approximate position of the barrier. The turquoise arrows indicate the direction of inundation. Note the close proximity of the neighbouring impoundment.

3. Nature of Development

The barrier is proposed to be approximately 5m high and a total of 113 m long and is to be built entirely of concrete. The identified site is on Coldstream Farm, approximately 1km upstream of the Inchbrakie Falls. Two sites, 4A and 4B, have been identified on Coldstream, each giving a slightly different result. A completed barrier at site 4A will create an impoundment of 23Ha and is set to inundate the river for 2,60 km upstream of the barrier. The alternate site, 4B will only create an impoundment of 9Ha and is set to inundate the river for 1,7 km.

The section of river expected to be most affected by the barrier is the section of the river that forms a meander above a small series of cascades on the Coldstream property. On the opposite side of the river (north bank) a dam and a pump house border the river. The north bank is generally steep, while the south bank (Coldstream) has a more, gentle gradient, forming a small flood plain, which becomes inundated during periods of high flows. This area has not been subject to extensive grazing for the last 3 years (J Clements *pers. comm.*) creating a wide undisturbed area adjacent to the riparian zone. The riparian zone on the north bank holds a power line servitude and has been reduced (in comparison) by agricultural practices (grazing of cattle, fodder cropping).

This assessment was conducted on the Coldstream portion of the affected site as it is most affected (during construction and inundation), has emerging secondary vegetation with minimal disturbance in the short term and is easily accessible.

4. Nature of Receiving Environment

4.1 Vegetative Assessment

In general, grasses characteristic of both Moist and Dry Highland Sourveld (Camp 1997) were present on the site. These included: *Sporobolus africanus*, *Themeda triandra*, *Cymbopogon excavatus*, *Hyparrhenia hirta*, *Rendlia altera* and *Trachypogon spicatus*.

In both veld types, the presence of *T. triandra* is a characteristic grass of good veld condition (Camp 1997). The presence of other shrub vegetation such as *Rhus pondoensis* and *Rhus rehmanniana* suggests that the veld has not been burned for some time (Camp 1997).

With reference to Table 1, the cover of species varied slightly along transect 1 with no single species dominating. This may be explained by the lack of grazing on site and the equal opportunity afforded to each species of grass. A relatively high diversity can be attributed to this site. The species composition also changed with distance from the river. Most distal from the river, *T. triandra* dominated, while proximal to the river species associated with hygrophyllic environments became more prolific. These included *A. nepalensis*, *A. junciformis* and *H. hirta* (Van Oudtshoorn 1999).

This would suggest that the structure of the grass community on site is controlled by soil composition, and moisture content.

Table 1. Results of transect 1 showing the composition of the veld community at various distances from the river.

Distance from River (m)	Species	Estimated Cover (%)
15	• <i>Sporobolus africanus</i>	20
	• <i>S. fimbriatus</i>	30
	• <i>Tremedia triandra</i>	50
10	• <i>S. fimbriatus</i>	30
	• <i>Cyperus rotundus</i>	5
	• <i>Arundinella nepalensis</i>	10
	• <i>Rendlia altera</i>	45
5	• <i>nepalensis</i>	50
	• <i>Cymbopogon excavatus</i>	50
0-1	• <i>S. africanus</i>	30
	• <i>Aristida junciformis</i>	30
	• <i>Helichrysum odoratissim</i>	20
	• <i>Hyparrhenia hirta</i>	20

The change in species composition along the transect lines was most obvious in transect 2 (Annexure A). On the river banks woody species *Erica woodii*, *Leucosidea sercea*, *Acacia mearnsii* and the hygrophillous grass *Miscanthus capensis* are situated. These are then replaced by sedge beds dominated by *Scirpus ficinoides* (nearest the river) and *Mariscus solidus* (further from the river).

Further more, *S. ficinoides* is a reliable indicator of subsurface water (Pooley 1998).

This portion of the transect is characterised by a number of depressions, which were most likely formed by silt deposition and removal during periods of flooding. As the steep opposite bank continued to be eroded, more alternating ridges and depressions are formed on the convex portion of the near bank, increasing the size of the wetland area.

This wetland system ended abruptly at a small rocky ledge. Above this point *Trachypogon spicatus* becomes abundant and *Helichrysum* species invaded. At more distal points away from the river *Themeda triandra* appears as the climax grass.

Two exotic and noted invasive plants were noted on site, namely Black Wattle *Acacia mearnsii* and American Bramble *Rubus cuneifolius*. *Paspalum dilatatum* was also noted on site and is an introduced grass originating from South America (Van Oudtshoorn 1999). Further upstream of the study site were a number of large *Eucalyptus grandis*. Other plants that were found on site included: Arum lily *Zantedeschia aethiopica* and a *Crinum* species, most likely *C. macowanii*.

4.2 Terrestrial Fauna Assessment

4.2.1 Vertebrata

During the site visit there was little evidence to suggest the presence of resident large mammals and that their use of the site may be a transitory one. Clements did state that serval *Felis serval* (Red Data Book status: Rare) and otter (most likely the Cape Clawless Otter *Aonyx capensis*) were present at the site (J. Clements pers. com.). On the Mennie property Reedbuck *Redunca arundium* were noted. It was also made clear that seasonal sightings of Oribi, *Ourebia ourebi* (Red Data Book status: Vulnerable) also occur on the Mennie property. Reedbuck would more than likely occur on the Coldstream property, making use of the riverside grazing. The presence of Oribi at Coldstream is likely with improved grazing.

From habitat on site, smaller mammals would be fairly prevalent. Common users of the riparian zones may include (Taylor 1998, Apps 2000):

Porcupine	<i>Hystrix africaeaustralis</i>
Scrub Hare	<i>Lepus saxatilis</i>
Natal Red Hare (Natal Red Rock Rabbit)	<i>Pronolagus crassicaudatus</i>
Water Rat	<i>Dasymys incomptus</i>
Vlei Rat	<i>Otomys irroratus</i>
Angoni-vlei rat	<i>O. angoniensis</i>

Natal Multimammate Mouse	<i>Mastomys natalensis</i>
Forest Shrew	<i>Myosorex varius</i>
Greater Musk Shrew (Greater Red Musk Shrew)	<i>Crocidura flavescens</i>
Swamp Musk Shrew	<i>C. mariquensis</i>
Hottentot Golden Mole (Dryer soils)	<i>Amblysomus hottentotus</i>
Brant's Climbing Mouse	<i>Dendromus mesomelas</i>
Chestnut Climbing Mouse	<i>D. mystacalis</i>

4.2.2 Reptilia

No reptiles were seen during the site visit, however this may be due to the cooler autumn temperatures. The habitat available is favourable for smaller lizards of the Gekkonidae (Geckos), Agamidae (Agamas), Scinidae (Skinks) and Amphisbaenadae (Legless lizards) families, which may occur in the area (Irwin et al 1980). A number of snakes may also be present (Irwin et al 1980) including:

Puff Adder	<i>Bitis arietans</i>
Night Adder	<i>Causus rhombeatus</i>
Rinkals	<i>Hemachatus haemachatus</i>
Olive Grass Snake	<i>Psammophis sibilans</i>
Rhombic Skaapsteker	<i>Psammophylax rhombeatus</i>
Reed Snake	<i>Amplorhinus multimaculatus</i>
Red-lipped Herald	<i>Crotrophopeltis hotamboeia</i>
Natal Garter Snake	<i>Elapsoidea sundevallii</i>
Cross-marked Grass Snake	<i>Psammophis crucifer</i>
Brown House Snake	<i>Boaedon fuliginosus</i>
Brown Water Snake	<i>Lycodonormorphus rufulus</i>
Natal Green Snake	<i>Philothamnus natalensis</i>
Spotted Bush Snake	<i>Philothamnus semivariegatus</i>

4.2.3 Aves

Although not formally assessed a number of bird species occur in the area and may utilise the affected area (Irwin et al 1980). These include:

Black-headed Heron
 Cattle Egret
 Bald Ibis (sighting on the Mennie's property)
 Hadedda Ibis
 Yellow-billed Kite
 Jackal Buzzard
 Crowned Guineafowl
 Hamerkop
 Black-shouldered Kite
 Red-wing Francolin
 Giant Kingfisher
 Turtle Dove
 Fork-tailed Drongo

Olive Thrush
 Red-winged Starling
 African Quail
 Malachite Kingfisher
 Fiscal Shrike
 Spotted-backed Weaver
 Red Bishop

4.2.4 Invertebrata

With the onset of winter and cooler temperatures, few terrestrial insects were active. A number of adult damselflies (Order: Odonata, Families: Chlorolestidae and Lestidae) and dragonflies (Order: Odonata, Family: Libellulidae) were active at the water's edge. A number of garden grasshoppers, stick grasshoppers and grass-mimicking grasshoppers (Family: Acrididae) were noted amongst the grasses and sedges. Few butterflies were active, but as the day warmed a few specimens of the Gaudy Commodore *Junonia octavia* were noted. It is expected that during the warmer, wetter months a larger variety of insect species would be present.

4.3 Aquatic Habitat Assessment

According to the criteria given by Barbour et al (1999) the affected stretch of the Mooi River on Coldstream can be considered optimal aquatic habitat. This stretch of the river scored well since it contained all four velocity depth regimes (slow-deep, slow-shallow, fast-deep and fast shallow), there is little or no enlargement of islands or point bars with little of the visible bottom being affected by sediment deposition, no canalisation or dredging was present with a normal stream pattern and the width of the riparian zone on the Coldstream (south) bank was generally greater than 18 meters.

A wide variety of habitats are present within the study site. Growth of aquatic macrophytes is particularly limited due to limited instream sediment availability, but large boulders and bedrock are covered in a rough algal growth, which provides microhabitats for a number of mayfly (Baetidae) and caddis (Hydropsychidae) species. Foliage and roots of bank vegetation penetrate the water, creating additional substrate on which invertebrates can thrive.

Generally, the substrate form is good, with a variation in size and composition evident. In places, worn bed rock, larger boulders, medium sized rocks, pebbles and sand can be found. In slower moving sections the littoral zone is dominated by fine sediments and vegetable matter, but have been stabilised by encroaching bank side vegetation. The stability of both banks through-out the site is good, due to well vegetated banks.

The water clarity was (at the time of the assessment) good with minimal sediment present. Both the water level and clarity do tend to vary from season to season. The lowest flows and clearest water occur during the dry winter, while the highest flows and poor clarity occur during the wet summer. During periods of extreme

precipitation the river breaches the main channel (J. Clements pers. comm.) to inundate a small flood plain (wetland area described in 3.1).



Fig 3. Shallow riffle habitat with deep water both upstream and downstream. Note the encroachment of riparian vegetation

4.4 Aquatic Fauna Assessment

4.4.1 Invertebrates

In total 13 taxa were found (Table 2) with a total SASS score of 84 and an Average Score Per Taxon (ASPT) of 6.5

Table 2: Summary of SASS sample.

Class	Order	Family	SASS
Turbellaria	-	-	3
Insecta	Ephemeroptera	Baetidae (>2sp)	12
		Leptophlebiidae	9
	Odonata	Chlorolestidae	8
		Lestidae	8
		Aeshnidae	8
	Hemiptera	Corixidae	3
		Notonectidae	3
		Pleidae	4
	Trichoptera	Hydropsychidae (2sp)	6
		Philopotamidae	10
	Coleoptera	Dytiscidae	5
Diptera	Tipulidae	5	
Total			84
No. of Taxa			13
ASPT			6.5

Although not present in this rapid sampling a number of other invertebrates are expected to be present in the system and include:

Crustacea (freshwater crabs and Amphipoda);
 Leeches;
 Caenidae, Heptageniidae, Tricorythidae (Ephemeroptera);
 Libellulidae, Coenagrionidae (Odonata);
 Gerridae, Nepidae (Hemiptera);
 Hydroptilidae, Leptoceridae (Trichoptera);
 Gyrinidae (Coleoptera);
 Chironomidae, Simuliidae (Diptera) and
 Snails (Gastropoda).

Many of the taxa found were not air breathers (exceptions were all Hemiptera) indicating that the water quality is good. The abundance of individuals was also high with between 10 and 100 Baetidae and Hydropsychidae being present in the sample.

4.4.2 Pisces

It is already clear that the exotic brown trout *Salmo trutta* inhabit the upper Mooi River. Since their introduction they have become the dominant pisceans, much to the detriment of the smaller indigenous species. According to the distribution maps given by Skelton (1993) a number of indigenous cyprinids, namely *Barbus anoplus*, *Labeobarbus natalensis*, *Labeo rubromaculatus* and *Labeo molybdinus* occur in the system. The latter three are strong swimmers and known to migrate up river after summer rains to spawn. For this reason, it is possible that they could perhaps move above the falls, or may have already been above the falls prior to its formation. These fish species are also vulnerable to ousting by smallmouth bass.

An example of the vanishing indigenous fish species (that may still occur in the upper Mooi River) is the Natal mountain catfish *Amphilius natalensis*. This small catfish

used to be abundant in all inland streams and rivers of Natal, but has been heavily preyed upon by trout and is now scarce in certain streams.



Fig 4. The secondary stream where the SASS sample was taken (S 29°20'40.4" E 029°53'42.7")

4.4.3 Amphibia

The banks' side vegetation and presence of slower pools supported a good population of Common River Frog *Afrana angolensis*. A number of other anuran species may also inhabit the area, namely the Common Platanna *Xenopus laevis*, Striped Stream Frog *Strongylopus fasciatus*, Drakensberg River Frog *Afrana dracomontana*, Raucous Toad *Bufo rangeri* and Guttural Toad *Bufo gutturalis*. These are common species throughout the region (Carruthers 2001) and are unlikely to be seriously affected by the barrier.

According to Carruthers (2001) and Irwin (1980) smaller less conspicuous species occurring in the general area include:

Natal Chirping Frog	<i>Arthroleptella hewitti</i>
Bushveld Rain Frog	<i>Breviceps adspersus</i>
Common Caco	<i>Cacosternum boettgeri</i>
Natal Ghost Frog	<i>Heleophryne natalensis</i>
Bubbling Cassina	<i>Kassina senegalensis</i>
Snoring Puddle Frog	<i>Phrynobatrachus natalensis</i>
Clicking Stream Frog	<i>Strongylopus grayii</i>

5. Ecological Issues

Generally, any form of weir or barrier that creates an artificial impoundment on a river affects the existing ecology negatively. The inundation of the area upstream of the barrier will cause the loss of an established section of the riparian zone and wetland habitats. A number of species (including some amphibians and small mammals) will be forced to move either up river or down river to find suitable habitat while the new riparian zones created by the impoundment mature. The creation of a large slow flowing area will encourage the deposition of silt, reducing the diversity of aquatic habitats throughout the impoundment. Hydraulic movement, as a result of floods, will be unable to remove the silt or sunken organic debris trapped in this impoundment, potentially creating an anoxic layer during times of low flow. All invertebrate species associated with riffle and moving water habitats will be ousted and thus forced to move to new parts of the river where more suitable habitat exists. Refugia will be disturbed, thus predation of species will also change accordingly (ie otter on crabs and fish).

The impoundment created will also place an element of control upon flood waters, reducing the amount of freshwater that can penetrate downstream particularly during low flow periods. This may reduce the presence of spawning cues for migratory fish. Even if sufficient cues are available, any migratory indigenous fish species present within the proposed Spring Grove impoundment may not be able to pass over the barrier, preventing them from reaching spawning habitat.

6. Conclusion and Recommendations

Given the above information, it is evident that the construction of a fish barrier will:

1. Alter localised aquatic habitat and concomitant species diversity.
2. Alter terrestrial synusia and thus habitat either side of the riparian area, with concomitant impacts found above the high water level of the dam/barrier.
3. Benefits of the barrier are however to be noted through the possible prevention of the invasion of upstream habitats by smallmouth bass and thus preventing the ousting of indigenous fish species by such an invasion.

In addition it is notable that confirmation of the presence of smallmouth in the upper reaches of the river is needed. One should **not** look at this as protecting the trout from the smallmouth bass, but rather protecting what indigenous fish still survive in the upper Mooi from the more destructive introduced predator. Should the barrier be constructed, then monitoring of species diversity in the upper and lower reaches of the river should be instituted.

7. References

- Apps P. (Ed.) (2000) – *Smithers' Mammals Of Southern Africa, A Field Guide*. Struik Publishers, Cape Town. 364 pp
- Barbour M.T., J. Gerritsen, B.D. Snyder and J.B. Stribbling (1999) – *Rapid Bioassessment Protocols For use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish*. Second Edition. EPA 841-B-99-002. US Environmental Protection Agency, Office of Water, Washington DC.
- Camp K. G. (1997) – *The Bioresource Groups of KwaZulu-Natal*. Condensed report. Cedara Report No. **N/A/97/6**. 84 pp
- Carruthers V. (2001) – *Frogs and Frogging in Southern Africa*. Struik Publishers, Cape Town. 100 pp
- Irwin P., J. Akhurst and D. Irwin (1980) – *A Field Guide to the Natal Drakensberg*. Wildlife Society of Southern Africa. 249 pp
- Pooley E. (1998) – *A Field Guide to Wild Flowers: KwaZulu-Natal and the Eastern Region*. First Edition. Natal Flora Publications Trust, Durban. 630 pp
- Skelton P. H. (1993) – *A Complete Guide to the Freshwater Fishes of Southern Africa*. Southern Book Publishers (Pty) Ltd. 388 pp
- Taylor P. (1998) – *The Smaller Mammals of KwaZulu-Natal*. University of Natal Press, Pietermaritzburg. 141 pp
- Van Oudtshoorn F. (1999) – *Guide to Grasses of Southern Africa*. First Edition. Briza Publications, Pretoria. 288 pp

Non Cited References

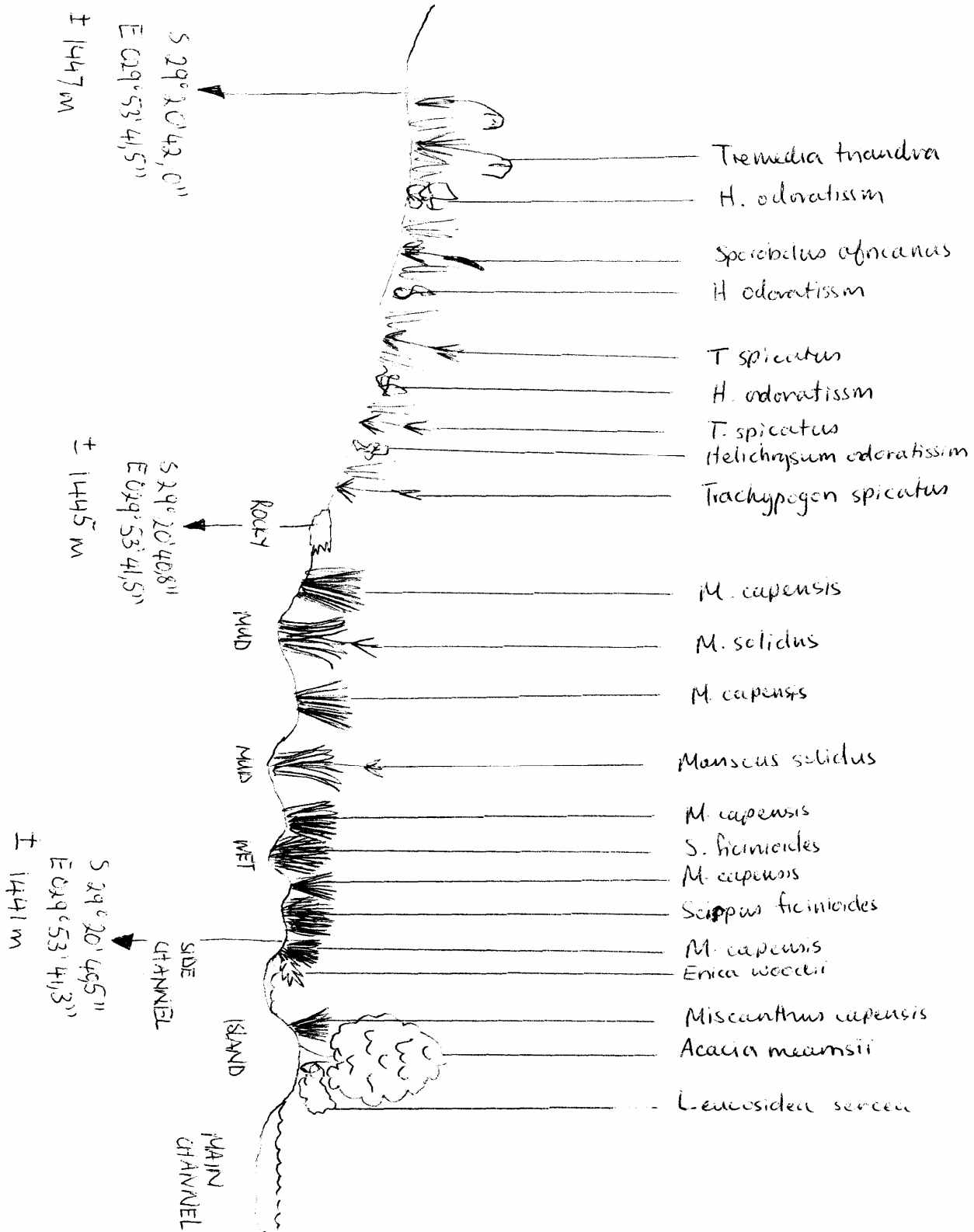
- Picker M., C. Griffiths and A. Weaving (2003) – *Field Guide to Insects of Southern Africa*. Struik Publishers, Cape Town. 444 pp
- Pooley E. (1994) – *The Complete Field Guide to Trees of Natal, Zululand and Transkei*. Second Edition. Natal Flora Publications Trust, Durban. 512 pp

Personal Communications

Mrs Judy Clements – 28 April 2006

Transect 2

This is a hand drawn figure indicating change within the plant community with increasing distance from the river.



Annexure B

SASS Version 5 Protocol (as per Dickens and Graham (2002))

Using a fine meshed net of approximately 30cm by 30cm the following biotopes are sampled:

Biotope	Procedure
Stones-in-current (SIC) (includes bedrock)	Disturb (kick) stones and sweep up biota into net for 2 minutes. Effort must not exceed 5 minutes.
Stones-out-of-current (SOOC) (includes bedrock)	Kick and sweep for approx. 1min with net.
Marginal vegetation (IC and OOC)	Sweep net through vegetation for distance of 2 metres.
Aquatic Vegetation	Sweep area of 1m ² .
Gravel/Sand/Mud (GSM)	Stir up substrate and flush biota into net for 1 minute.

Samples are then sorted and identified on site. This process should be kept to 15 minutes and stopped if no new taxa are found after 5 minutes. Results are then entered into a SASS score sheet and quantified. If necessary, specimens that need further identification are preserved temporarily. Abundances are estimated using the following system:

No of individuals	Symbol
1	1
2-10	A
10-100	B
100-1000	C
>1000	D

Analysis

In this instance the protocol was used to give an idea of aquatic invertebrate diversity present. An analysis of water quality using these results was not undertaken.