6. IMPACT ASSESSMENT SCOPE AND GENERAL MITIGATION

6.1 SCOPE OF IMPACT ASESSMENT

This Chapter presents the findings of the environmental impact assessment for the dams and associated activities (DEA Ref no. 14/12/16/3/3/2/677).

The activities assessed under this chapter are listed below:

- The Ntabelanga and Lalini Dams;
- Five flow gauging weirs;
- Primary and secondary bulk potable water infrastructure:
  - Primary infrastructure: main water treatment works, including four major treated water pumping stations and three minor treated water pumping stations, main bulk treated water rising mains, and eight Command Reservoirs that will supply the whole region;
  - Secondary distribution lines: conveying bulk treated water from Command Reservoirs to existing and new District Reservoirs;
- Bulk raw water conveyance infrastructure (abstraction, pipelines, one raw water pumping station, one reservoir and two booster pumps) for irrigated agriculture (raw water supply up to field edge);
- Impact of commercial agriculture in earmarked irrigation areas;
- WWTWs at the Ntabelanga and Lalini Dam sites;
- Accommodation for operational staff at the Ntabelanga and Lalini Dam sites;
- Ten construction materials quarries and borrow pits;
- River intake structures and associated works;
- Information centres at the two dam sites; and
- Miscellaneous construction camps, lay down areas, and storage sites.

6.2 GENERAL MANAGEMENT AND GOOD HOUSEKEEPING PRACTICES

Latent and general everyday impacts which may impact on the aquatic ecosystem will include any activities which take place within the Lalini and Ntabelanga study areas that may impact on the receiving environment. These impacts are highlighted below and are relevant for all sensitive aquatic related areas identified in this report.

- No areas falling outside of the study area may be cleared for construction purposes;
- Ensure that operational related activities are kept strictly within the development footprint;
- Do not allow dumping of refuse within the surrounding environment;
- The boundaries of the development footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- The proposed development footprint areas should remain as small as possible;
- Edge effects of all construction activities, such as erosion and riparian zone alien plant species proliferation, which may affect aquatic habitat within surrounding areas, need to be strictly managed in all areas of increased ecological sensitivity;
- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced to prevent the ingress of hydrocarbons into the topsoil, as this may end up in the aquatic systems due to run-off;
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities;
- No trapping or hunting of fauna is to take place;
- All informal fires in the vicinity of construction areas should be prohibited to prevent impacts on the riparian vegetation and stream substrate;
- Throughout the life of the operation and prior to construction aquatic biomonitoring should take place to develop a set of baseline data and monitor aquatic ecological trends in the receiving environment at strategic points upstream and downstream of the impoundments, weirs and crossings;
- The WWTW must be well managed and strict monitoring and control of effluent discharge must take place to ensure that the impact on the receiving environment is minimised;
- Aquaculture would be a viable option in the impoundments. This is especially true since the segment of the river is not sensitive from a fish ecology point of view. The Ntabelanga Dam may be suitable for aquaculture with trout as the water in the dam may be cool enough to support the fish at this point in the system. Both the Ntabelanga dam and the Lalini dam can potentially be used for aquaculture of Tilapia (*Oreochromis mossamicus*) and/or catfish (*Clarias gariepinus*). Tilapia have more commercial value but both can definitely contribute to the production of protein in the area, which is generally lacking in protein production.

7. IMPACT ASSESSMENT FOR DAMS AND ASSOCIATED WATER INFRASTRUCTURE

This Chapter presents the findings of the environmental impact assessment for the dams and associated activities (DEA Ref no. 14/12/16/3/3/2/677).

The activities assessed under this chapter are listed below:

- The Ntabelanga and Lalini Dams;
- Five flow gauging weirs;
- Primary and secondary bulk potable water infrastructure:
  - Primary infrastructure: main water treatment works, including four major treated water pumping stations and three minor treated water pumping stations, main bulk treated water rising mains, and eight Command Reservoirs that will supply the whole region;
  - Secondary distribution lines: conveying bulk treated water from Command Reservoirs to existing and new District Reservoirs;
- Bulk raw water conveyance infrastructure (abstraction, pipelines, one raw water pumping station, one reservoir and two booster pumps) for irrigated agriculture (raw water supply up to field edge);
- Impact of commercial agriculture in earmarked irrigation areas;
- WWTWs at the Ntabelanga and Lalini Dam sites;
- Accommodation for operational staff at the Ntabelanga and Lalini Dam sites;
- Ten construction materials quarries and borrow pits;
- River intake structures and associated works;
- Information centres at the two dam sites; and
- Miscellaneous construction camps, lay down areas, and storage sites.

7.1 CONSTRUCTION AND FIRST FILL PHASES

7.1.1 Loss of aquatic habitat

Habitat destruction is the alteration of a natural habitat to the point that it is rendered unfit to support the species dependent upon it as their home territory. Many organisms previously using the area are displaced or destroyed, reducing biodiversity. Globally modification of habitats for agriculture is the chief cause of such habitat loss. Other causes of habitat destruction include surface mining, deforestation, slash and burn practices and urban development. Habitat destruction is presently ranked as the most significant cause of species extinction worldwide. Additional causes of habitat destruction include water pollution, introduction of alien species, overgrazing and overfishing. Riverine systems and particularly larger riverine systems or river systems that have sites suitable for impoundment are particularly susceptible to changes in habitat condition due to the need to impound drainage systems to supply water to communities, agriculture and industry.

The proposed dam construction project has significant potential to lead to habitat loss and/or alteration of the aquatic and riparian resources on the study area. Dam wall construction activities itself will be disruptive to current habitat conditions in the Tsitsa River within the dam wall footprint area and associated adjacent laydown areas. Construction activities also generally result in destruction of bank cover, generation of loose soil and other debris that may result in silting and sedimentation of downstream habitat. Apart from dam wall construction, construction of flow gauging weirs, bulk potable water infrastructure (pumping stations, reservoirs, treatment works and distribution lines) and bulk raw water conveyance infrastructure (pipelines, pumping station and reservoir) quarries and borrow pits, accommodation infrastructure and infrastructure will potentially have the same effect on the aquatic resources of the region albeit on a much smaller local scale. The macro-invertebrates community of the Tsitsa River relies on clear water and a stream substrate that is clear of fine silt and sediment. Close monitoring of erosion patterns downstream of the construction area is deemed essential and any areas which are showing erosion to be occurring should immediately be rehabilitated through resloping, stabilisation and revegetation techniques as part of the catchment management plan.

In addition inundation of upstream habitat as the dam fills will result in severe habitat changes, pertaining to the water column depth habitat as well as availability of riffle and rapid habitats upstream of the dam on a local scale. The impounding of the dam will thus lead to a significant loss of habitats comprising of flowing water over rock substrate which is significant for many aquatic macro-invertebrate taxa in the system. In addition less desirable species of fish such as *Micropterus salmoides* and *Cyprinus carpio* will become dominant in the system to the detriment of the endemic ecology of the region. Impacts due to sedimentation can be significant and have the potential to affect the biodiversity and functioning of the system. The still water in the newly created impoundment will allow sediment to settle and will smother the rocky substrate in the stream leading to a loss of rocky habitat types.

Loss of aquatic habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Site (1)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
Please note that reference to the respective projects also considers impact from associated activities, including gauging weirs, bulk potable water infrastructure, bulk raw water conveyance infrastructure, irrigation and agriculture, WWTWs, accommodation infrastructure, quarries and pits, river intake structures and associated works, information centres and miscellaneous activities like constructions camps, lay down areas and storage sites.							
Cumulative Impact – Construction of the dam wall may result in destruction of bank cover and site-specific habitat types. First filling will result in inundation resulting in a variety of habitat types over a large area being permanently lost. The larger the dam the greater the area affected by inundation, shifting impact from site specific to local relevance with specific mention of the management of instream flows.							

Recommended mitigation

- The construction of the dams will lead to reduced stream flow and hence loss of fast shallow riffle habitat and glide habitat. This impact is considered to be of high significance in the construction phase and even with mitigation the impact remains relatively unchanged. It is however deemed important that during construction the maintenance of base flows in the system is maintained at all times and that the duration of impacts on flows is limited to as short a period as possible.
- Ensure that all stockpiles are well managed and have measures such as berms and hessian sheets implemented to prevent erosion and sedimentation;
- Through ensuring that good construction practice is followed in terms of the clearing of areas, such as the use of water control berms and clearing footprint areas that are as small as possible, the severity of the impact can be reduced;
- Ongoing aquatic biomonitoring on a minimum of a quarterly basis must take place from six (6) months prior to construction till one (1) year after construction to determine trends in ecology and define any impacts requiring mitigation.

7.1.2 Impact on flow dependant species

The damming of drainage areas that occur upstream of the proposed dam walls will lead to a loss of flow and an altered instream flow regime in the Tsitsa River system further downstream. It is notable that the aquatic macro-invertebrate community of the Tsitsa River system are reliant on good flow of water over the rocky stream substrate and the area downstream of the Lalini Dam, due to the remote nature of the gorge has an intact biodiversity. Impacts on instream flow can be significant and has the potential to affect the biodiversity and functioning of the system. Apart from the dam wall itself resulting in local to regional impact, gauging weirs will also have a smaller, local impact in terms of flow, habitat alteration and risk of erosion and sedimentation. With the varying hydro-electric energy generation options, there are varying levels of impact significance on the receiving aquatic environment with the degree of impact varying based on the extent of river in which a significant portion of the instream flow will be lost. All the proposed options are considered to have a borderline high to very high level of impact prior to mitigation while with mitigation, with specific mention of adhering to the Environmental Water Requirement releases the overall significance of the impacts can be reduced to high level impacts.

Recommended mitigation

- It must be ensured that downstream of both the Ntabelanga dam as well as Lalini Dam that the flows as defined in the EWR are maintained at all times to support the flow sensitive aquatic macro-invertebrate community in this system;
- Impact on flow-dependent species is considered to be of high to very high importance in the construction phase and even with mitigation the impact remains relatively unchanged;

- During construction the maintenance of base flows in the system must be maintained at all times and the duration of impacts on flows should be limited to as short a period as possible.

Impact on flow dependant species	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
Proposed Project with Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
Proposed Project with Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
Proposed Project with Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
Please note that reference to the respective projects also considers impact from associated activities, including gauging weirs, bulk potable water infrastructure, bulk raw water conveyance infrastructure, irrigation and agriculture, WWTWs, accommodation infrastructure, quarries and pits, river intake structures and associated works, information centres and miscellaneous activities like constructions camps, lay down areas and storage sites.							
Cumulative Impact – Construction of the dam wall will restrict downstream flow to baseline as required by legislation. This will result in reduced downstream flow, particularly in terms of seasonal flow variation, that will affect flow-sensitive macro-invertebrate community composition and also possibly eel migration negatively. Upstream of the development inundation will also reduce flow and negatively affect flow-sensitive species.							

7.1.3 Loss of aquatic biodiversity

The Tsitsa River is regarded as being of very high importance for migration of eels although the significance of eel migration is considered limited. The system may also provide some migratory connectivity for smaller faunal species including avifauna. In addition to impacts on migration impacts on habitat and instream flow are likely to lead to impacts on biodiversity with the loss of taxa which are sensitive to habitat changes as well changes/reductions in flow.

In particular, the impact on the aquatic macro-invertebrate community which relies on rocky substrate in fast flowing clear water will be significantly impacted by the proposed development.

Loss of aquatic biodiversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
Proposed Project with Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
Proposed Project with Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
Proposed Project with Lalini Dam size 3 (alterative) and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	Definite (5)	High	High
Please note that reference to the respective projects also considers impact from associated activities, including gauging weirs, bulk potable water infrastructure, bulk raw water conveyance infrastructure, irrigation and agriculture, WWTWs, accommodation infrastructure, quarries and pits, river intake structures and associated works, information centres and miscellaneous activities like constructions camps, lay down areas and storage sites.							
Cumulative Impact – Construction of the dam wall will negatively affect biodiversity in the immediate site vicinity because of direct impacts resulting from habitat destruction and flow disruption. Inundation upstream will result in further habitat destruction and with associated downstream base flow restriction, impact extent will be local.							

The movement of instream taxa, with special mention of eels, will be severely affected by the proposed dam, including local effects from gauging weirs. Impacts on migratory movements are likely to occur during the construction and operational phase of the proposed development. In the long term this may negatively affect populations upstream of the dams and may result in loss of this species in certain sections.

In addition loss of habitat and alteration of flow rate discussed previously will also negatively affect the diversity of the macro-invertebrate community within the system on a local scale. Even with mitigation the impact on aquatic ecology is considered high.

Recommended mitigation

- Even with attempted mitigation, impact will remain high;
- During construction the maintenance of base flows in the system must be maintained at all times and the duration of impacts on flows should be limited to as short a period as possible;
- Ongoing aquatic biomonitoring on a minimum of a quarterly basis must take place from six (6) months prior to construction till one (1) year after construction to determine trends in ecology and define any impacts requiring mitigation.

7.1.4 Impact on species with conservation concern

The proposed infrastructures, with special mention of the proposed dam and to a lesser extent gauging weirs, will lead to the formation of an migratory barrier for fish species and in particular eels, as mentioned in the previous section. The area is known to harbour endemic mayflies (Kleynhans 1999). With the location of the two dams situated between two waterfalls and hence geographically isolated, the area is likely to contain several macro-invertebrate species of conservation concern. Both prior to and after mitigation this impact is considered to be high to moderately high. Through minimising the time in which stream flow, water quality and habitat is affected during the construction phase of the project this impact can, however, be mitigated to a limited degree. The “construction phase” does not only refer to dam wall construction, but also all related activities and in particular the gauging weirs.

Recommended mitigation

- Even with attempted mitigation impact will remain high, as first filling causing upstream inundation and alteration of flow rate downstream cannot be mitigated to any great extent.
- During construction the maintenance of base flows in the system must be maintained at all times and the duration of impacts on flows should be limited to as short a period as possible.

Loss of aquatic biodiversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	High(4)	High	Medium-High
Proposed Project with Lalini Dam size 1 (preferred) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	High(4)	High	Medium-High
Proposed Project with Lalini Dam size 2 (alternative) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	High(4)	High	Medium-High
Proposed Project with Lalini Dam size 3 (alternative) and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – no mitigation (5)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	High (5)	High(4)	High	Medium-High
Please note that reference to the respective projects also considers impact from associated activities, including gauging weirs, bulk potable water infrastructure, bulk raw water conveyance infrastructure, irrigation and agriculture, WWTWs, accommodation infrastructure, quarries and pits, river intake structures and associated works, information centres and miscellaneous activities like constructions camps, lay down areas and storage sites.							
Cumulative Impact – Two taxa of concern are local mayflies species (Order Ephemeroptera) and to a lesser extend eels. Construction of the dam wall will have limited direct negative effects but changes resulting from initial filling will result in more substantial negative effects. This will pertain to destruction of habitat limiting habitat suitable to mayfly inhabitation as well as creating barriers to eel migration.							

7.2 OPERATION PHASE

In terms of aquatic ecology impact, the three different size options for the proposed Lalini Dam will only have geographical relevance on a site to local scale. In other words, the larger the dam the more likely impact will move towards local as opposed to site relevance, especially with reference to construction and first fill events.

However, during operation the impact will remain local for all dam size alternatives. Dam size differences will also have no effect on the duration or intensity impacts associated with the operation.

However, flow regime to be employed during the operation phase of both Lalini and Ntabelanga Dams will have greater relevance in terms of impact. As a result, for the purpose of discussing operation phase impact, dam size options in tables to follow have been replaced with the following three flow regime options: base generation only and peak generation. Base generation is assumed to be based on regulating generation and flow in the tunnel to meet the EWR. The latter is the preferred alternative. As with assessment of the first filling and construction phase, all activities related to the respective dam projects were considered in both the discussions and the tabulated impacts assessments that follow.

Under peak hourly operation there are up to six peak hours per day split between the morning and evening peak consumption periods, namely breakfast and evening meal times. Peaking months would be May to October inclusive, when the plant is being run on a semi-peaking mode with an installed capacity of 37.5 MW or 50 MW. Due to the perceived highly significant impact, due to flow variations induced in the system, peak generation is not considered appropriate to this project.

7.2.1 Loss of aquatic habitat

Loss of upstream riverine aquatic habitat resulting from inundation during filling will be permanent. Disruption of habitat downstream from the proposed Dam site will vary largely depending on flow rates. The most significant impact on habitat will be within the impoundments where permanent loss of all riverine habitat below the full supply level will occur permanently. The impact on the areas downstream of the impoundments will be less affected with the degree of impact determined by the degree to which the instream flow requirements downstream of the dams are met as well as the way in which hydroelectric energy generation takes place and in particular base and peak energy generation options.

The section directly below the dam wall up to the dam discharge point will only experience controlled base flow conditions at most times that would lead to impairment of the waterfall habitat as well as loss of seasonal natural flow fluctuation events that will affect availability of especially riffle and rapid habitats. Base generation flow only will affect the section after

the discharge point by potentially leading to reduced instream flows but more likely elevated instream flows in relation to the natural discharge which would occur under natural conditions. This is particularly evident in the winter months when the release from the hydro tunnel will be higher than natural flows in the winter months. Peak flow will result in daily changes in habitat availability. Ill managed base and peak generation are considered likely to impact on the system highly. Well managed base generation based on available water and based on the simulation of natural stream discharge patterns, as defined by the EWR is considered the most suitable option for the proposed development.

Loss of aquatic habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-high
Proposed Project with Lalini Dam Base generation only and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-high
Proposed Project with Lalini Dam Peak time generation and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-high
Proposed Project with Lalini Dam Variable base generation and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	High (4)	High (5)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-high
Please note that reference to the respective projects also considers impact from associated activities, including gauging weirs, WWTWs, accommodation infrastructure, river intake structures and associated works and information centres.							
Cumulative Impact and Comments – Base generation will preclude natural seasonal variation in flow to some degree, which may include scouring of the system to maintain riffle and rapid habitats and alter breeding ques. Absence of such events will lead to long-term loss of certain habitat types and the associated aquatic biota. Peak flow will result in daily variations in habitat availability. Seasonal peak flow will restrict such variations to one season (winter) only. Mitigation measures with reference to individual peak flow regimes are not possible, with mitigation effect value of each option to be evaluated individually as part of the EWR assessment.							

Recommended mitigation

- Loss of habitat will impact on a regional scale with the duration permanent however impacts downstream of the impoundments can be mitigated through management of the flow regime to simulate natural discharge patterns throughout the year. The intensity of impact is considered high, with loss of resources and a definite probability of occurrence in all instances. Maintenance of base flow is to be maintained and energy generation should take place by means of well managed base generation based on available water and based on the simulation of natural stream discharge patterns, as defined by the EWR.

7.2.2 Impact on flow dependant species

Abstraction for agricultural and other purposes from Ntabelanga Dam, will negatively affect the amount of water for release and hence flow in the river section between the Ntabelanga and Tsitsa Dams. Even with the base- and peak flow regimes in operation at Lalini Dam, the river section between the dam wall and entry point of the discharge pipe will experience controlled base flows at most times which may affect some more sensitive taxa. As discussed in the section above there will be an impact on the aquatic community downstream of the dam due to the impacts altered streamflow regimes.

Impact on flow dependant species	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	Medium (3)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Proposed Project with Lalini Dam Base flow only and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	Medium (3)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Proposed Project with Lalini Dam Peak time generation and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	Medium (3)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Proposed Project with Lalini Dam Variable base generation and associated infrastructure							
Without Mitigation	Regional (3)	Permanent – with mitigation (4)	High (4)	Medium (3)	Definite (5)	High	High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Please note that reference to the respective projects also considers impact from associated activities, including gauging weirs, WWTWs, accommodation infrastructure, river intake structures and associated works and information centres.							
Cumulative Impact and Comments – Base energy generation only will alter natural variation in flow. Peak energy generation is not considered appropriate for this system. The Lalini Dam section below the dam wall up to where the discharge pipe enters will experience constant significantly altered flow regimes. This will result in permanent changes in flow in this river segment as well seasonal variation in flow. Upstream, flow will be permanently disrupted due to inundation. It is essential that the Ntabelanga and Lalini dams be managed conjunctively to ensure that EWR's are met and natural discharge patterns are accurately simulated.							

With an altered flow regime the river system, this section may be subjected to excessive vegetation growth or silting over the long term which will negatively affect flow-dependant species. Daily peak energy generation will lead to drastic daily fluctuations in flow rate that will also negatively affect flow-sensitive species and a change in the natural aquatic macro-invertebrate community structure is deemed highly likely. For this reason peak generation is not deemed appropriate. If base generation is employed base generation where flows through the entire system are not well managed will impact on natural discharge patterns through the year leading to constant high flows which will impact significantly on the system and is not deemed appropriate. Well managed base generation based on available water and based on the simulation of natural stream discharge patterns, as defined by the EWR is considered to have a significantly lower impact.

Recommended mitigation:

- The impact on the aquatic community structures within the full supply level will be very significant with drastic changes to the aquatic community structure in these areas with more sensitive taxa no longer occurring and less desirable species of fish becoming dominant in the system;
- The impact on stream flow during the operational phase of the project is high if no mitigatory measures are implemented;
- If mitigation takes place through ensuring that some release of water takes place throughout the life of the operation to recharge the downstream riverine and wetland resources and to ensure that base flows are maintained at all times, the severity of the impact can be reduced. However, the impact is still regarded as being a medium-high level impact.
- Well managed base generation based on available water and based on the simulation of natural stream discharge patterns, as defined by the EWR is deemed the most appropriate regime for the system.

7.2.3 Loss of aquatic biodiversity

The proposed dam walls will lead to the formation of migratory barrier and the movement of instream taxa, with special mention of eels, will be severely and permanently affected. No mitigation for eel migration is possible. As for the construction phase, permanent alteration of natural flow rates and habitat will negative affect aquatic biodiversity with specific reference to macro-invertebrates and riparian vegetation.

Loss of aquatic biodiversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Proposed Project with Lalini Dam Base generation only and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Proposed Project with Lalini Dam Peak time generation and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Proposed Project with Lalini Dam Base generation in summer and Peak generation in winter and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with no mitigation (5)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
Please note that reference to the respective projects also considers impact from associated activities, including gauging weirs, WWTWs, accommodation infrastructure, river intake structures and associated works and information centres.							
Cumulative Impact and Comments – Both changes in habitat modification as well as flow regime will be permanent. Mitigation measures, either in terms of base flow or variation in flow when employing a peak generation, will result in constant impact that would preclude species sensitive to either habitat or flow suitability. Decrease in biodiversity is deemed unavoidable.							

Recommended mitigation:

- Even with attempted mitigation, impact will remain moderately high.
- The defined instream flow requirements must be adhered to at all times.
- Well managed base generation based on available water and based on the simulation of natural stream discharge patterns, as defined by the EWR is deemed the most appropriate regime for the system.

7.2.4 Impact on species with conservation concern

As described for the construction phase, impact pertains to eel migration and presence of endemic mayflies. With the two dams situated between two waterfalls and hence geographically isolated, the area is likely to contain several macro-invertebrate species of conservation concern. The impact associated with the operational phase will be permanent and the only mitigation measures applicable pertaining to flow regime.

Impact on species with conservation concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	Medium (3)	High	Medium-Low
Proposed Project with Lalini Dam Base generation only and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	Medium (3)	High	Medium-Low
Proposed Project with Lalini Dam Peak time generation and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	Medium (3)	High	Medium-Low
Proposed Project with Lalini Dam Base generation in summer and Peak generation in winter and associated infrastructure							
Without Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	High (4)	High	Medium-High
With Mitigation	Local (2)	Permanent – with mitigation (4)	Medium (3)	Medium (3)	Medium (3)	High	Medium-Low
Please note that reference to the respective projects also considers impact from associated activities, including gauging weirs, WWTWs, accommodation infrastructure, river intake structures and associated works and information centres.							

Recommended mitigation:

- The instream flow requirements defined for the system must be maintained at all times.
- Well managed base generation based on available water and based on the simulation of natural stream discharge patterns, as defined by the EWR is deemed the most appropriate regime for the system.

8. IMPACT ASSESSMENT FOR ELECTRICITY GENERATION AND DISTRIBUTION INFRASTRUCTURE

This Chapter presents the findings of the environmental impact assessment for the electricity generation and distribution related activities (DEA Ref no. 14/12/16/3/3/2/678).

The activities assessed under this chapter are listed below:

- Pipeline and tunnel (including tunnel alternatives) at the proposed Lalini Dam leading to the Tsitsa River in the gorge downstream;
- Generation of hydro power and feeding of this power into the existing grid; and
- 18.5km power line from the Lalini Dam tunnel;
- In this section less focus was given instream impacts associated with instream flow and the releases from the hydro-electricity generation as these have already been dealt with as part of the discussions on the dam construction and will also be dealt with in detail as part of the Environmental Water Requirements studies and determinations.

8.1 CONSTRUCTION PHASE

8.1.1 Loss of aquatic habitat

Impacts due to canalisation and erosion will potentially be caused due to the disturbance of soils, during site clearing and construction, and the alteration of flow regimes in the Tsitsa River. Water released from the Lalini Dam during hydroelectric generation, if not correctly designed can also lead to erosion and canalisation of the system as well as changes to habitat downstream of the release point. This impact can be significant and has the potential to affect the hydrological functioning and biodiversity of riverine and wetland systems. However, if mitigated the impact can be restricted to construction sites and a short distance downstream and is considered low.

Recommended mitigation

- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of clean water runoff areas and the concomitant recharge of streams in the area;
- Ensure that all stockpiles are well managed and have measures such as berms and hessian sheets implemented to prevent erosion and sedimentation;
- Through ensuring that good construction practice is followed in terms of the clearing of areas, such as the use of water control berms and clearing footprint areas that are as small as possible, the severity of the impact can be reduced.
- During construction the maintenance of base flows in the system must be maintained at all times and the duration of impacts on flows should be limited to as short a period as possible.

Loss of aquatic habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (3)	High (4)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 1 (near falls) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 2 (medium range) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Low
Please note that reference to the respective hydroelectric generation projects also considers impact from associated power lines and the Lalini Dam tunnel.							
Residual Impact and Comments– Construction of the development will have temporary impact that could be mitigated to some extent.							

8.1.2 Impact on flow dependant species

Impacts on flow will mostly pertain to general construction activities and baseline flow as effected through the Lalini Dam tunnel. These effects have been discussed with reference to dam impact. Construction of the electricity generation and distribution phases will have lower impact compared to that associated with the dams due to the smaller scale of both activity and potential impact.

Impact of flow dependant species	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Please note that reference to the respective hydroelectric generation projects also considers impact from associated power lines and the Lalini Dam tunnel.							
Residual Impact and Comments– Construction of the development will have temporary impact that could be mitigated to some extent.							

Recommended mitigation

- Limit the footprint area of the construction activity to what is absolutely essential;
- During construction the maintenance of base flows in the system must be maintained at all times and the duration of impacts on flows should be limited to as short a period as possible.

8.1.3 Loss of aquatic biodiversity

Impacts on diversity will mostly pertain to habitat alteration and flow alteration as effected through the Lalini Dam tunnel. These effects have been discussed with reference to dam impact. Construction of the electricity generation and distribution phases will have lower impact compared to that associated with the dams due to the smaller scale of both activity and potential impact.

Loss of aquatic biodiversity	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
Please note that reference to the respective hydroelectric generation projects also considers impact from associated power lines and the Lalini Dam tunnel.							
Residual Impact and Comments– Construction of the development will have temporary impact that could be mitigated to some extent.							

Recommended mitigation

- Limit the footprint area of the construction activity to what is absolutely essential;
- During construction the maintenance of base flows in the system must be maintained at all times and the duration of impacts on flows should be limited to as short a period as possible; and
- Eelways should be incorporated into the design of the dam.

8.1.4 Impact on species with conservation concern

Impacts on species with conservation concern will mostly pertain to habitat alteration and flow alteration as effected through the Lalini Dam tunnel. These effects have been discussed with reference to the impacts associated with the proposed dams. Construction of the electricity generation and distribution phases will have lower impact compared to that associated with the dams due to the smaller scale of both activity and potential impact. It must however be noted that the further the tunnel daylights from the Lalini dam wall the larger the impact on the instream ecology will be.

Impact on species with conservation concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential)							
High	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Please note that reference to the respective hydroelectric generation projects also considers impact from associated power lines and the Lalini Dam tunnel.							
Residual Impact and Comments– Construction of the development will have temporary impact that could be mitigated to some extent.							

Recommended mitigation

- Limit the footprint area of the construction activity to what is absolutely essential;
- During construction the maintenance of base flows in the system must be maintained at all times and the duration of impacts on flows should be limited to as short a period as possible.

8.2 OPERATIONAL PHASE

8.2.1 Loss of aquatic habitat

Once construction is complete impact will be low. Water released from the Lalini Dam, if not correctly designed can lead to severe erosion and canalisation of the system at the point where the discharge from the Lalini Dam enters the river. This impact can be significant on a site to local scale in terms of river modification and habitat loss, with the potential to affect the hydrological functioning and biodiversity of riverine and wetland systems on a local to regional scale. The closer to the dam wall the pipeline enters the river, the shorter the section subjected to reduced instream flow will be. These impacts have been discussed previously with reference to the operational phase of the dams.

Loss of aquatic habitat	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
High	Local (2)	Medium term (2)	Medium (3)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Please note that reference to the respective hydroelectric generation projects also considers impact from associated power lines and the Lalini Dam tunnel.							

It must be noted that although the impact significance for each option of the Lalini dam was classified as being the same the further from the dam wall water is re-introduced to the system the larger the impact on the Tsitsa River due altered instream flows.

Recommended mitigation

- The discharge point and discharge structure must be designed and positioned in a way that would minimise incision, erosion and changes to instream habitat structures.
- The infrastructure should be adequately maintained to retain the smallest footprint possible and prevent post construction impacts on the local instream habitat due to a lack of infrastructure maintenance.

8.2.2 Impact on flow dependant species

Considering impact of dam operation on flow rate, contribution of run-off from hard services associated with the electricity generation and distribution phase development to flow rate alteration, is deemed negligible. Impact on flow dependent species will predominantly pertain to the discharge of water from the Lalini Dam pipeline into the river. Differences in flow regime have been discussed previously with reference to the proposed dam operation. It must be noted that although the impact significance for each option of the Lalini dam was classified as being the same the further from the dam wall water is re-introduced to the system the larger the impact on the Tsitsa River due altered instream flows.

Impact of flow dependant species	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	High (4)	High	Medium-Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Please note that reference to the respective hydroelectric generation projects also considers impact from associated power lines and the Lalini Dam tunnel.							
Residual Impact and Comments– Construction of the development will have temporary impact that could be mitigated to some extent.							

Recommended mitigation

- The Instream Flow Requirements defined for the Tsitsa system must be maintained at all times.
- The infrastructure should be adequately maintained to retain the smallest footprint possible and minimise post construction impacts on local habitat.

8.2.3 Loss of aquatic biodiversity

Potential loss of biodiversity, with particular reference to mayflies from the order *Ephemeroptera*, will mostly pertain to habitat alteration and flow alteration as effected through the Lalini Dam tunnel. These effects have been discussed with reference to dam impact. Construction of the electricity generation and distribution phases will have lower impact compared to that associated with the dams due to the smaller scale of both activity and potential impact. It must be noted that although the impact significance for each option of the Lalini dam was classified as being the same the further from the dam wall water is re-introduced to the system the larger the impact on the Tsitsa River due altered instream flows.

Impact of flow dependant species	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
Without Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (1)	Low (2)	High	Very low
Please note that reference to the respective hydroelectric generation projects also considers impact from associated power lines and the Lalini Dam tunnel.							
Residual Impact and Comments– Construction of the development will have temporary impact that could be mitigated to some extent.							

Recommended mitigation

- The Instream Flow Requirements defined for the Tsitsa system must be maintained at all times.
- The infrastructure should be adequately maintained to retain the smallest footprint possible and minimise post construction impacts on local habitat.

8.2.4 Impact on species with conservation concern

Impacts on species with conservation concern will mostly pertain to habitat alteration and flow alteration as effected through the Lalini Dam tunnel. These effects have been discussed along with the proposed dam construction impacts. Construction of the electricity generation and distribution phases will have lower impact compared to that associated with the dams due to the smaller scale of both activity and potential impact. It must be noted that although the impact significance for each option of the Lalini dam was classified as being the same the further from the dam wall water is re-introduced to the system the larger the impact on the Tsitsa River due altered instream flows.

Impact on species with conservation concern	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Project with Ntabelanga Dam and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 1 (nearest to falls lowest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 2 (midway option) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Proposed Project with Lalini Dam hydroelectric generation site 3 (furthest from falls largest generation potential) and associated infrastructure							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Please note that reference to the respective hydroelectric generation projects also considers impact from associated power lines and the Lalini Dam tunnel.							
Residual Impact and Comments– Construction of the development will have temporary impact that could be mitigated to some extent.							

Recommended mitigation

- The Instream Flow Requirements defined for the Tsitsa system must be maintained at all times;
- Well managed base generation based on available water and based on the simulation of natural stream discharge patterns, as defined by the EWR is deemed the most appropriate regime for the system;
- The infrastructure should be adequately maintained to retain the smallest footprint possible and minimise post construction impacts on local habitat.

9. IMPACT ASSESSMENT FOR ROADS AND PIPELINE INFRASTRUCTURE

This Chapter presents the findings of the environmental impact assessment for the road infrastructure (DEA Ref no. 14/12/16/3/3/1/1169).

The activities included under this chapter are listed below:

- Upgrading and relocation of roads and bridges;
- Construction of new access roads around the Lalini Dam site.

9.1 CONSTRUCTION PHASE

During the construction phase initial impact will be local to establish the necessary infrastructure. Relocation and upgrading of bridges will have site specific impacts at riverine points of construction. Impacts due to canalisation and erosion will potentially be caused due to the disturbance of soils, during site clearing, and the alteration of flow regimes in the Tsitsa River and tributaries. If effectively mitigated, such impacts will be of short duration and low intensity. It must be noted that many of the crossings will be over small streams of limited ecological importance and sensitivity although due to the limited flow in the systems care must be taken during construction to not adversely affect these systems.

Probable latent impacts on a site specific to local scale thus include:

- Localised erosion (not significant);
- Localised changes to instream and riparian habitat (not significant);
- Localised sedimentation of the system may lead to altered instream habitat (potentially significant);
- Localised changes to instream and riparian habitat (not significant);
- Some localised changes to aquatic and riparian zone community assemblages (not significant).
- Some changes to the hydrology of the system may occur altering instream habitats on a localised scale (not significant).
- Localised changes to instream and riparian habitat and cover types (not significant);
- Some localised changes to aquatic and riparian zone community assemblages (not significant).

General impact	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed Roadways							
Without Mitigation	Local (1)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Primary pipelines							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Secondary pipelines							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Irrigation pipelines							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Medium (3)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Please note that reference to the respective projects also considers impact from upgrading of roads and bridges.							
Cumulative Impact and Comments– Construction of the development will have temporary impact that could be mitigated to some extent.							

Recommended mitigation

- All bridges should span the entire active channel (normal to moderately high flows) and no support piers should occur within the active channel;
- All crossing construction should be undertaken in the low flow season and must be completed within six (6) months;
- The duration of construction works needs to be kept to the absolute minimum and all project planning must be very well orchestrated to reach this goal;
- The construction infrastructure and coffer dams and stream diversions must at no time lead to upstream ponding and inundation or lead to the constriction of flow and downstream erosion;
- Minimise disturbance of instream and bankside areas and minimise activities in these areas;
- As far as possible keep all instream areas and stream banks off limits to general activity during the construction phase;
- Any construction-related waste must not be placed in the vicinity of any riparian areas;

- Ensure that on-site camp fires are forbidden;
- Edge effects (impacts on areas beyond the construction footprint due to less than desirable care and management) during construction and operation need to be strictly controlled through ensuring good housekeeping and strict management of activities near the stream crossing;
- During construction, drift fences constructed from hessian sheets should be installed at erodible areas to minimise erosion. Silt traps should also be provided to remove sand/silt particles from runoff;
- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise environmental damage;
- Riparian areas that may have been disturbed during construction should be rehabilitated through reprofiling and revegetation upon completion of the construction phase;
- Desilt all riparian areas affected by construction activities;
- Reprofiling of the banks of disturbed drainage areas to a maximum gradient of 1 V : 3 H to ensure bank stability if necessary;
- Reinforce banks and drainage features where necessary with gabions, reno mattresses and geotextiles;
- During construction care must be taken to disrupt the riparian zone as little as possible to avoid erosion and sediment load into the system. This can be achieved by permitting only essential construction personnel within 32 m of all riparian systems; and
- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of clean water runoff areas and the concomitant recharge of streams in the area.

9.2 OPERATION PHASE

Extensive development project activities often cause a change to peak flows in the river system downstream of the project site, due to changes in surface coverage. Development of a project area will change the surface coverage in some areas from vegetated soil to buildings, hardened gravel roads, paved areas (parking), and compacted earth. These new surface types will allow considerably less infiltration into the ground (typically 0-20%) as compared to the natural surface (typically 60-70%), resulting in more surface runoff following storms and consequently higher peak flow rates. However, considering inundation due to dam wall construction as well as base- and peak flow management during the operational phase, such an impact on river peak flow rates would be large insignificant on a local or regional scale. On a site specific scale run-off may result in erosion and sedimentation but such impact can be mitigated.

Recommended mitigation

- Roads and associated pipeline developments must be well maintained to avoid site specific impacts such as erosion or sedimentation resulting from run-off.

- Sheet runoff from access roads and the final road structure needs to be curtailed and slowed down by the strategic placement of energy dissipation structures;
- Adequate stormwater management must be incorporated into the design of the proposed structure in order to prevent erosion and the associated sedimentation of the system for the life of the structure; and
- As far as possible, all construction activities should occur in the low flow season, during the drier summer months;
- It must be ensured that migratory connectivity and stream continuity is maintained throughout the construction phase of the project;
- Removal of alien vegetation and good housekeeping within the road reserve must take place at all times;
- Any spills by maintenance teams or road users should be cleaned up immediately and all work overseen by a suitably qualified professional.

General impact	Extent	Duration	Intensity	Potential for irreplaceable loss of resources	Probability	Confidence	Significance
Proposed road upgrades							
Without Mitigation	Local (1)	Short term (1)	Low (2)	Low (2)	Low (2)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Low (2)	Low (2)	High	Very low
Primary pipelines							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Secondary pipelines							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Irrigation pipelines							
Without Mitigation	Local (2)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
With Mitigation	Site (1)	Short term (1)	Low (2)	Medium (3)	Low (2)	High	Very low
Please note that reference to the respective projects also considers impact from upgrading of roads and bridges.							
Cumulative Impact and Comments– Construction of the development will have temporary impact that could be mitigated to some extent.							

10. IMPACT ASSESSMENT FOR THE NO PROJECT ALTERNATIVE

This Chapter presents the findings of the environmental impact assessment for the no-project alternative.

From the impacts assessed in the previous sections, it is clear that habitat and flow rate alterations are the two main concerns. With reference to both the conditions will be permanently altered and impacts cannot be mitigated (habitat alteration through inundation) or only partially mitigated (maintaining base flows).

From a purely ecological perspective, the no project alternative will best ensure maintenance of ecological integrity within the system with the current rocky habitat in fast flowing clear water being maintained. In addition the PES of the system will most likely remain unchanged and the more sensitive aquatic taxa populations will most likely remain intact.

11. CONSULTATION PROCESS

11.1 CONSULATION PROCESS FOLLOWED

Engagement with Interested and Affected Parties (I&APs) forms an integral component of the EIA process. I&APs have an opportunity at various stages throughout the EIA process to gain more knowledge about the proposed project, to provide input into the process and to verify that their issues and concerns have been addressed.

The proposed project was announced in April 2014 to elicit comment from and register I&APs from as broad a spectrum of public as possible. The announcement was done by the following means:

- The distribution of Background Information Documents (BIDs) in English and IsiXhosa;
- Placement of site notices in the project area and Municipal offices (Tsolo and Qumbu);
- Placement of advertisements in one regional (The Herald) and two local (Daily Dispatch and the Mthatha Fever) newspapers; and
- Publication of all available information on the DWA web site (www.dwa.gov.za/mzimvubu).

The Draft Scoping Report (DSR) was made available for a 30 day public comment period in May 2014. All documents were uploaded to the web, notification letters were sent out, the summary of the DSR was translated into isiXhosa, distributed to all registered stakeholders and hardcopies of the full report and translated summary report were available at public places. Additionally, three public meetings were held in the affected areas, Siqhungqwini, Tsolo and Lalini respectively. An Authorities Forum Meeting with all relevant authorities was held in the Eastern Cape on the 28 May 2014. This was to assist the authorities with commenting on the relevant documentation.

Comments received from stakeholders were captured in the Issues and Response Report (IRR) which formed part of the Final Scoping Report (FSR). The FSR was made available to the public for a 21 day comment period on 13 June 2014 and was submitted to the Department of Environmental Affairs (DEA). Comments received during the Final Scoping public comment period were compiled and an updated IRR was submitted to DEA on 8 July 204 and uploaded to the website. The FSR was accepted by DEA with certain conditions on 15 July 2014. Following this, a newsletter was compiled and translated to isiXhosa, explaining everything that has happened to date as well as what is to come. Both the English and isiXhosa versions were electronically distributed to all registered stakeholders and hardcopies were distributed by the local facilitators in the affected areas.

The Draft Environmental Impact Assessment Report (DEIR), its summary (translated into isiXhosa), the various specialist studies, the Environmental Management Programmes (one for the construction and operation of the project, and one for the borrow areas and

quarries) as well as the Water Use Licence Application will be made available for a period of thirty (30 days) for stakeholders to comment. Hardcopies will be made available at the same venues as the DSR and all documents will be uploaded to the website. The availability of these documents as well as the announcement of the upcoming public meetings in Siqhungqwini, Tsolo and Lalini will be advertised on the Eastern Cape SABC radio station, Umhlobo Wenene FM, which has a listenership of over 4 million people. Another Authorities Forum Meeting is scheduled for October 2014.
Stakeholder comments will be taken into consideration with the preparation of the final documents. The availability of the final documents will be announced prior to submission to the decision-making authority. Once a decision has been made by the DEA, all stakeholders will again be notified.

The following issues were sourced from the Issue and Response Report (Final Version 1) as submitted to the Department of Environmental Affairs with the Final Scoping Report.

11.2 SUMMARY OF COMMENTS RECEIVED

Table 43: Issues related to the Reserve determination and aquatic ecology

Issue/Comment/Question	Date received	Origin	Response
Inappropriately dumped waste (such as cans and plastic bags) will also pollute the dam and could cause the water pipes to become blocked.	09.06.2014 via fax	Sivuyise Mange (Resident) Asanda Zihlwele (Resident) Zukisa Madasa (Resident)	The Environmental Management Programme applicable to the construction of the dam has waste management requirements that all Contractors must adhere to. These will be monitored for compliance.
Will the Reserve determination go all the way to the mouth of the river? The potential impacts on the estuary need to be considered and managed.	28.05.2014 AFM	John Geeringh (Eskom)	The Tsita River contributes a small percentage of the flow in the Mzimvubu River that reaches the estuary. The Ntabelanga/Lalini system will always be operated in a manner that fulfills the EWR downstream of the HEP outfall, both in terms of minimum and maximum flows. The project is also not expected to impact of the water quality. The Reserve determined for the estuary indicated that if a dam of 1.5MAR at Ntabelanga would support the estuarine EWR. The Ntabelanga dam will be a 1.2 MAR Dam while the Lallini dam is a 0.36 MAR Dam. These figures are in line with the Reserve determination of the estuary which will support the Best Attainable State for the estuary. The impact on the estuary is therefore predicted to be negligible and will most likely support the prescribed

Issue/Comment/Question	Date received	Origin	Response
			ecostatus for the estuary.
The Mzimvubu river is one of the main rivers flowing in the Eastern Cape Drakensberg and Pondoland Coast water source areas, these have <3% protection and are critical for water supply. This should be taken into account during the EIA.	23.06.2014 via email	Dean Muruven (World Wildlife Fund)	Part of the purpose of the project is to supply domestic water needs of communities in the project area. In addition, the Reserve determination undertaken in the feasibility study took into account basic human needs of communities living downstream of the two dam sites. The findings of the Reserve study will be revisited during the EIA to confirm the availability of water for human needs.
Stakeholder stated that soil erosion may be a potential problem.	09.06.2014 via fax	Sivuyise Mange (Resident)	Soil erosion is indeed a big issue in this catchment. The Department of Environmental Affairs has therefore initiated a Catchment Rehabilitation and Management Programme aimed at addressing this and related issues. This project includes the removal of alien invasive species, rehabilitation of eroded areas and other land management exercises. The project has already commenced. Should any activities of the Catchment Rehabilitation and Management Programme (e.g. the construction of soil erosion abatement structures) require environmental authorisation or a water use licence these are not included in the applications that we have submitted for the dams, and separate EIAs will have to be undertaken for them. There is close liaison between the catchment management and Mzimvubu Water Project teams to focus their initial activities on areas that will most benefit the dams.

12. IMPACT STATEMENT

Impact assessment summary: Impact assessment results are tabulated below.

Impact	Construction and first filling		Operational phase	
Mitigation status	Unmitigated	Mitigated	Unmitigated	Mitigated
Roads and Infrastructure	Very low	Very low	Very low	Very low
Electricity Generation and Distribution impact on habitat	Medium low	Low	Medium low	Very low
Electricity Generation and Distribution impact on flow	Medium low	Low	Medium low	Very low
Electricity Generation and Distribution impact on species	Medium low	Low	Low	Medium low
Electricity Generation and Distribution impact on SCC	Low	Very low	Low	Very Low
Dam impact on habitat	High	High	High	Medium high
Dam impact on flow dependant species	High	High	High	Medium high
Dam impact on species diversity	High	High	Medium high	Medium high
Dam impact on SCC	High	Medium high	Medium high	Medium low

- **Dam construction and operation:** In terms of both dam construction and first filling phase, greatest impact pertains to habitat alteration/destruction as well as natural flow rate and the impact can be considered a high level impact. These impacts result in secondary impacts on flow sensitive species, species of conservation concern and aquatic biodiversity in general. The effects (inundation of habitat upstream of the dam walls and disruption of natural flow downstream) are considered high impact and permanent and hence also applicable to the operation phase. In terms of dam size alternatives, the impact on the aquatic system will be largely the same with only slight impact in terms of scale, moving more towards a local impact compared to a site impact. Very little mitigation is available to reduce the impacts of these proposed developments. In order to facilitate migration Eelways should be incorporated into the design of the dam.

In terms of flow rate, base flows need to be maintained during both the construction/initial filling and operation phases. Without periodic, seasonal floods with associated flushing of the river system, impacts such as silting/sedimentation and decrease in general water quality is a possibility. In addition periods of higher flow will be required to provide environmental ques to the aquatic ecology of the area. In order to facilitate abstraction of water from Ntabelanga Dam electricity would have to be generated at Lalini Dam. With peaking generation the system will be subject to daily unnatural variations in water level and flow rates, which will negatively affect flow sensitive species, and as a result decrease biodiversity which could have a significant impact on the aquatic ecology, especially if

peaking takes place year round. With seasonal peak flow during winter only, such negative effects can be restricted to a single season.

Electricity generation and distribution: Construction of such infrastructure will be of low impact if mitigated. Mitigation includes minimising the spatial footprint of the development to the greatest degree possible, with special reference to avoiding erosion, silting and sedimentation within the aquatic system. During the operation phase discharge through the Lalini Dam tunnel into the river will also be applicable. The section of river below the dam wall up to the tunnel discharge point will be largely subjected to base flow as defined by the EWR except in times of heavy rainfall, which may impact on the most flow sensitive biota. This may result in silting, sedimentation, decrease in water quality and excessive vegetation growth. The shorter the length of this section between the dam wall and discharge point, the smaller the area of impact. The tunnel must also be constructed and positioned in such a manner as to preclude erosion effects at times of peak discharge. Peak electricity generation is not deemed appropriate to the system as it will significantly impact on the ecology of the system. Poorly managed Base energy generation would impact on the system. Well managed base generation based on available water and based on the simulation of natural stream discharge patterns, as defined by the EWR, is deemed the most appropriate regime for the project.

Road and pipeline infrastructure: Construction of such infrastructure will be of low impact if mitigated. Mitigation again includes minimising the spatial footprint of the development to the greatest degree possible, with special reference to avoiding erosion, silting and sedimentation within the aquatic system during both construction and operation. During the operation phase increased run-off from hard surfaces may also result in erosion and construction design must ensure that operational phase impacts are suitably managed.

13. CONCLUSION AND RECOMMENDATIONS

Construction of the dam will have a high impact in terms of habitat and natural flow rate alteration as well as impacts on the habitat upstream of the proposed dams. This may in turn have negative effects on flow sensitive species, species of conservation concern (particularly mayflies and also eels) and biodiversity in general. Impact will be high and permanent and dam size will have little effect (spatial scale only) on overall aquatic impact. The instream flow requirements of the systems are to be adhered to at all times. Peak electricity generation is not deemed appropriate to the system as it will significantly impact on the ecology of the system. Poorly managed base energy generation would impact on the system. Well managed base generation based on available water and based on the simulation of natural stream discharge patterns, as defined by the EWR, is deemed the most appropriate regime for the project.

Construction of electricity, road and pipeline infrastructure will be of low impact, if the spatial footprint of the development is minimised to the greatest degree possible, with special reference to avoiding erosion, silting and sedimentation within the aquatic system.

Throughout the life of the project ongoing aquatic biomonitoring must take place and if any trends are observed where impacts on the aquatic ecology is becoming unacceptable, measures to reduce the impacts must be immediately implemented. All aquatic biomonitoring should be undertaken by a suitably qualified and South African River Health Program (SA RHP) accredited assessor.

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APPENDIX A: IHIA DATA (JUNE 2014)

Instream Zone Habitat Integrity

	Weights	14	13	13	13	14	10	9	8	6		
Reach	ASSESSMENT DATE	Water abstraction	Flow modification	Bed modification	Channel modification	Water quality	Inundation	Exotic macrophytes	Exotic fauna	Solid waste disposal	Total Score (%)	Classification
TS1	20 April 2014	2	1	2	0	2	0	0	8	3	93.6	A (Unmodified)
TS4	18 April 2014	2	1	2	0	4	0	0	8	2	87.4	B (Largely natural)
TS7	21 April 2014	1	4	6	8	4	0	0	0	3	78.2	C (Moderately modified)
TS8	17 April 2014	2	1	2	0	2	0	0	8	3	75.4	C (Moderately modified)
None	*Small*		*Moderate*			*Large*			*Serious*		*Critical*	

Riparian Zone Habitat Integrity

	Weights	13	12	14	12	13	11	12	13		
Reach	ASSESSMENT DATE	Vegetation removal	Alien encroachment	Bank erosion	Water abstraction	Flow modification	Channel modification	Water quality	Inundation	Total Score (%)	Classification
TS1	20 April 2014	11	7	2	0	0	0	0	0	85.5	B (Largely natural)
TS4	18 April 2014	13	11	1	0	0	0	0	0	72.4	C (Moderately modified)
TS7	21 April 2014	14	8	14	0	0	0	0	0	72.8	C (Moderately modified)
TS8	17 April 2014	11	7	2	0	0	0	0	0	76.9	C (Moderately modified)
None	*Small*		*Moderate*			*Large*			*Serious*		*Critical*

REACH	ASSESSMENT DATE	INSTREAM HABITAT	RIPARIAN ZONE	IHI SCORE	CLASS
TS1	20 April 2014	93.6	85.5	89.5	B (Largely natural)
TS4	18 April 2014	87.4	72.4	79.9	B (Largely natural)
TS7	21 April 2014	78.2	72.8	75.5	C (Moderately modified)
TS8	17 April 2014	75.4	76.9	76.2	C (Moderately modified)

Instream Zone Habitat Integrity

Weights		14	13	13	13	14	10	9	8	6		
Reach	ASSESSMENT DATE	Water abstraction	Flow modification	Bed modification	Channel modification	Water quality	Inundation	Exotic macrophytes	Exotic fauna	Solid waste disposal	Total Score (%)	Classification
TS2	20 April 2014	0	2	2	4	4	0	0	0	4	88	B (Largely natural)
TS3	20 April 2014	1	4	6	8	4	0	0	0	3	87.1	B (Largely natural)
TS5	20 April 2014	2	1	2	0	2	0	0	8	3	75.4	C (Moderately modified)
TS6	19 April 2014	2	2	12	13	2	0	0	2	2	71.6	C (Moderately modified)
TS9	21 April 2014	1	4	5	8	4	0	0	0	3	69.5	C (Moderately modified)
None	*Small*	*Moderate*	*Large*	*Serious*	*Critical*							

Riparian Zone Habitat Integrity

Weights		13	12	14	12	13	11	12	13		
Reach	ASSESSMENT DATE	Vegetation removal	Alien encroachment	Bank erosion	Water abstraction	Flow modification	Channel modification	Water quality	Inundation	Total Score (%)	Classification
TS2	20 April 2014	13	9	13	0	2	2	0	0	66.9	C (Moderately modified)
TS3	20 April 2014	14	8	14	0	0	0	0	0	76.6	C (Moderately modified)
TS5	20 April 2014	11	7	2	0	0	0	0	0	76.9	C (Moderately modified)
TS6	19 April 2014	13	11	12	0	0	9	0	0	65.1	C (Moderately modified)
TS9	21 April 2014	11	14	9	0	0	0	0	0	74.3	C (Moderately modified)
None	*Small*	*Moderate*	*Large*	*Serious*	*Critical*						

REACH	ASSESSMENT DATE	INSTREAM HABITAT	RIPARIAN ZONE	IHI SCORE	CLASS
TS2	20 April 2014	88.0	66.9	77.4	C (Moderately modified)
TS3	20 April 2014	87.1	76.6	81.9	B (Largely natural)
TS5	20 April 2014	75.4	76.9	76.2	C (Moderately modified)
TS6	19 April 2014	71.6	65.1	68.4	C (Moderately modified)
TS9	21 April 2014	69.5	74.3	71.9	C (Moderately modified)

APPENDIX B: IHAS SCORE SHEETS (APRIL 2014 AND JUNE 2014)

TS 1 – APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)

River Name: TSITSA
Site Name: TS1
Date: 20/04/2014

SAMPLING HABITAT	0	1	2	3	4	5
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
SIC Score (max 20):				**23**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
Vegetation Score (max 15):					**6**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
Other Habitat Score (max 20):					**12**	
HABITAT TOTAL (MAX 55):					**41**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
STREAM CONDITIONS TOTAL (MAX 45)						**36**
TOTAL IHAS SCORE (%):					**77**	

TS 1 – APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name: TSITSA						
Site Name: TS1	**Date**: 02/06/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):			**23**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):				**5**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):				**16**	
	HABITAT TOTAL (MAX 55):				**44**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX				**27**	
	TOTAL IHAS SCORE (%):				**71**	

TS 2 – APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name: UNNAMED TRIB						
Site Name: TS2	**Date**: 20/04/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
SIC Score (max 20):				**20**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
Vegetation Score (max 15):					**0**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
Other Habitat Score (max 20):					**12**	
HABITAT TOTAL (MAX 55):					**32**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
STREAM CONDITIONS TOTAL (MAX 45)						**35**
TOTAL IHAS SCORE (%):						**67**

TS 2 – JUNE 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name:						
Site Name: TS2	**Date**: 02/06/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):			**20**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):				**0**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):				**12**	
	HABITAT TOTAL (MAX 55):				**32**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX				**33**	
	TOTAL IHAS SCORE (%):				**65**	

TS 3 – APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name: UNNAMED TRIB						
Site Name: TS3	**Date**: 20/04/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):			**14**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):				**0**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):				**12**	
	HABITAT TOTAL (MAX 55):				**26**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX 45)				**26**	
	TOTAL IHAS SCORE (%):				**52**	

TS 3 – JUNE 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name:						
Site Name: TS3	**Date**: 02/06/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):			**14**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):				**0**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):				**12**	
	HABITAT TOTAL (MAX 55):				**26**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <¼m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX				**26**	
	TOTAL IHAS SCORE (%):				**52**	

TS 4 – APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name: TSITSA						
Site Name: TS4	**Date**: 18/04/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
SIC Score (max 20):				**17**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
Vegetation Score (max 15):					**7**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
Other Habitat Score (max 20):					**12**	
HABITAT TOTAL (MAX 55):					**36**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
STREAM CONDITIONS TOTAL (MAX 45)						**30**
TOTAL IHAS SCORE (%):						**66**

TS 4 – JUNE 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name:						
Site Name: TS4	**Date**: 02/06/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):		**16**			
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):		**7**			
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):		**12**			
	HABITAT TOTAL (MAX 55):		**35**			
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX					**30**
	TOTAL IHAS SCORE (%):		**65**			

TS 5 – APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name: INTU						
Site Name: TS5	**Date**: 20/04/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
SIC Score (max 20):				**11**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
Vegetation Score (max 15):					**0**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
Other Habitat Score (max 20):					**12**	
HABITAT TOTAL (MAX 55):					**23**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
STREAM CONDITIONS TOTAL (MAX 45)						**21**
TOTAL IHAS SCORE (%):					**44**	

TS 5 –JUNE 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name:						
Site Name: TS5	**Date**: 02/06/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):			**12**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):				**4**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):				**12**	
	HABITAT TOTAL (MAX 55):				**28**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX				**23**	
	TOTAL IHAS SCORE (%):				**51**	

TS 6 –APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name: UNNAMED TRIB						
Site Name: TS6	**Date**: 19/04/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
SIC Score (max 20):				**18**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
Vegetation Score (max 15):					**11**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
Other Habitat Score (max 20):					**11**	
HABITAT TOTAL (MAX 55):					**40**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
STREAM CONDITIONS TOTAL (MAX 45)						**30**
TOTAL IHAS SCORE (%):						**70**

TS 6 –JUNE 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name:						
Site Name: TS6	**Date**: 02/06/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):			**18**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):				**11**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):				**11**	
	HABITAT TOTAL (MAX 55):				**40**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX					**29**
	TOTAL IHAS SCORE (%):				**69**	

TS 7 –APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name: TSITSA						
Site Name: TS7	**Date**: 21/04/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):			**22**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):				**7**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):				**11**	
	HABITAT TOTAL (MAX 55):				**40**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX 45)				**31**	
	TOTAL IHAS SCORE (%):				**71**	

TS 7 –JUNE 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name:						
Site Name: TS7	**Date**: 03/06/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):			**22**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):				**7**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):				**11**	
	HABITAT TOTAL (MAX 55):				**40**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX					**31**
	TOTAL IHAS SCORE (%):				**71**	

TS 8 – APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)

River Name: TSITSA
Site Name: TS8
Date: 17/04/2014

SAMPLING HABITAT	0	1	2	3	4	5
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
SIC Score (max 20):				**22**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
Vegetation Score (max 15):					**9**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
Other Habitat Score (max 20):					**14**	
HABITAT TOTAL (MAX 55):					**45**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
STREAM CONDITIONS TOTAL (MAX 45)						**30**
TOTAL IHAS SCORE (%):						**75**

TS 8 – JUNE 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)						
River Name:						
Site Name: TS8	**Date**: 03/06/2014					
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
	SIC Score (max 20):			**22**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
	Vegetation Score (max 15):				**10**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
	Other Habitat Score (max 20):				**14**	
	HABITAT TOTAL (MAX 55):				**46**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
	STREAM CONDITIONS TOTAL (MAX					**30**
	TOTAL IHAS SCORE (%):				**76**	

TS 9 – APRIL 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)

River Name:
Site Name: TS9 **Date**: 21/04/2014

SAMPLING HABITAT	0	1	2	3	4	5
STONES IN CURRENT (SIC)						
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10	
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+	
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20	
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75	
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)						
SIC Score (max 20):				**16**		
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1		
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75
Vegetation Score (max 15):					**0**	
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1	
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½	
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½**		
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**	
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over
(** NOTE: you must still fill in the SIC section)						
Other Habitat Score (max 20):					**14**	
HABITAT TOTAL (MAX 55):					**30**	
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**
PHYSICAL						
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix	
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95		
(*** NOTE: if more than one option, choose the lowest)						
STREAM CONDITIONS TOTAL (MAX 45)						**36**
TOTAL IHAS SCORE (%):					**66**	

TS 9 – JUNE 2014

INVERTEBRATE HABITAT ASSESSMENT SYSTEM (IHAS)							
River Name:							
Site Name: TS9	**Date**: 03/06/2014						
SAMPLING HABITAT	**0**	**1**	**2**	**3**	**4**	**5**	
STONES IN CURRENT (SIC)							
Total length of white water rapids (i.e.: bubbling water) (in meters)	none	0-1	>1-2	>2-3	>3-5	>5	
Total length of submerged stones in current (run) (in meters)	none	0-2	>2-5	>5-10	>10		
Number of separate SIC area's kicked (not individual stones)	0	1	2-3	4-5	6+		
Average stone size's kicked (cm's) (gravel is <2, bedrock is >20)	none	<2>20	2-10	11-20	2-20		
Amount of stone surface clear (of algae, sediment, etc) (in %)*	n/a	0-25	26-50	51-75	>75		
PROTOCOL: time spent actually kicking stones (in minutes) (gravel/bedrock = 0 min)	0	<1	>1-2	2	>2-3	>3	
(* NOTE: up to 25% of stone is usually embedded in the stream bottom)							
	SIC Score (max 20):			**16**			
VEGETATION	**0**	**1**	**2**	**3**	**4**	**5**	
Length of fringing vegetation sampled (river banks) (PROTOCOL - in meters)	none	0-½	>½-1	>1-2	2	>2	
Amount of aquatic vegetation sampled (underwater) (in square meters)	none	0-½	>½-1	>1			
Fringing vegetation sampled in: ('still' = pool/still water only; 'run' = run only)	none		run	pool		mix	
Type of vegetation (% leafy veg. As opposed to stems/shoots) (aq. Veg. Only = 49%)	none	0	1-25	26-50	51-75	>75	
	Vegetation Score (max 15):				**3**		
OTHER HABITAT/GENERAL	**0**	**1**	**2**	**3**	**4**	**5**	
Stones out of current (SOOC) sampled: (PROTOCOL - in square meters)	none	0-½	>½-1	1	>1		
Sand sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	>½-1	1	>1	
Mud sampled: (PROTOCOL - in minutes) ('under' = present, but only under stones)	none	under	0-½	½	>½		
Gravel sampled: (PROTOCOL - in minutes) (if all gravel, SIC stone size = <2)**	none	0-½	½	>½*			
Bedrock sampled: ('all' = no SIC, sand, or gravel then SIC stone size = >20)**	none	some			all**		
Algae present: ('1-2m² = algal bed; 'rocks' = on rocks; 'isol' = isolated clumps)***	>2m²	rocks	1-2m²	<1m²	isol	none	
Tray identification: (PROTOCOL - using time: 'coor' = correct time)		under		corr		over	
(** NOTE: you must still fill in the SIC section)							
	Other Habitat Score (max 20):				**14**		
	HABITAT TOTAL (MAX 55):				**33**		
STREAM CONDITION	**0**	**1**	**2**	**3**	**4**	**5**	
PHYSICAL							
River make up: ('pool' = pool/still/dam only; 'run' only; etc)	pool		run	rapid	2mix	3mix	
Average width of stream: (in meters)		>10	>5-10	<1	1-2	>2-5	
Average depth of stream: (in meters)	>2	>1-2	1	>½-1	½	<½	
Approximate velocity of stream: ('slow' = <½m/s; 'fast' = >1m/s) (use twig to test)	still	slow	fast	med		mix	
Water colour: ('disc' = discoloured with visible colour but still transparent)	silty	opaque		disc		clear	
Recent disturbance due to: ('const.' = construction; 'fl/dr' = flood or drought)***	flood	fire	constr	other		none	
Bank/riparian vegetation is: ('grass' = includes reeds; 'shrubs' = include trees)	none		grass	shrubs	mix		
Surrounding impacts: ('erosn' = erosion/shear bank; 'farm' = farmland/settlement)***	erosn	farm	trees	other		open	
Left bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95			
Right bank cover: (rocks and vegetation) (in %)	0-50	51-80	81-95	>95			
(*** NOTE: if more than one option, choose the lowest)							
	STREAM CONDITIONS TOTAL (MAX					**35**	
	TOTAL IHAS SCORE (%):				**68**		

APPENDIX C: SASS5 SCORE SHEETS (APRIL 2014 AND JUNE 2014)

TS1 – APRIL 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 20/04/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3					Blepharoceridae	15				
SITE CODE: TS1	**ANNELIDA:**						Gerridae*	5		1		1	Ceratopogonidae	5				
RIVER: TSITSA	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2	A	A		A
SITE DESCRIPTION: UPSTREAM OF NTABA	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION: WARM / CLEAR	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 18.6 °C	Amphipoda	13					Notonectidae*	3		1		1	Empididae	6				
Ph: 8.78	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M. veliidae*	5					Muscidae	1				
Cond: 0.9 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1				
BIOTOPES SAMPLED:	**HYDRACARINA**	8	1			1	Cordalidae	8					Simuliidae	5	A	A		A
SIC: 4 TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC: 2	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12	A			A	Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: 1 DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4					Ancylidae	6				
M VEG OOC: DOM SP:	Baetidae 2 sp	6					Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12	B			B	Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND:	Caenidae	6					Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:YES	Heptageniidae	13		1		1	Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW: MEDIUM	Leptophlebiidae	9					**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY: MEDIUM	Oligoneuridae	15	A			A	Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	B			B	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		85	37	0	115
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		10	7	0	15
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		9	5.3	0	7.7
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:		77%			
	Coenagrionidae	4		1		1	Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8	A			A	* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5					SWC = South Western Cape					
	Aeshnidae	8					Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6					Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4	A			A	Hydrophilidae*	5		1		1	VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10	A			A	1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS1 – JUNE 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 02/06/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3					Blepharoceridae	15				
SITE CODE: TS1	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER: TSITSA	Oligochaeta	1			A	A	Hydrometridae*	6					Chironomidae	2			A	A
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 14.4 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 7.1	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M..veliidae*	5					Muscidae	1				
Cond: 518 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1				
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5			A	A
SIC: TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5	A			A
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
MVEGIC: DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4					Ancylidae	6				
MVEGOOC: DOM SP:	Baetidae 2 sp	6					Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12	A		A	B	Hydropsychidae >2 sp	12	A			A	Hydrobiidae*	3				
SAND:	Caenidae	6	1		1	A	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW:	Leptophlebiidae	9			1	1	**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY:	Oligoneuridae	15	A		A	B	Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	A		A	B	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		71	12	67	88
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		8	2	9	12
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		9	6.0	7	7.3
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:		71%			
	Coenagrionidae	4					Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**						TADPOLES / FROGS					
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5					SWC = South Western Cape					
	Aeshnidae	8	A	1	A	B	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6					Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4	A	1		A	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS2 – APRIL 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 20/04/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3			**A**	**A**	Blepharoceridae	15				
SITE CODE: TS2	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER: UNNAMED TRIB. TSITSA	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2			**A**	**A**
SITE DESCRIPTION: REPRESENTATIVE	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION: WARM / CLEAR	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 17.2 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 8.75	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M.veliidae*	5					Muscidae	1				
Cond: 0.8 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1	**1**			**1**
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5	**A**			**A**
SIC: 4 TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: DOM SP:	Baetidae 1 sp	4					Hydropsychidae 1 sp	4					Ancylidae	6				
M VEG OOC: DOM SP:	Baetidae 2 sp	6					Hydropsychidae 2 sp	6	**A**		**A**	**B**	Bulininae*	3				
GRAVEL: 3	Baetidae >2 sp	12	**B**		**B**	**B**	Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND: 3	Caenidae	6					Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS: YES	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW: LOW	Leptophlebiidae	9	**A**		**A**	**A**	**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY: LOW	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	**B**		**A**	**B**	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		59	0	55	70
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		9	0	8	12
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		7	0.0	7	5.8
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:	67%				
	Coenagrionidae	4					Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5	**1**			**1**	SWC = South Western Cape					
	Aeshnidae	8	**A**		**A**	**A**	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6			**A**	**A**	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4	**A**			**A**	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS2 – JUNE 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 02/06/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	PORIFERA	5					HEMIPTERA:						DIPTERA:					
S:°	COELENTERATA	1					Belostomatidae*	3					Athericidae	10				
E:°	TURBELLARIA	3					Corixidae*	3					Blepharoceridae	15				
SITE CODE: TS2	ANNELIDA:						Gerridae*	5					Ceratopogonidae	5				
RIVER: TSITSA	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2				
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	CRUSTACEA:						Nepidae*	3					Dixidae*	10				
TEMP: 14.6 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 7.3	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M..veliidae*	5					Muscidae	1				
Cond: 18.1 mS/m	Palaemonidae	10					MEGALOPTERA:						Psychodidae	1				
BIOTOPES SAMPLED:	HYDRACARINA	8					Cordalidae	8					Simuliidae	5			A	A
SIC: TIME: minutes	PLECOPTERA:						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					TRICHOPTERA						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5			1	1
AQUATIC VEG: DOM SP:	EPHEMEROPTERA						Ecnomidae	8					GASTROPODA					
MVEGIC: DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4			A	A	Ancylidae	6				
MVEGOOC: DOM SP:	Baetidae 2 sp	6					Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12	A		A	B	Hydropsychidae >2 sp	12	A			A	Hydrobiidae*	3				
SAND:	Caenidae	6	A		A	B	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW:	Leptophlebiidae	9					CASED CADDIS:						Thiaridae*	3				
TURBIDITY:	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					PELECYPODA					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	A			A	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					SASS SCORE:		49	0	38	63
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					NO OF TAXA:		6	0	6	9
	Chlorocyphidae	10					Petrothrincidae SWC	11					ASPT:		8	0.0	6	7.0
	Chlorolestidae	8					Pisuliidae	10					IHAS:		65%			
	Coenagrionidae	4					Sericostomatidae SWC	13					OTHER BIOTA:					
	Lestidae	8					COLEOPTERA:											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					COMMENTS:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5					SWC = South Western Cape					
	Aeshnidae	8					Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	A		A	B	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4	A			A	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS3 – APRIL 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 20/04/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3	**A**		**A**	**A**	Blepharoceridae	15				
SITE CODE: NTABA TRIB 2 (TS3)	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER: UNNAMED TRIB	Oligochaeta	1	**1**			**1**	Hydrometridae*	6					Chironomidae	2	**A**		**B**	**B**
SITE DESCRIPTION: REPRESENTATIVE	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION: WARM / CLEAR	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 24.2 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 9.08	Potamonautidae*	3	**1**			**1**	Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M.veliidae*	5					Muscidae	1				
Cond: 1.3 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1	**1**		**1**	**1**
BIOTOPES SAMPLED:	**HYDRACARINA**	8	**1**			**1**	Cordalidae	8					Simuliidae	5				
SIC: 2 TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: DOM SP:	Baetidae 1 sp	4					Hydropsychidae 1 sp	4			**A**	**A**	Ancylidae	6				
M VEG OOC: DOM SP:	Baetidae 2 sp	6	**B**			**B**	Hydropsychidae 2 sp	6	**B**			**B**	Bulininae*	3				
GRAVEL: 3	Baetidae >2 sp	12					Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND: 2	Caenidae	6					Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS: YES	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW: LOW	Leptophlebiidae	9	**A**			**A**	**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY: LOW	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	**A**		**A**	**A**	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		75	0	35	79
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		14	0	7	15
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		5	0.0	5	5.3
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:	52%				
	Coenagrionidae	4					Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8	**A**		**1**	**1**	* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5	**A**			**A**	SWC = South Western Cape					
	Aeshnidae	8	**A**		**A**	**A**	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	**A**			**A**	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4					Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS3 – JUNE 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 02/06/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	PORIFERA	5					HEMIPTERA:						DIPTERA:					
S:°	COELENTERATA	1					Belostomatidae*	3					Athericidae	10				
E: °	TURBELLARIA	3					Corixidae*	3					Blepharoceridae	15				
SITE CODE: TS3	ANNELIDA:				1	1	Gerridae*	5					Ceratopogonidae	5				
RIVER:	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2			A	A
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	CRUSTACEA:						Nepidae*	3					Dixidae*	10				
TEMP: 18.2 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 7.2	Potamonautidae*	3			A	A	Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M..veliidae*	5					Muscidae	1				
Cond: 22.3 mS/m	Palaemonidae	10					MEGALOPTERA:						Psychodidae	1				
BIOTOPES SAMPLED:	HYDRACARINA	8					Cordalidae	8					Simuliidae	5	A		A	B
SIC: TIME: minutes	PLECOPTERA:						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					TRICHOPTERA						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5			A	A
AQUATIC VEG: DOM SP:	EPHEMEROPTERA						Ecnomidae	8					GASTROPODA					
MVEGIC: DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4					Ancylidae	6				
MVEGOOC: DOM SP:	Baetidae 2 sp	6	A		B	B	Hydropsychidae 2 sp	6	A			A	Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12					Hydropsychidae >2 sp	12			B	B	Hydrobiidae*	3				
SAND:	Caenidae	6					Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW:	Leptophlebiidae	9					CASED CADDIS:						Thiaridae*	3				
TURBIDITY:	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					PELECYPODA					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	A			A	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					SASS SCORE:		50	0	52	77
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					NO OF TAXA:		7	0	10	13
	Chlorocyphidae	10					Petrothrincidae SWC	11					ASPT:		7	0.0	5	5.9
	Chlorolestidae	8					Pisuliidae	10					IHAS:		52%			
	Coenagrionidae	4					Sericostomatidae SWC	13					OTHER BIOTA:					
	Lestidae	8					COLEOPTERA:						TADPOLES / FROGS					
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					COMMENTS:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5			A	A	SWC = South Western Cape					
	Aeshnidae	8	A		B	B	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	A		B	B	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4					Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10	A			A	1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS4 – APRIL 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 18/04/2014	**TAXON**		**S**	**VG**	**GSM**	**TOT**	**TAXON**		**S**	**VG**	**GSM**	**TOT**	**TAXON**		**S**	**VG**	**GSM**	**TOT**
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3					Blepharoceridae	15				
SITE CODE: NTABA WALL (TS4)	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER: TSITSA	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2	**1**		**1**	**A**
SITE DESCRIPTION: NTABALONGA WALL	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION: WARM / SUNNY	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 20.8 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 8.57	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M.veliidae*	5		**1**		**1**	Muscidae	1				
Cond: 1.4 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1	**1**			**1**
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5	**1**			**1**
SIC: 4 TIME: 2 minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK: 1	Perlidae	12	**A**			**A**	Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: 1 DOM SP:	Baetidae 1 sp	4					Hydropsychidae 1 sp	4	**B**			**B**	Ancylidae	6				
M VEG OOC: DOM SP:	Baetidae 2 sp	6					Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12	**A**	**A**	**A**	**B**	Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND: 4	Caenidae	6	**A**		**A**	**B**	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS: YES	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW: MEDIUM	Leptophlebiidae	9					**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY: LOW	Oligoneuridae	15	**A**			**A**	Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
AGRICULTURAL	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9					Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		85	22	36	85
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		12	3	5	13
NONE	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		7	7.3	7	6.5
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:	66%				
	Coenagrionidae	4					Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**						C. CAR					
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
NONE	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5		**A**		**A**	SWC = South Western Cape					
	Aeshnidae	8	**A**			**A**	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	**1**		**1**	**A**	Hydraenidae*	8					S = Stone & rock					
LIMITED RECENT DISTURBANCES	Libellulidae	4	**A**			**A**	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10	**1**		**1**		1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS4 – JUNE 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 02/06/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	PORIFERA	5					HEMIPTERA:						DIPTERA:					
S:°	COELENTERATA	1					Belostomatidae*	3					Athericidae	10				
E: °	TURBELLARIA	3					Corixidae*	3	A			A	Blepharoceridae	15				
SITE CODE: TS4	ANNELIDA:						Gerridae*	5					Ceratopogonidae	5				
RIVER:	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2				
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	CRUSTACEA:						Nepidae*	3					Dixidae*	10				
TEMP: 17.3 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 8.1	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M..veliidae*	5					Muscidae	1				
Cond: 14.2 mS/m	Palaemonidae	10					MEGALOPTERA:						Psychodidae	1				
BIOTOPES SAMPLED:	HYDRACARINA	8					Cordalidae	8					Simuliidae	5	A			A
SIC: TIME: minutes	PLECOPTERA:						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					TRICHOPTERA						Tabanidae	5				
BEDROCK:	Perlidae	12	A			A	Dipseudopsidae	10					Tipulidae	5	A			A
AQUATIC VEG: DOM SP:	EPHEMEROPTERA						Ecnomidae	8					GASTROPODA					
M VEGIC: DOM SP:	Baetidae 1sp	4			A	A	Hydropsychidae 1sp	4			A	A	Ancylidae	6				
M VEGOOC: DOM SP:	Baetidae 2 sp	6	A	A		B	Hydropsychidae 2 sp	6	B			B	Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12					Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND:	Caenidae	6	A			A	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13	A			A	Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW:	Leptophlebiidae	9					CASED CADDIS:						Thiaridae*	3				
TURBIDITY:	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					PELECYPODA					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9					Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					SASS SCORE:		76	11	19	89
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					NO OF TAXA:		11	2	4	14
	Chlorocyphidae	10					Petrothrincidae SWC	11					ASPT:		7	5.5	5	6.4
	Chlorolestidae	8					Pisuliidae	10					IHAS:		65%			
	Coenagrionidae	4					Sericostomatidae SWC	13					OTHER BIOTA:					
	Lestidae	8					COLEOPTERA:											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					COMMENTS:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5		A	A	B	SWC = South Western Cape					
	Aeshnidae	8					Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	A		B	B	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4	A			A	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10	A			A	1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS5 – APRIL 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 20/04/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3	**A**	**A**		**B**	Blepharoceridae	15				
SITE CODE: TS5	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER: INTU	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2	**A**		**B**	**B**
SITE DESCRIPTION: ABOVE CONFLUENCE	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION: WARM / CLEAR	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 23.3 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 8.68	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M.veliidae*	5		**A**		**A**	Muscidae	1				
Cond: 1 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1	**1**			**1**
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5				
SIC: 2 TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC: 0	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK: 0	Perlidae	12	**A**			**A**	Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: DOM SP:	Baetidae 1sp	4			**A**		Hydropsychidae 1sp	4	**A**			**A**	Ancylidae	6				
M VEG OOC: DOM SP:	Baetidae 2 sp	6	**B**				Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL: 4	Baetidae >2 sp	12		**B**		**B**	Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND: 3	Caenidae	6	**A**			**A**	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS: YES	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW: LOW	Leptophlebiidae	9					**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY: LOW	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9					Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		42	20	6	53
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		8	3	2	9
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		5	6.7	3	5.9
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:	44%				
	Coenagrionidae	4					Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5					SWC = South Western Cape					
	Aeshnidae	8	**A**			**A**	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6					Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4					Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS5 – JUNE 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 02/06/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	PORIFERA	5					HEMIPTERA:						DIPTERA:					
S:°	COELENTERATA	1					Belostomatidae*	3					Athericidae	10				
E: °	TURBELLARIA	3					Corixidae*	3		A		A	Blepharoceridae	15				
SITE CODE: TS5	ANNELIDA:						Gerridae*	5					Ceratopogonidae	5				
RIVER:	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2			A	A
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	CRUSTACEA:						Nepidae*	3					Dixidae*	10				
TEMP: 20.6 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 7.7	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M..veliidae*	5					Muscidae	1				
Cond: 14.3 mS/m	Palaemonidae	10					MEGALOPTERA:						Psychodidae	1				
BIOTOPES SAMPLED:	HYDRACARINA	8					Cordalidae	8					Simuliidae	5				
SIC: TIME: minutes	PLECOPTERA:						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					TRICHOPTERA						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	EPHEMEROPTERA						Ecnomidae	8					GASTROPODA					
MVEGIC: DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4					Ancylidae	6				
MVEGOOC: DOM SP:	Baetidae 2 sp	6		A	A	B	Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12					Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND:	Caenidae	6	A		A	B	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW:	Leptophlebiidae	9					CASED CADDIS:						Thiaridae*	3				
TURBIDITY:	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					PELECYPODA					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9					Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					SASS SCORE:		14	9	14	25
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					NO OF TAXA:		2	2	3	5
	Chlorocyphidae	10					Petrothrincidae SWC	11					ASPT:		7	4.5	5	5.0
	Chlorolestidae	8					Pisuliidae	10					IHAS:		51%			
	Coenagrionidae	4					Sericostomatidae SWC	13					OTHER BIOTA:					
	Lestidae	8					COLEOPTERA:											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					COMMENTS:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5					SWC = South Western Cape					
	Aeshnidae	8	1			1	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6					Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4					Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS6 – APRIL 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 19/04/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3		**A**		**A**	Blepharoceridae	15				
SITE CODE: TS6	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER: UNNAMED TRIB	Oligochaeta	1	**1**		**A**	**A**	Hydrometridae*	6					Chironomidae	2	**A**		**B**	**B**
SITE DESCRIPTION: REPRESENTATIVE	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 24.2 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 8.49	Potamonautidae*	3	**A**		**A**	**A**	Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M.veliidae*	5					Muscidae	1				
Cond: 0.8 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1				
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5				
SIC: 4 TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: 2 DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4					Ancylidae	6				
M VEG OOC: 3 DOM SP:	Baetidae 2 sp	6					Hydropsychidae 2 sp	6	**B**		**A**	**B**	Bulininae*	3				
GRAVEL: 4	Baetidae >2 sp	12	**B**	**B**		**B**	Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND: 3	Caenidae	6	**A**			**A**	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS: YES	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW: LOW	Leptophlebiidae	9	**A**	**A**		**A**	**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY: LOW	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	**A**			**A**	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		71	49	26	86
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		12	7	6	15
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		6	7.0	4	5.7
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:	70%				
	Coenagrionidae	4		**1**		**1**	Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5	**A**	**B**		**A**	SWC = South Western Cape					
	Aeshnidae	8	**A**	**1**	**A**	**A**	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	**A**		**A**	**B**	Hydraenidae*	8		**A**		**A**	S = Stone & rock					
	Libellulidae	4	**B**			**B**	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS6 – JUNE 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 02/06/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	PORIFERA	5					HEMIPTERA:						DIPTERA:					
S:°	COELENTERATA	1					Belostomatidae*	3					Athericidae	10				
E: °	TURBELLARIA	3					Corixidae*	3					Blepharoceridae	15				
SITE CODE: TS6	ANNELIDA:						Gerridae*	5					Ceratopogonidae	5				
RIVER:	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2	A			A
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	CRUSTACEA:						Nepidae*	3					Dixidae*	10				
TEMP: 20.1 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 7.1	Potamonautidae*	3	A			A	Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M..veliidae*	5					Muscidae	1				
Cond: 9.2 mS/m	Palaemonidae	10					MEGALOPTERA:						Psychodidae	1				
BIOTOPES SAMPLED:	HYDRACARINA	8					Cordalidae	8					Simuliidae	5	A			A
SIC: TIME: minutes	PLECOPTERA:						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					TRICHOPTERA						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5			A	A
AQUATIC VEG: DOM SP:	EPHEMEROPTERA						Ecnomidae	8					GASTROPODA					
M VEGIC: DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4					Ancylidae	6				
M VEGOOC: DOM SP:	Baetidae 2 sp	6	A	A	A	B	Hydropsychidae 2 sp	6	A		A	B	Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12					Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND:	Caenidae	6	A		1	A	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW:	Leptophlebiidae	9					CASED CADDIS:						Thiaridae*	3				
TURBIDITY:	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					PELECYPODA					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	A			A	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					SASS SCORE:		66	11	42	71
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					NO OF TAXA:		11	2	7	12
	Chlorocyphidae	10					Petrothrincidae SWC	11					ASPT:		6	5.5	6	5.9
	Chlorolestidae	8					Pisuliidae	10					IHAS:		69%			
	Coenagrionidae	4					Sericostomatidae SWC	13					OTHER BIOTA:					
	Lestidae	8					COLEOPTERA:						TADPOLES					
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					COMMENTS:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5	A	B	B	B	SWC = South Western Cape					
	Aeshnidae	8	B		A	B	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	A		A	B	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4					Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10	A			A	1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS7 – APRIL 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 21/04/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3					Blepharoceridae	15				
SITE CODE: LALENI U/S (TS7)	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER: TSITSA	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2	**A**		**A**	
SITE DESCRIPTION: UPPER LALENI DAM	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION: HOT / CLEAR	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 22.8 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 8.81	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M.veliidae*	5		**B**		**B**	Muscidae	1				
Cond: 1.4 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1				
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5	**1**			**1**
SIC: 5 TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12	**A**			**A**	Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: 1 DOM SP:	Baetidae 1 sp	4			**1**		Hydropsychidae 1 sp	4					Ancylidae	6				
M VEG OOC: 2 DOM SP:	Baetidae 2 sp	6					Hydropsychidae 2 sp	6	**B**			**B**	Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12	**B**	**A**		**B**	Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND: 3	Caenidae	6			**1**	**1**	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS: YES	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW: LOW	Leptophlebiidae	9					**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY: LOW	Oligoneuridae	15	**B**			**B**	Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15	**1**			**1**	Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9					Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		107	21	22	116
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		12	3	5	13
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		9	7.0	4	8.9
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:	71%				
	Coenagrionidae	4					Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8	**1**			**1**	* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5					SWC = South Western Cape					
	Aeshnidae	8					Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	**A**		**A**	**A**	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4	**B**	**1**	**A**	**B**	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12	**1**			**1**	Psephenidae	10	**A**			**A**	1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS7 – JUNE 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 03/06/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3		**A**	**A**	**B**	Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3	**A**			**A**	Blepharoceridae	15				
SITE CODE: TS7	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER:	Oligochaeta	1			**A**	**A**	Hydrometridae*	6					Chironomidae	2	**A**		**A**	**B**
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 12.1 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 7.8	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M..veliidae*	5		**A**	**A**	**B**	Muscidae	1				
Cond: 12.6 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1				
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5				
SIC: TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
MVEGIC: DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4	**1**			**1**	Ancylidae	6				
MVEGOOC: DOM SP:	Baetidae 2 sp	6	**A**			**A**	Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12			**A**	**A**	Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND:	Caenidae	6			**A**	**A**	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW:	Leptophlebiidae	9					**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY:	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15	**1**		**1**	**A**	Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9					Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		36	12	54	67
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		6	3	9	12
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		6	4.0	6	5.6
	Chlorolestidae	8					Pisuliidae	10					**IHAS:**		71%			
	Coenagrionidae	4		**A**	**1**	**A**	Sericostomatidae SWC	13					**OTHER BIOTA:**					
	Lestidae	8					**COLEOPTERA:**						TADPOLES					
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS:**					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5					SWC = South Western Cape					
	Aeshnidae	8					Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	**A**		**A**	**B**	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4					Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS8 – APRIL 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 17/04/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3	1		A	A	Blepharoceridae	15				
SITE CODE: TS8	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER: TSITSA	Oligochaeta	1					Hydrometridae*	6					Chironomidae	2				
SITE DESCRIPTION: NEAR LALENI WALL	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 22.8 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 8.79	Potamonautidae*	3					Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M.veliidae*	5					Muscidae	1				
Cond: 1.3 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1				
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5	B		A	B
SIC: 5 TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC: 3	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12	B			B	Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: 1 DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4					Ancylidae	6	1			1
M VEG OOC: 1 DOM SP:	Baetidae 2 sp	6		A	A		Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL: 3	Baetidae >2 sp	12	B			B	Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND: 2	Caenidae	6	A			A	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS: YES	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW: MEDIUM	Leptophlebiidae	9					**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY: LOW	Oligoneuridae	15	C			C	Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9					Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		87	6	14	87
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		11	1	3	11
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		8	6.0	5	7.9
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:	75%				
	Coenagrionidae	4					Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8	A			A	* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5					SWC = South Western Cape					
	Aeshnidae	8					Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	A			A	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4	B			B	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10	A			A	1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS8 – JUNE 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 03/06/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	PORIFERA	5					HEMIPTERA:						DIPTERA:					
S:°	COELENTERATA	1					Belostomatidae*	3					Athericidae	10				
E:°	TURBELLARIA	3					Corixidae*	3		A	A	B	Blepharoceridae	15				
SITE CODE: TS8 (DS)	ANNELIDA:						Gerridae*	5					Ceratopogonidae	5				
RIVER:	Oligochaeta	1	A		A	B	Hydrometridae*	6					Chironomidae	2			A	A
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	CRUSTACEA:						Nepidae*	3					Dixidae*	10				
TEMP: 20.1 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 7.6	Potamonautidae*	3					Pleidae*	4	A		A	B	Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M..veliidae*	5					Muscidae	1				
Cond: 12.3 mS/m	Palaemonidae	10					MEGALOPTERA:						Psychodidae	1				
BIOTOPES SAMPLED:	HYDRACARINA	8					Cordalidae	8					Simuliidae	5	A		A	B
SIC: TIME: minutes	PLECOPTERA:						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					TRICHOPTERA						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	EPHEMEROPTERA						Ecnomidae	8					GASTROPODA					
M VEGIC: DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4	A			A	Ancylidae	6				
M VEGOOC: DOM SP:	Baetidae 2 sp	6					Hydropsychidae 2 sp	6			A	A	Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12	A		A	B	Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND:	Caenidae	6					Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13	A	A	A	B	Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW:	Leptophlebiidae	9					CASED CADDIS:						Thiaridae*	3				
TURBIDITY:	Oligoneuridae	15	A		A	B	Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					PELECYPODA					
	Prosopistomatidae	15	A		A	B	Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9			A	A	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					SASS SCORE:		79	21	99	114
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					NO OF TAXA:		10	3	13	16
	Chlorocyphidae	10					Petrothrincidae SWC	11					ASPT:		8	7.0	8	7.1
	Chlorolestidae	8					Pisuliidae	10					IHAS:		76%			
	Coenagrionidae	4					Sericostomatidae SWC	13					OTHER BIOTA:					
	Lestidae	8					COLEOPTERA:											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					COMMENTS:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5		A		A	SWC = South Western Cape					
	Aeshnidae	8					Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6	A			A	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4	B		A	B	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10			A	A	1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS9 – APRIL 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 21/04/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3			**A**	**A**	Blepharoceridae	15				
SITE CODE: TS9	**ANNELIDA:**						Gerridae*	5	**1**			**1**	Ceratopogonidae	5				
RIVER:	Oligochaeta	1			**1**	**1**	Hydrometridae*	6					Chironomidae	2	**B**		**B**	**B**
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION: WARM / CLOUDY	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 19.4 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 8.78	Potamonautidae*	3	**A**			**A**	Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M.veliidae*	5					Muscidae	1				
Cond: 1.0 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1	**1**			**1**
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5	**A**			**A**
SIC: TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5				
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4	**A**			**A**	Ancylidae	6				
M VEG OOC: DOM SP:	Baetidae 2 sp	6	**B**			**B**	Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12					Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND:	Caenidae	6					Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW: LOW	Leptophlebiidae	9	**A**			**A**	**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY: LOW	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	**A**			**A**	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		61	0	6	65
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		12	0	3	14
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		5	0.0	2	4.6
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:	66%				
	Coenagrionidae	4					Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**											
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5	**A**			**A**	SWC = South Western Cape					
	Aeshnidae	8	**1**			**1**	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6					Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4	**1**			**1**	Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					

TS9 – JUNE 2014

RIVER HEALTH PROGRAMME - SASS 5 SCORE SHEET

DATE: 03/06/2014	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT	TAXON		S	VG	GSM	TOT
GRID REFERENCE:	**PORIFERA**	5					**HEMIPTERA:**						**DIPTERA:**					
S:°	**COELENTERATA**	1					Belostomatidae*	3					Athericidae	10				
E: °	**TURBELLARIA**	3					Corixidae*	3					Blepharoceridae	15				
SITE CODE: TS9	**ANNELIDA:**						Gerridae*	5					Ceratopogonidae	5				
RIVER:	Oligochaeta	1			1	1	Hydrometridae*	6					Chironomidae	2				
SITE DESCRIPTION:	Leeches	3					Naucoridae*	7					Culicidae*	1				
WEATHER CONDITION:	**CRUSTACEA:**						Nepidae*	3					Dixidae*	10				
TEMP: 8.8 °C	Amphipoda	13					Notonectidae*	3					Empididae	6				
Ph: 7.8	Potamonautidae*	3	A			A	Pleidae*	4					Ephydridae	3				
DO: mg/l	Atyidae	8					Veliidae/M..veliidae*	5		A	A	B	Muscidae	1				
Cond: 11.7 mS/m	Palaemonidae	10					**MEGALOPTERA:**						Psychodidae	1				
BIOTOPES SAMPLED:	**HYDRACARINA**	8					Cordalidae	8					Simuliidae	5				
SIC: TIME: minutes	**PLECOPTERA:**						Sialidae	6					Syrphidae*	1				
SOOC:	Notonemouridae	14					**TRICHOPTERA**						Tabanidae	5				
BEDROCK:	Perlidae	12					Dipseudopsidae	10					Tipulidae	5	A		A	A
AQUATIC VEG: DOM SP:	**EPHEMEROPTERA**						Ecnomidae	8					**GASTROPODA**					
M VEG IC: DOM SP:	Baetidae 1sp	4					Hydropsychidae 1sp	4	1			1	Ancylidae	6				
M VEG OOC: DOM SP:	Baetidae 2 sp	6	A	A	A	B	Hydropsychidae 2 sp	6					Bulininae*	3				
GRAVEL:	Baetidae >2 sp	12					Hydropsychidae >2 sp	12					Hydrobiidae*	3				
SAND:	Caenidae	6	A		1	A	Philopotamidae	10					Lymnaeidae*	3				
MUD:	Ephemeridae	15					Polycentropodidae	12					Physidae*	3				
HAND PICKING/VISUAL OBS:	Heptageniidae	13					Psychomyiidae/Xiphocen.	8					Planorbidae*	3				
FLOW:	Leptophlebiidae	9					**CASED CADDIS:**						Thiaridae*	3				
TURBIDITY:	Oligoneuridae	15					Barbarochthonidae SWC	13					Viviparidae* ST	5				
RIPARIAN LAND USE:	Polymitarcyidae	10					Calamoceratidae ST	11					**PELECYPODA**					
	Prosopistomatidae	15					Glossosomatidae SWC	11					Corbiculidae	5				
	Teloganodidae SWC	12					Hydroptilidae	6					Sphaeriidae	3				
	Tricorythidae	9	A			A	Hydrosalpingidae SWC	15					Unionidae	6				
	ODONATA:						Lepidostomatidae	10					**SASS SCORE:**		41	11	29	53
DISTURBANCE IN RIVER:	Calopterygidae ST,T	10					Leptoceridae	6					**NO OF TAXA:**		7	2	6	10
	Chlorocyphidae	10					Petrothrincidae SWC	11					**ASPT:**		6	5.5	5	5.3
	Chlorolestidae	8					Pisuliidae	10					**IHAS**:	68%				
	Coenagrionidae	4					Sericostomatidae SWC	13					**OTHER BIOTA**:					
	Lestidae	8					**COLEOPTERA:**						ALGAE ON ROCKS					
SIGNS OF POLLUTION:	Platycnemidae	10					Dytiscidae*	5					**COMMENTS**:					
	Protoneuridae	8					Elmidae/Dryopidae*	8					* = airbreathers					
	Zygoptera juvs.	6					Gyrinidae*	5					SWC = South Western Cape					
	Aeshnidae	8	1			1	Halipidae*	5					T = Tropical					
	Corduliidae	8					Helodidae	12					ST = Sub-tropical					
OTHER OBSERVATIONS:	Gomphidae	6			A	A	Hydraenidae*	8					S = Stone & rock					
	Libellulidae	4					Hydrophilidae*	5					VG = all vegetation					
	LEPIDOPTERA:						Limnichidae	10					GSM = gravel, sand & mud					
	Pyralidae	12					Psephenidae	10					1=1, A=2-10, B=10-100, C=100-1000, D=>1000					