Guidance on Application and Use of the SSRS in Enforcement of Urban Waste Water Discharge Authorisations in Ireland

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Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Authors and Acknowledgements

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1.1 Background

The Small Streams Risk Score (SSRS) is a biological risk assessment system for identifying rivers that are definitely 'at risk' of failing to achieve the 'good' water quality status goals of the Water Framework Directive (WFD). It was developed by the Environmental Protection Agency (EPA) in association with the Western River Basin District (WRBD) in 2006.

The main aim of the SSRS is to support the programme of measures for the WFD which has its main objective to achieve 'good' water quality status in all water bodies by 2015.

To date, the use of the SSRS monitoring tool has been widespread in terms of its potential in identifying key plants from EPA authorised wastewater facilities that are currently contributing to river pollution, particularly in the first and second order streams. The SSRS monitoring tool has been expanded and applied by other interested parties e.g. IPC/IED facilities, Fisheries and Local Authorities as an assessment tool to investigate impacts of point source and/or diffuse discharges from agricultural, industrial etc. sources and is not restricted to assessing discharges from Urban Wastewater Treatment Plants (UWWTPs) only.

This document outlines how the SSRS may be more extensively deployed as a key monitoring tool to effectively detect impact on water quality in smaller streams due to discharges from authorised wastewater discharges, particularly discharges from towns and villages which hold a Certificate of Authorisation (CoA). The licensing and certification authorisation process was introduced on a phased basis in December 2007 in accordance with the requirements of the Wastewater Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007).

1.2 Introduction to SSRS Methodology

The SSRS method is a rapid field methodology for risk assessment that is based solely on macroinvertebrate indicators of water quality and their well-understood response to pollution. The SSRS method is a method for defining streams that are 'at risk'. The method produces a continuous score and threshold values are used to decide on the degree of risk at a site. It is possible to compare 'before' and 'after' scores, which may be useful in assessing the potential impact of a development.

Advantages of SSRS system

- The assessment may be carried out by non-specialists after completing a training course;
- Very small streams can be sampled effectively;
- It assesses if a stream is **at risk** from pollution (Note: it does not indicate the ecological health of a stream);
- SSRS values can be compared from one year to the next provided they are taken within a short time (2 weeks) of each other in successive years.

Freshwater macroinvertebrates are visible to the human eye and can be found in the benthic environments in both rivers (river bed) and lakes (lake bed). Macroinvertebrates live in the water for all or part of their lives and therefore, their survival is directly related to the quality of the water in which they live. A change in the physical or chemical environment may change the composition and abundance of macroinvertebrate communities. In addition to being a suitable assessment tool, macroinvertebrates are also part of the aquatic food chain as primary consumers and are preyed upon by tertiary consumers such as fish and birds.

The EPA recommends using the SSRS when carrying out risk assessments of streams. The SSRS has a recognised training course which is provided by the Environmental Services Training Group (ESTG) as part of the various courses provided by the Local Authority Services National Training Group (LASNTG).

The training can be provided in any of the Regional Training Centers which are located in Ballincollig, Ballycoolen, Castlebar, Roscrea and Stranorlar. Contact www.wsntg.ie for details. A comprehensive manual is provided as part of the training. At least two SSRS Investigations must be performed by participants following completion of the course for quality control and assessment purposes and prior to successful registration on the approved EPA SSRS Assessors Register.

1.3 Application and future use

The SSRS is particularly useful for monitoring potential impacts on small first and second order streams and was incorporated into the National WFD Monitoring Programme in 2006 as a recommended investigative monitoring tool. In some instances SSRS monitoring is incorporated into specific Wastewater Discharge Licence conditions. It is important to note however, that CoA's which apply to smaller agglomerations do not provide for SSRS monitoring but specify that the discharge should not cause environmental pollution as defined under Article 3 of the Wastewater Discharge (Authorisation) Regulations, 2007. To date, the EPA has issued 526 CoA's and 411 licences. The CoA's issued to date typically require very limited self-monitoring (e.g. chemical monitoring twice per annum) and currently independent monitoring is not always carried out by the EPA to monitor performance at individual plants.

Establishing whether a discharge is causing environmental pollution is quite difficult to determine without appropriate monitoring data. The CoA holder is required under Condition 3.8 of the licence to carryout biannual sampling and analysis of the primary effluent discharge for BOD, COD and suspended solids. It is also recommended that an annual SSRS survey is performed in conjunction with the biannual chemical monitoring. This would help to identify streams and smaller rivers located within larger water bodies that are definitely 'at risk' of failing to achieve the 'good' water quality status goals of the Water Framework Directive (WFD). As a result, the information derived from using the SSRS monitoring tool can be used to support the development of much more focussed and effective monitoring programmes and investigations than is available under the current WWDL monitoring system.

Recent EPA wastewater reports (Focus on Urban Waste Water Reports 2012 and 2013) summarise the treatment provided for 525 Certificates of Authorisation sites. The reports highlight vulnerable receptors, specifically freshwater pearl mussel sites, adjacent designated shellfish waters and downstream drinking water abstraction points where waste water discharges may have a potential to impact upon. For wastewater discharges in these receptor areas, the Certificate of Authorisation holder are required to carry out assessments of the impact of the discharges, report on the assessment findings and implement recommendations.

For sites where this level of reporting is not required and for sites where information on the receiving water is lacking, the SSRS could be used as an efficient monitoring tool to assess impacts of discharges on vulnerable receptors. The SSRS monitoring tool can also be expanded further and applied by other relevant organisations for use as an assessment tool to investigate impacts of point source and/or diffuse discharges.

1.4 Example of the SSRS methodology used to assess impact of point source pollution from UWWTPs

1.4.1 OEE pilot project

In 2013, as part of the project, *Investigative Assessment and SSRS Monitoring at CoA Sites,* the Water Team in Castlebar worked with the Informatics Unit of the EPA in developing a database which captures detailed information including the level of treatment, sensitive receiving waters in terms of pearl mussel, shellfish and drinking water reporting required under the CoAs, ecological status or River Basin Districts.

An Information Database was interrogated to identify priority CoA sites based on potential for environmental damage. Criterion for inspection and SSRS monitoring at selected sites was developed (Table 1).

Table 1: National CoA figures and project CoA study sites

Criteria specified	Total number Nationally	Project study sites *
Pearl Mussel sites	53	6
Sites with no treatment	9	1
Water quality ≤ Q3 within 1km of primary discharge	17	6
Total number of CoAs nationally	526	

*CoAs located in Mayo, Galway, Longford, Sligo, Donegal, Westmeath, Leitrim, Roscommon and Cavan.

A list of CoA sites with the following criteria was selected by the EPA for further investigations:

1. Sites with no treatment
2. Sites discharging into Pearl Mussel areas
3. Sites where the water quality up to 1km downstream of the final discharge is ≤ Q3**

**A Q- Value of Q3 indicates poor water quality where the condition is unsatisfactory.

These three specific criteria were selected for this project however other criteria may be applied and are not restricted to those outlined above. For example, investigations may also include plants that are overloaded, plants discharging to Salmonid Rivers (Quality of Salmonid Waters Regulations, S.I. No. 84 of 1988) or plants with ongoing complaint issues. The criteria applied for investigative purposes are variable dependent on the environmental management objectives for a particular waterbody.

Two of the eight potential project study sites (as per Table 1), located in Co. Sligo, were selected by the OEE for this project. The overall performance of the treatment plants in terms of operation and control were assessed and investigative monitoring of the receiving water was carried out using the SSRS. The aim of the investigations in Sligo was to establish whether discharges from the wastewater treatment plants were impacting on the receiving environment by using the SSRS tool and reviewing supporting physico-chemical data. An audit of the plant performance was also completed and infrastructural deficits requiring improvement were examined.

1. **Bunnanaddan and Environs (A0305-01)** wastewater treatment plant was selected for further investigations as it met one of the projects site selection criteria i.e. the water quality of the receiving water is ≤ Q3 within 1km downstream of the final effluent discharge.
2. **Cloonacool and Environs (A0350-01)** was selected as the agglomeration discharges upstream of known pearl mussel (M*argaritifera margaritifera*) population. The pearl mussel site is approximately 15.7km downstream. Certificates of Authorisation (CoA) holders are required to carry out an assessment of the impact of discharges from the waste water works on the receiving pearl mussel habitats. Assessments should be carried out in consultation with sampling methodologies issued by the National Parks and Wildlife Service (NPWS).

As part of the overall audit at both sites, the following documents and records were reviewed with reference to the specific conditions of the CoAs:

1. Identification of improvement measures required to meet Surface Water Regulations (2009) and/or Groundwater Regulations (2010) (Condition 3.4)
2. Assessment of the sewerage system including identification of necessary improvements (Condition 3.6)
3. Documents associated with operation and maintenance of the plant
4. Effluent and ambient monitoring data where available
5. Site map

An SSRS survey was performed at upstream and downstream locations at both sites using the following methodology:

Brief methodology (Walsh, 2005) - The rapid technique encompasses the following:

- Site selection criteria including health and safety
- 2 minute kick sample using the “Travelling Kick Method”
- 1 minute stone wash
- weed sweep depending on the nature of the river
- sampler spends at least 20 minutes studying the contents of the sample tray to identify the macroinvertebrate types
- field sheet is filled out and SSRS score assigned based on the presence or absence of indicator macroinvertebrate taxa **(Appendix 1)**
- The SSRS scores are categorised as follows:
    i. >7.25 – stream ‘probably not at risk’
    ii. >6.5 to 7.25 – stream ‘probably at risk’
    iii. <6.5 stream ‘at risk’

Findings from the SSRS assessment show that the effluent discharges from both Bunnanaddan and Environs (A0305-01) and Cloonacool and Environs (A0350-01) wastewater treatment plants are not impacting negatively on their respective receiving waters. Maps outlining the site locations and the SSRS findings derived from the investigations in Sligo are detailed in Appendix 2, 3 and 4.

1.4.2 SSRS risk assessment – Bredagh River (Donegal)

There is currently no municipal wastewater treatment plant in Moville and discharges are directed to the Bredagh River and to Lough Foyle through numerous outfalls. The water quality status of the Bredagh River is routinely monitored by the EPA as part of their Biological River Quality Monitoring Programme and is also sampled and analysed by Donegal County Council. The receiving waters of the Bredagh River is recognised as a “Red Dot” site (i.e. seriously polluted site where there is pollution from a specific major activity, such as sewage discharge). Results indicate it is generally unpolluted in the upper reaches of the River but are seriously polluted through the town of Moville as a direct result of the discharge of untreated sewage and general lack of treatment currently in Moville.

The SSRS risk assessment (Appendix 4) carried out but the EPA in 2013 shows that the upper station sampled on the Bredagh (0200, Moglass Bridge) was “probably not at risk”. The sample contained two species of the Ephemeroptera (*Ecdyonurus* and *Ephemerella*) and one species of Plectopera (*Leuctra*). Both of these macroinvetebrate groups are generally sensitive indicator taxa and have intolerance to serious pollution. The lower station (0400, Bridge in Moville) was, however, “at risk” due to the impacts of the untreated sewage discharges at this location. The sample did not contain any sensitive Ephermeroptera taxa and the *Chironomus* genus (bioindicator of organic pollution) was confirmed. Sewage fungus was also noted at this location which is typical of organic pollutants associated with untreated sewage effluent.

The investigations performed in the Bredagh River in February 2013, are a classic example of how effective the SSRS can be used as a monitoring tool to detect differences in upstream and downstream macroinvertebrate composition and to identify plants that are currently contributing to river pollution.

1.5 Considerations when performing SSRS assessments:

1.5.1 Sampling location

The location of where the SSRS monitoring is to be performed in a river is a critical consideration when attempting to determine impacts from wastewater treatment plant discharges. The exact location of the discharge pipe must be determined before sampling commences e.g. emanating from the river bank or mid-channel via a diffuser, as these characteristics are important in the determination of the mixing zone.

The mixing zone is an area where an effluent discharge undergoes initial dilution and is extended to cover the secondary mixing in the ambient waterbody. A mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented (Directive 2008/105/EC). The water quality criteria must be met at the edge of the mixing zone. Ideally the SSRS should be carried out below the mixing zone to ensure that adequate mixing of the effluent has occurred.

For CoA sites where improvements have being implemented as a result of the certification process, then proximity to the discharge where the residual impact is detectable may give a more sensitive means of gauging trends in performance of the plant and provide better management information for the plant operator.

Both an upstream and downstream SSRS should generally be completed. Ideally locations having similar habitat characteristics should be selected and sampled as far as practicable, so that differences in scores can be meaningfully compared and the likely impact of the discharges be assessed.

The distance downstream of the WWTP is a critical factor when engaging in SSRS monitoring. The improvements following the wastewater license/authorisation process and programme of measures, if any, will be much clearer as the SSRS score improves from a lower score to a higher score. Further downstream, the influence of the discharge may be less obvious owing to dilution from other streams or impacts from other discharges and it may not be so clear if changes are resulting from the measures that are being put in place itself or due to other factors.

Accessibility and Health and Safety (H&S) are always important issues when it comes to river water quality monitoring. The nearest bridge or safe access point may not always be the perfect scientific answer but logistics and H&S are key factors to address. The nearest convenient downstream location that is comparable with a similar upstream control may be the best in the end regardless of whether it is or outside the mixing zone.

1.5.2 Sampling period

The SSRS system should be performed within the same time period e.g. within two or three weeks from year to year to compare like with like. If the plant is a poor performer then a series of winter samples will give a more sensitive indicator of improvements over time from year to year.

A poorly performing wastewater treatment plant may cause deterioration in receiving waters giving a low SSRS score and therefore improvements due to investment measures may be more easily determined with winter sampling. The maximum SSRS score is higher during winter due to the expected occurrence of a higher number of sensitive scoring taxa during this season.

If discharges from a plant are not significantly impacting on the water quality, then a summer sample provides an opportunity to detect deterioration (or improving) trends in the receiving watercourse at an earlier stage, owing to a higher level of precision with sampling during this season. Relative change is more obvious during summer as average SSRS scores are inherently lower owing to the expected lower number of stonefly and mayfly taxa present. The impact of discharges will generally be greater during summer owing to higher temperature and low flows. A slight deterioration in the operation of a WWTP may deplete the summer taxa reducing the score to the ‘at risk’ category and would therefore be more noticeable in summer as opposed to winter due the greater resilience in winter as a result of the combined effect of flow volume and life cycles. Seasonal sampling choice depends therefore on the purpose of the assessment and the management requirements for the individual sites.

Summary of SSRS guidelines:

- Perform SSRS monitoring as instructed by trainer during the winter season as it has a wider scoring range.
- If sampling during other seasons, ensure that samples are taken within two or three weeks to enable annual comparisons to be made.
- SSRS Sampling distance: the nearest convenient access point downstream of the mixing point; often 150-250 metres downstream of the primary discharge. Sampling may be performed closer to the final effluent discharge point where access is otherwise prohibited. Operators should be mindful of other discharges and other tributaries that may contribute pollution to or dilute any potential effects.
- The upstream control is also important as there may be upstream pollution in many instances.
- Take the location of all storm water overflows into consideration when selecting sampling sites.
- Review the results and then categorise them into high risk and low risk and consider changes required to the sampling season and/or sampling location depending on the risk.
- Take a grab sample of the river water upstream and downstream of the final effluent to assess the key physico-chemical parameters.
- Carry out an audit of the WWTP to assess plant performance as outlined in section 1.4.

1.6 References:

European Communities Environmental Objectives (Surface Waters) Regulations, 2009, S.I. No. 272 of 2009.

European Communities Environmental Objectives (Groundwater) Regulations, 2010, S.I. No. 9 of 2010.

Focus on Urban Waste Water Treatment in 2012, EPA 2012.

Focus on Urban Waste Water Treatment in 2013, EPA 2013.

Quality of Salmonid Waters Regulations, S.I. No. 84 of 1988

Summary of Urban Waste Water Treatment provided at areas subject to a Certificate of Authorisation, EPA (2012).

Technical Guidelines for the Identification OF Mixing Zones pursuant to Art. 4(4) of the Directive 2008/105/EC

Wastewater Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007).

1.6.1 Aids to Identification

A pollution Investigation Tool for Use in the Field, Small Stream Risk Score (SSRS) Training Manual (2009) published by White Young Green (Ireland).

Further Characterisation of Small Streams and Development of a New Small Stream Risk Score (SSRS) Project Output Report. Western River Basin District Project (2007), Unpublished.

Small Stream Risk Score Method Manual. Western River Basin District Project (2005) Unpublished.

Appendix 1 – Specimen SSRS field sheet
Appendix 2 – Summary of SSRS findings
Appendix 3 – GIS maps of project sites
Appendix 4 – Completed SSRS field sheets

Appendix 1

River:	Code:	Date:	Time:
Station no.	Location:		Grid (6 figure):
	Stream Order:		Stream flow: Riffle, Riffle/Glide, Slow flow

Field Chemistry

DO%	
DO mg/l	
Temp (°C)	
Conductivity	
pH	
Bank width (cm)	
Wet width (cm)	
Avg Depth (cm)	
Staff gauge	

Velocity	Colour
Torrential	None
Fast	Slight
Moderate	Moderate
Slow	High
Very slow	

Clarity	Discharge
Very clear	Flood
Clear	Normal
Slightly turbid	Low
Highly turbid	Very Low
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:
Bedrock
Boulder (>128mm)
Cobble (32-128mm)
Gravel (8-32mm)
Fine Gravel (2-8mm)
Sand (0.25-2mm)
Silt (<0.25mm)

Slope: Low – Medium – High – Very High

Shading: High – Moderate – Low - None

Geology: Calcareous-Siliceous-Mixed

Substratum Condition: Calcareous-Compacted-Loose - Normal

Cattle access Y: upstream – downstream or N

Substratum:
Stoney bottom-Muddy bottom-Mud over stones

Photo: Y / N

Degree of siltation: Clean-Slight-Moderate-Heavy

Depth of mud: None: <1cm: 1-5cm: 5-10cm: >10cm

Litter: None – Present – Moderate - Abundant

Filamentous Algae:
None – Present – Moderate - Abundant

Sewage Fungus:
None – Present – Moderate - Abundant

Main land use u/s:
Pasture | Urban
Bog | Tillage
Forestry | Other

Sample retained:
Y / N

Sampled in Minutes:
Pond net x
Stone wash x
Weed sweep x

General Comments:

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

Relative Abundance

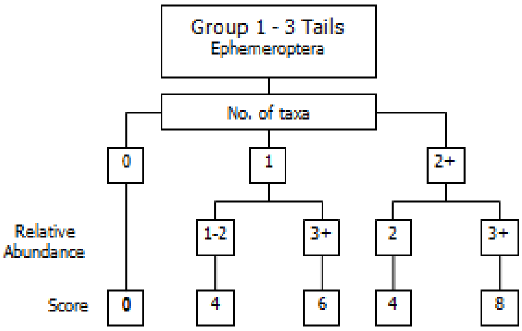
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

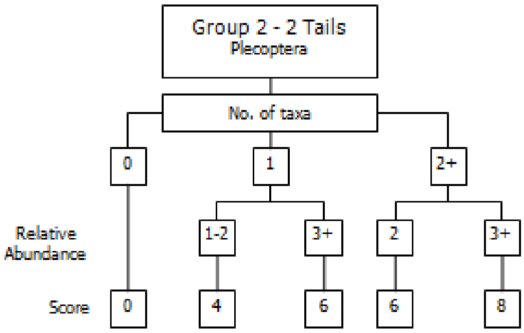
Ephemeroptera:		Plecoptera:	
Ecdyonurus Ab		*Leuctra* Ab	
Rhithrogena Ab		*Isoperla* Ab	
Heptagenia Ab		*Protonemura* Ab	
Ephemerella Ab		*Amphinemura* Ab	
Caenis Ab		*Perla* Ab	
Paraleptophlebia Ab		*Dinocras* Ab	
Ephemera danica Ab		Other Plecop Ab	
Other Ephem Ab		Other Plecop Ab	
Total no. of taxa	Total Relative Abundance	Total no. of Taxa	Total Relative Abundance

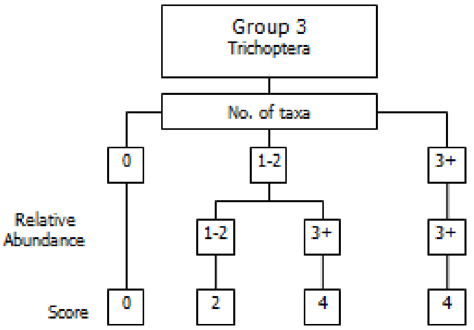
Trichoptera:		G.OL.D:				*Asellus*:
Hydropsychidae Ab		*Lymnaea* (G) Ab		Chironomidae (D) Ab		Absent
Polycentropodidae Ab		*Potamopyrgus* (G) Ab		*Chironomus* (D) Ab		Few (1-20)
Rhyacophila Ab		*Planorbis* (G) Ab		Simuliidae (D) Ab		Common (>20)
Philopotamidae Ab		*Ancylus* (G) Ab		*Dicranota* (D) Ab		
Limnephilidae Ab		*Physa* (G) Ab		Tipulidae (D) Ab		
Sericostomatidae Ab		*Lumbriculus* (Ol) Ab		Ceratopogonidae (D) Ab		**NOTE:** *Asellus* must be recorded as absent if none are found
Glossosomatidae Ab		*Eiseniella* (Ol) Ab		Other GOLD Ab		
Lepidostomatidae Ab		Tubificidae (Ol) Ab				
Other Trichoptera Ab						
Total no. of Taxa	Total Relative Abundance	Total no. of Taxa		Total Relative Abundance		

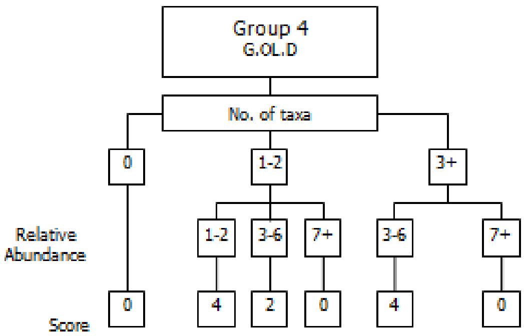
NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

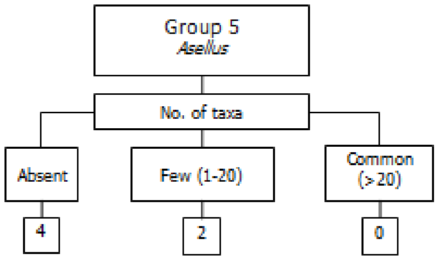
Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.











Step 2

a) Index Score Group 1	
b) Index Score Group 2	
c) Index Score Group 3	
d) Index Score Group 4	
e) Index Score Group 5	

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e)		Average Index Score (AIS) TIS/5 (5 for 5 groups)		**SSR Score** (AIS x 2)	

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk		> 6.5 – 7.25 Indeterminate Stream may be at risk		<6.5 Stream at risk	

Surveyor (signed): ____________________ Name (print): ______________________ Date: ______/______/_______

Appendix 2

Site inspections of Cert of Authorisation sites in Sligo:

Bunnanaddan and Environs (A0305-01):

Discharges from the agglomeration in Bunnanaddan are directed to the Owengarve River (35B08) in Sligo. The agglomeration is serviced by a waste water treatment plant which was upgraded in October 2013 and provides adequate treatment for the current loading. This site was selected for further assessment based on meeting one of the projects site selection criteria i.e. the water quality of the receiving water ≤ Q3 within 1km downstream of the final effluent discharge. The Q-value was derived from an assessment performed in 2012 in the Owengarve River approximately 200m downstream of the final effluent discharge point (station No. 0200).

The SSRS monitoring was performed as per SSRS Method 2005 (and 2009) on 08/10/2014, approximately 180m upstream of the final effluent discharge point (X: 159820, Y: 311805) and approximately 200m downstream of the final effluent discharge point (X: 160029, Y: 312054). Details of the SSRS assessment were recorded in an SSRS field sheet (see SSRS field sheets in Appendix 4). A grab sample of the river was also taken at both locations to establish background concentrations for physico-chemical parameters. Both sets of data were used for comparative purposes to ascertain whether discharges from the treatment plants were adversely impacting on the Owengarve River.

It was noted that the Dissolved Oxygen concentration was 32% and 67% upstream and downstream respectively which is particularly low. Concentrations at unpolluted sites would typically be between 85%-100%. Elevated ammonia was noted in samples taken at the upstream (0.25 mg N/l) and downstream (0.18 mg N/l) locations and do not meet the Surface Water Regulation (2009) requirements for 'good' water quality status for this parameter. Influences from other point or diffuse sources in the catchment may be contributory factors, however, a further review was outside the scope of this project. Analytical results show that the discharges from the treatment plant are not impacting on the Owenmore River.

Findings from the SSRS risk assessment showed that the river was deemed 'at risk' at both upstream and downstream locations based on the macroinvertebrate composition found. There were no Ephemeroptera (mayflies) or Plecoptera (stoneflies) in the sample and low numbers of Trichoptera (caddis flies). The Owengare River is significantly influenced by groundwater with a Spring well located 800m upstream of the station 35B080200 which may explain the low dissolved oxygen and potentially altered macroinvertebrate community which leads to a low SSRS.

The findings show that the river falls into the 'at risk' SSRS category of failing to achieve 'Good' WFD status by 2015, both upstream and downstream of the final effluent discharge point and indications show that this 'failure' is more than likely due to groundwater influences observed at these locations. It must be emphasised that the SSRS is solely a method for defining streams that are <u>at risk</u>. It can place a stream into the 'definitely at risk' category but cannot confirm that a stream is not at risk because a wider range of biological elements and chemical data are required to provide a full WFD status. The SSRS scheme was not designed to consider typology, or the ‘expected’ community for different river types. This case study illustrates the benefit of sampling at a control station upstream of the discharge, so that these additional factors can be controlled for. Additional information and datasets on the catchment, its characteristics and from chemical analysis are also useful when interpreting the results.

Cloonacool and Environs (A0350-01):

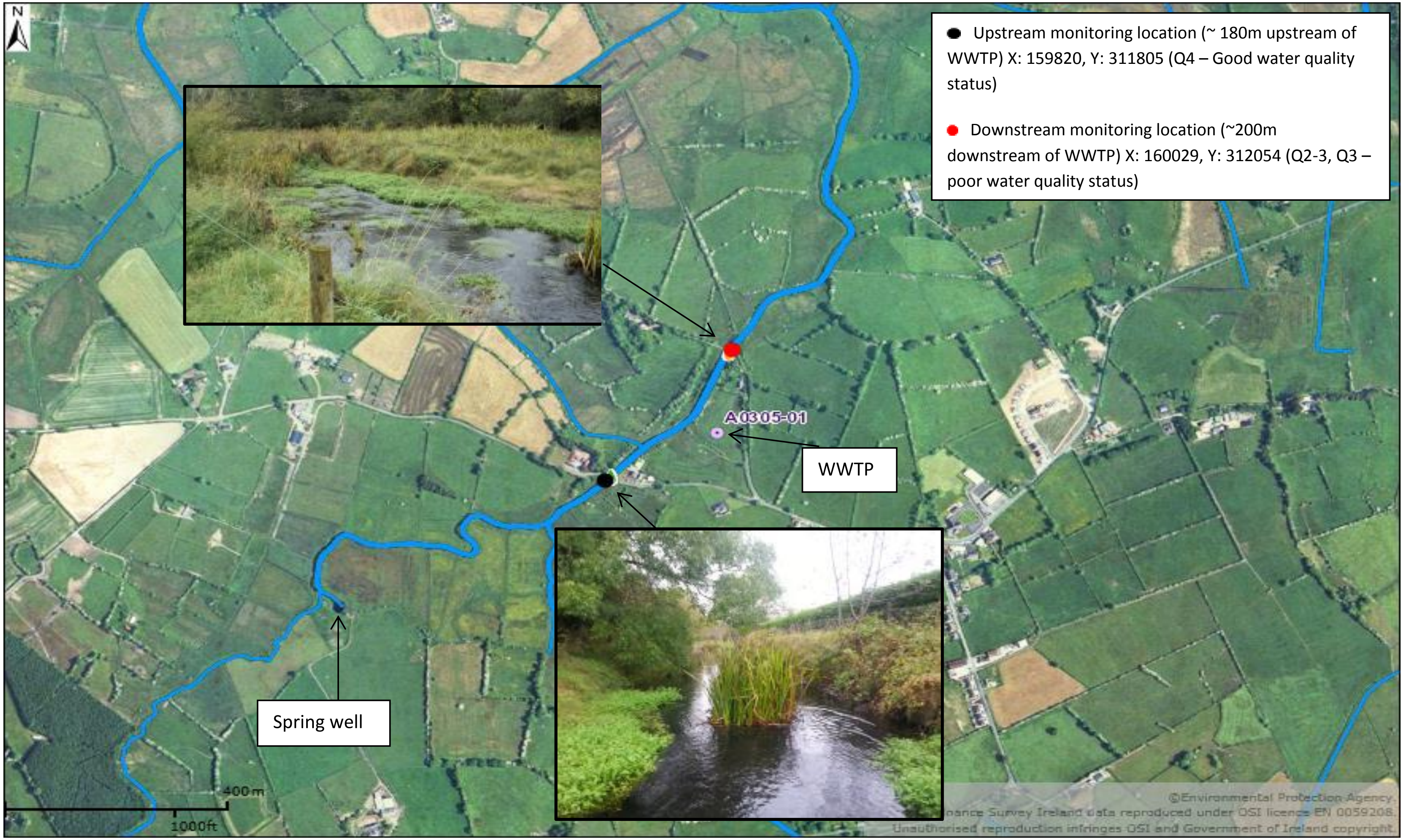
Discharges from the agglomeration in Cloonacool are directed to the River Moy (35M02) in Sligo. The agglomeration is serviced by a waste water treatment plant which provides secondary treatment with phosphorus removal, consisting of screening, anoxic tanks, aeration tanks, clarification and has a design capacity of 500 p.e. The agglomeration currently has a population equivalent of 169 p.e. This site was selected for further investigation as the agglomeration is discharging upstream of an area known for the presence of the pearl mussel (*Margaritifera margaritifera*). The pearl mussel site is approximately 15.7km downstream.

The SSRS monitoring was performed as per SSRS Method 2005 (and 2009) on 8th October 2014, approximately 200m upstream of the final effluent discharge point at an established EPA monitoring station (35M020200, X: 149314, Y: 316793) and approximately 70m downstream of the final effluent discharge point (X: 149176, Y: 316668)). The SSRS was carried out downstream of a riffled area to ensure good mixing of the final effluent had taken place. A water sample was taken to establish the background chemical concentrations at both upstream and downstream locations. The dissolved oxygen concentration was 102% saturation at both sites. It important to note that access further downstream of this location was not possible due to difficult terrain. Details of the SSRS assessment were recorded in an SSRS field sheet (see SSRS field sheet in Appendix 4).

The findings show that the river falls into the ‘probably not at risk’ SSRS category, both upstream and downstream of the final effluent discharge point. The River Moy had a Q-Value status of the Q4 in 2013 at station 0200, the same location where the SSRS monitoring was performed for this investigation. The sample contained three species from the Ephemeroptera (*Ecdyonurus*, *Rhithrogena* and *Heptagenia*) and two species of Plectopera (*Leuctra* and *Isoperla*). Both of these macroinvetebrate groups are generally sensitive indicators and have intolerance to pollutants. The macroinvertebrate composition was of a similar nature in the downstream sample.

The results of the SSRS assessment and review of supporting physico-chemical data carried out upstream and downstream of the final effluent discharge point at Cloonacool WWTP, show that the river was in a satisfactory condition. The investigation verifies that discharges from the WWTP were not impacting on the River Moy at these locations. It must be emphasised that at the time of the site visit, the licensee did not have information in relation to the locations of the storm water overflows within the agglomeration, therefore the effects of any potential impacts on the receiving environment could not be investigated.

Appendix 3



Bunnanadan and Environs WWTP (A0305-01) showing upstream and downstream monitoring locations.

Cloonacool and Environs WWTP (A0350-01) showing upstream and downstream monitoring locations.

Appendix 4

Bunnanaddan + Environs WWTP; A305-01

River: Owengarve	**Code:** 35G08	**Date:** 8/10/2014	**Time:** 13:50 hrs
Station no. 0200	**Location:** ~200m d/s WWTP, just u/s Bridge		**Grid (6 figure):** IG-60029, R054
	Stream Order: 4		**Stream flow:** Riffle / Riffle/Glide / Slow flow

Field Chemistry		**Modifications:** Y/N Canalised-widened-bank erosion-arterial drainage	
DO%	67%	**Dominant Types:**	
DO mg/l		Bedrock	
Temp (°C)	9.9°C	Boulder (>128mm)	
Conductivity		Cobble (32-128mm)	
pH		Gravel (8-32mm)	
Bank width (cm)	12 – 15 m	Fine Gravel (2-8mm)	
Wet width (cm)	8 – 9 m	Sand (0.25-2mm)	
Avg Depth (cm)	0.2 m	Silt (<0.25mm)	
Staff gauge		**Slope:** Low – Medium – High – Very High	**Shading:** High – Moderate – Low – None
Velocity	**Colour**	**Geology:** Calcareous-Siliceous-Mixed Coarse Sandstone	
Torrential	None	**Substratum Condition:** Calcareous-Compacted-Loose - Normal in places	**Cattle access** Y: upstream – downstream or N
Fast	Slight		
Moderate	Moderate	**Substratum:**	
Slow	High	Stoney bottom-Muddy bottom-Mud over stones in places	**Photo:** Y / N
Very slow		**Degree of siltation:** Clean-Slight-Moderate-Heavy	
Clarity	**Discharge**	**Depth of mud:** None: <1cm: 1-5cm: 5-10cm: >10cm	
Very clear	Flood		
Clear	Normal	**Litter:** None – Present – Moderate - Abundant	
Slightly turbid	Low	**Filamentous Algae:** None – Present – Moderate - Abundant	**Sewage Fungus:** None – Present – Moderate - Abundant
Highly turbid	Very Low	**Main land use u/s:** Pasture, Urban, Bog, Tillage, Forestry, Other — **Sample retained:** Y / N	**Sampled in Minutes:** Pond net x 3 minutes
	Dry		Stone wash x 1 minute
	Recent Flood		Weed sweep x

General Comments:
Sampled downstream of WWTP (previous EPA monitoring station - not on programme anymore). No mayflies or stoneflies. Gammarus dominant but not as much as upstream sample. Small no. of Baetis.

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

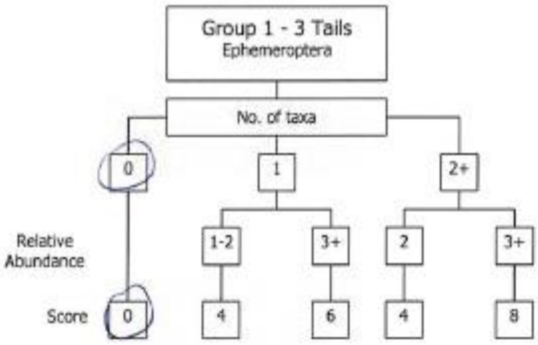
Relative Abundance	
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

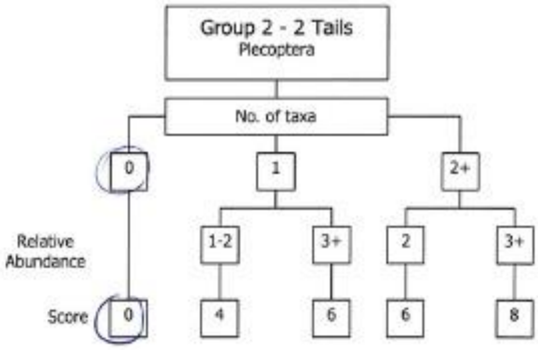
Ephemeroptera:		**Plecoptera:**	
Ecdyonurus Ab		*Leuctra* Ab	
Rhithrogena Ab		*Isoperla* Ab	
Heptagenia Ab		*Protonemura* Ab	
Ephemerella Ab		*Amphinemura* Ab	
Caenis Ab		*Perla* Ab	
Paraleptophlebia Ab		*Dinocras* Ab	
Ephemera danica Ab		Other Plecop Ab	
Other Ephem Ab		Other Plecop Ab	
Total no. of taxa 0	Total Relative Abundance 0	Total no. of Taxa	Total Relative Abundance 0

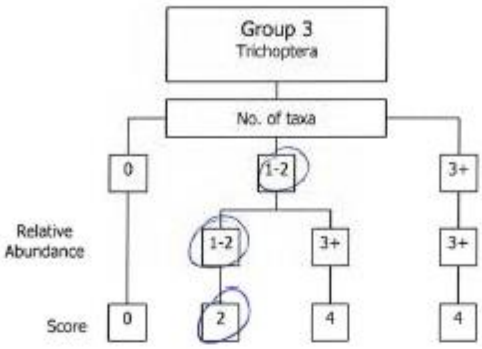
Trichoptera:		**G.OL.D:**				***Asellus*:**	
Hydropsychidae Ab		*Lymnaea* (G) Ab		Chironomidae (D) Ab	1	Absent	✓
Polycentropodidae Ab		*Potamopyrgus* (G) Ab		*Chironomus* (D) Ab		Few (1-20)	
Rhyacophila Ab		*Planorbis* (G) Ab		Simuliidae (D) Ab		Common (>20)	
Philopotamidae Ab		*Ancylus* (G) Ab		*Dicranota* (D) Ab			
Limnephilidae Ab		*Physa* (G) Ab		Tipulidae (D) Ab	1		
Sericostomatidae Ab		*Lumbriculus* (Ol) Ab		Ceratopogonidae (D) Ab	1		
Glossosomatidae Ab		*Eiseniella* (Ol) Ab		Other GOLD Ab		**NOTE:** *Asellus* must be recorded as absent if none are found	
Lepidostomatidae Ab	2	Tubificidae (Ol) Ab	1				
Other Trichoptera Ab							
Total no. of Taxa 1	Total Relative Abundance 2	Total no. of Taxa	4	Total Relative Abundance	4		

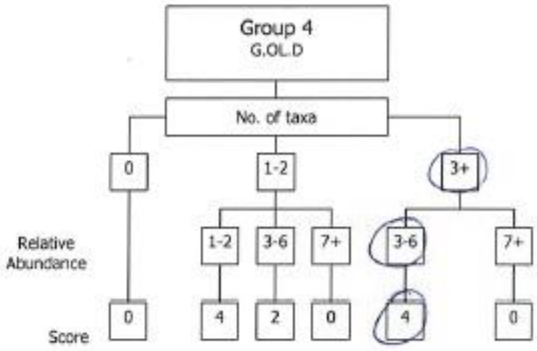
NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

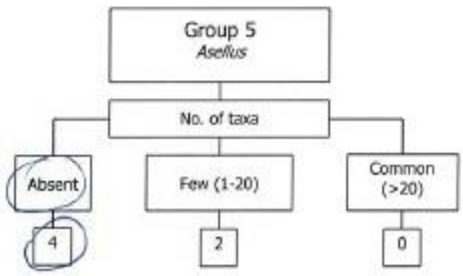
Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.











Step 2

a) Index Score Group 1	0
b) Index Score Group 2	0
c) Index Score Group 3	2
d) Index Score Group 4	4
e) Index Score Group 5	4

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e)	10	Average Index Score (AIS) TIS/5 (5 for 5 groups)	2	**SSR Score** (AIS x 2)	4

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk		> 6.5 – 7.25 Indeterminate Stream may be at risk		<6.5 Stream at risk	4 ✓

Surveyor (signed): Aisling Ryan Name (print): Aisling Ryan Date: 8 / 10 / 2014

Bunnaraddan & Environs A305-01

River: Owengarve	**Code:** 35B08	**Date:** 8-10-2014	**Time:** 11.15am
Station no. 1st bridge u/s ~~NWTP~~ (~ 180m)	**Location:** Just d/s of Bridge		**Grid (6 figure):** IG59820, IG11865
	Stream Order: 3		**Stream flow:** Riffle – Riffle/Glide – Slow flow

Field Chemistry	
DO%	32%
DO mg/l	
Temp (°C)	9.6°C
Conductivity	
pH	
Bank width (cm)	10 m
Wet width (cm)	9 m
Avg Depth (cm)	0.18 m
Staff gauge	

Velocity	Colour
Torrential	None
Fast	Slight
Moderate	Moderate
Slow	High
Very slow	
Clarity	**Discharge**
Very clear	Flood
Clear	Normal
Slightly turbid	Low
Highly turbid	Very Low
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:
Bedrock ✓
Boulder (>128mm) ✓
Cobble (32-128mm) ✓
Gravel (8-32mm) ✓
Fine Gravel (2-8mm)
Sand (0.25-2mm)
Silt (<0.25mm)

Slope: Low – Medium – High – Very High

Geology: Calcareous-Siliceous-Mixed Coarse Sandstone

Substratum Condition: Calcareous-Compacted-Loose-Normal

Substratum: Stoney bottom-Muddy bottom-Mud over stones

Degree of siltation: Clean-Slight-Moderate-Heavy

Depth of mud: None: <1cm: 1-5cm: 5-10cm: >10cm

Litter: None – Present – Moderate - Abundant

Shading: High – Moderate – Low – None

Cattle access Y: upstream – downstream or N

Photo: Y / N

Filamentous Algae: None – Present – Moderate - Abundant

Sewage Fungus: None – Present – Moderate - Abundant

Main land use u/s: Pasture, Urban, Bog, Tillage, Forestry, Other

Sample retained: Y / N

Sampled in Minutes:
Pond net x 3 minutes
Stone wash x 1 minute
Weed sweep x

General Comments:
Total dominance of Gammarus, completely abundant. Lots of Moss in River. possible ground water influence – to check/investigate further.

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

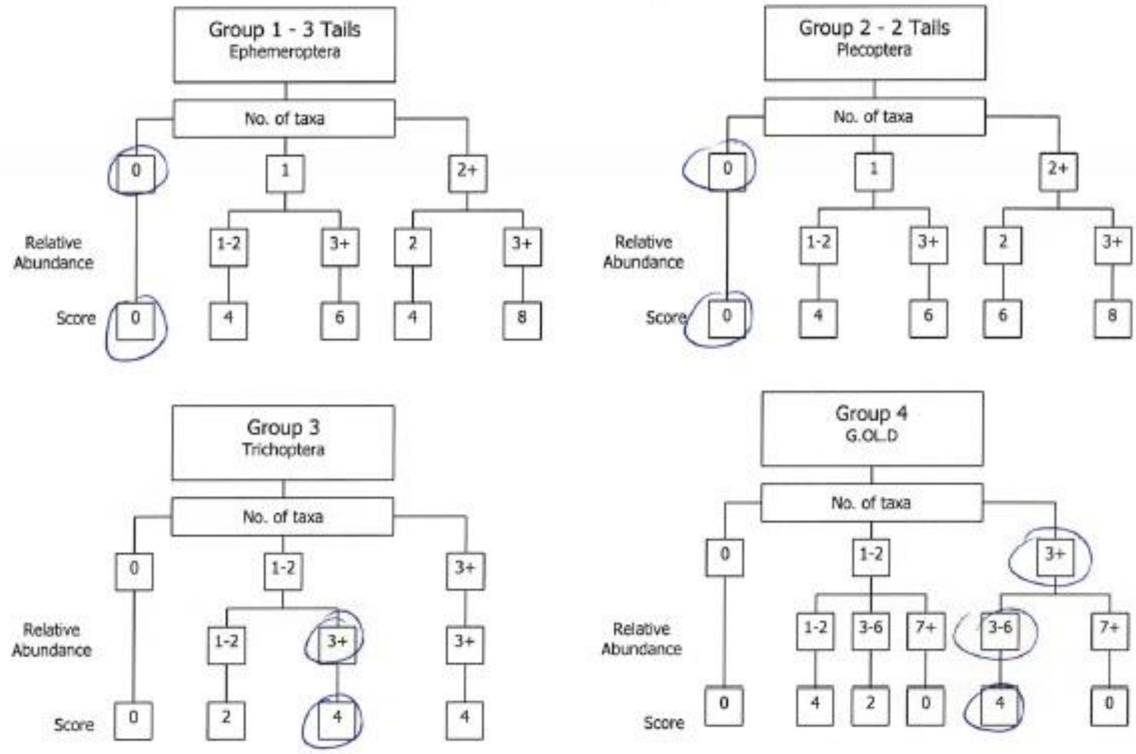
Relative Abundance	
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

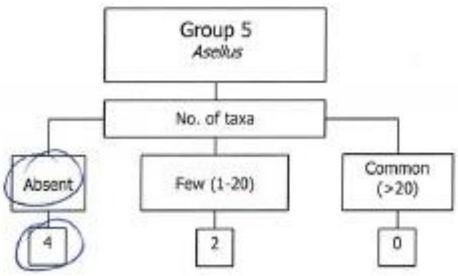
Ephemeroptera:		Plecoptera:	
Ecdyonurus Ab		*Leuctra* Ab	
Rhithrogena Ab		*Isoperla* Ab	
Heptagenia Ab		*Protonemura* Ab	
Ephemerella Ab		*Amphinemura* Ab	
Caenis Ab		*Perla* Ab	
Paraleptophlebia Ab		*Dinocras* Ab	
Ephemera danica Ab		Other Plecop Ab	
Other Ephem Ab		Other Plecop Ab	
Total no. of taxa: 0 / Total Relative Abundance	0	Total no. of Taxa: 0 / Total Relative Abundance	0

Trichoptera:		G.OL.D:				Asellus:	
Hydropsychidae Ab		*Lymnaea* (G) Ab		Chironomidae (D) Ab		Absent	✓
Polycentropodidae Ab		*Potamopyrgus* (G) Ab		*Chironomus* (D) Ab		Few (1-20)	
Rhyacophila Ab		*Planorbis* (G) Ab		Simuliidae (D) Ab		Common (>20)	
Philopotamidae Ab		*Ancylus* (G) Ab		*Dicranota* (D) Ab			
Limnephilidae Ab		*Physa* (G) Ab		Tipulidae (D) Ab			
Sericostomatidae Ab		*Lumbriculus* (Ol) Ab		Ceratopogonidae (D) Ab		**NOTE:** *Asellus* must be recorded as absent if none are found	
Glossosomatidae Ab		*Eiseniella* (Ol) Ab		Other GOLD Ab			
Lepidostomatidae Ab		Tubificidae (Ol) Ab					
Other Trichoptera Ab							
Total no. of Taxa: 2 / Total Relative Abundance	3	Total no. of Taxa	5	Total Relative Abundance	5		

NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.





Step 2

a) Index Score Group 1	0
b) Index Score Group 2	0
c) Index Score Group 3	4
d) Index Score Group 4	4
e) Index Score Group 5	4

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e) 12

Average Index Score (AIS) TIS/5 (5 for 5 groups) 2·4

SSR Score (AIS x 2) 4·8

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk	> 6.5 – 7.25 Indeterminate Stream may be at risk	<6.5 Stream at risk
		4·8

Surveyor (signed): Aisling Ryan Name (print): AisLinG RyAN Date: 8 / 10 / 2014

Cloonacool + Environs : Downstream location

River: Moy	**Code:** 34M02	**Date:** 8/10/2014	**Time:** 16.17hrs
Station no. 0150	**Location:** 50m d/s outfall pipe		**Grid (6 figure):** IN49176, IN16608
	Stream Order: 5		**Stream flow:** Riffle / Riffle/Glide / Slow flow

Field Chemistry	
DO%	102%
DO mg/l	
Temp (°C)	10.3°C
Conductivity	
pH	
Bank width (cm)	12-15m
Wet width (cm)	12-15m
Avg Depth (cm)	0.5m
Staff gauge	

Velocity	**Colour**
Torrential	None
Fast	Slight
Moderate	Moderate
Slow	High
Very slow	
Clarity	**Discharge**
Very clear	Flood
Clear	Normal
Slightly turbid	Low
Highly turbid	Very Low
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:
Bedrock
Boulder (>128mm) ✓
Cobble (32-128mm) ✓
Gravel (8-32mm) ✓
Fine Gravel (2-8mm) ✓
Sand (0.25-2mm)
Silt (<0.25mm)

Slope: Low – Medium – High – Very High

Geology: Calcareous-Siliceous-Mixed

Substratum Condition: Calcareous-Compacted-Loose-Normal

Substratum: Stoney bottom-Muddy bottom-Mud over stones

Degree of siltation: Clean-Slight-Moderate-Heavy

Depth of mud: None: <1cm: 1-5cm: 5-10cm: >10cm

Litter: None – Present – Moderate – Abundant

Filamentous Algae: None – Present – Moderate - Abundant

Main land use u/s: Pasture, Bog, Forestry, Urban, Tillage, Other

Sample retained: Y / N

Shading: High – Moderate – Low – None

Cattle access Y: upstream – downstream or N

Photo: Y / N

Sewage Fungus: None – Present – Moderate - Abundant

Sampled in Minutes:
Pond net x 2 1/2 minutes
Stone wash x 1/2 minute
Weed sweep x

General Comments:
0150 Station Q value 3K d/s = Q4-5 in 2013. Safest access point on the day of assessment was ~ 70m d/s final effluent pipe.

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

Relative Abundance	
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

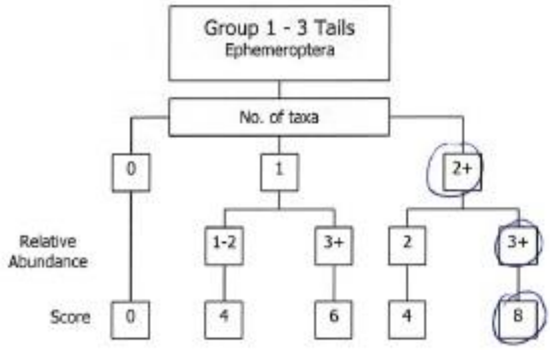
Ephemeroptera:		**Plecoptera:**	
Ecdyonurus Ab	2	*Leuctra* Ab	1
Rhithrogena Ab	2	*Isoperla* Ab	
Heptagenia Ab	2	*Protonemura* Ab	1
Ephemerella Ab	1	*Amphinemura* Ab	
Caenis Ab	1	*Perla* Ab	
Paraleptophlebia Ab		*Dinocras* Ab	
Ephemera danica Ab		Other Plecop Ab	
Other Ephem Ab		Other Plecop Ab	
Total no. of taxa 5 / **Total Relative Abundance**	8	**Total no. of Taxa** 2 / **Total Relative Abundance**	2

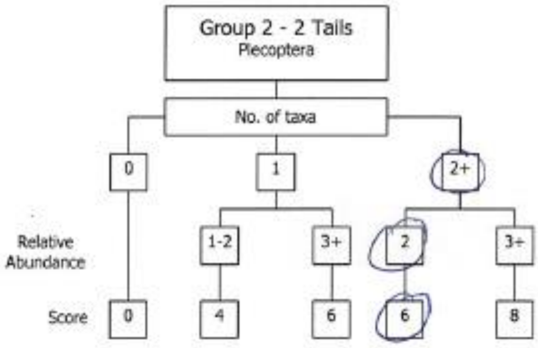
Trichoptera:		**G.OL.D:**				***Asellus*:**	
Hydropsychidae Ab	1	*Lymnaea* (G) Ab	1	Chironomidae (D) Ab	1	Absent	✓
Polycentropodidae Ab		*Potamopyrgus* (G) Ab	1	*Chironomus* (D) Ab		Few (1-20)	
Rhyacophila Ab	1	*Planorbis* (G) Ab		Simuliidae (D) Ab		Common (>20)	
Philopotamidae Ab		*Ancylus* (G) Ab		*Dicranota* (D) Ab			
Limnephilidae Ab	2	*Physa* (G) Ab		Tipulidae (D) Ab			
Sericostomatidae Ab		*Lumbriculus* (Ol) Ab		Ceratopogonidae (D) Ab			
Glossosomatidae Ab		*Eiseniella* (Ol) Ab		Other GOLD Ab			
Lepidostomatidae Ab		Tubificidae (Ol) Ab	1				
Other Trichoptera Ab							
Total no. of Taxa 3 / **Total Relative Abundance**	4	**Total no. of Taxa**	4	**Total Relative Abundance**	4		

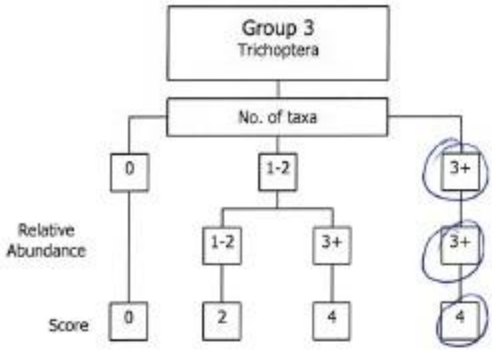
NOTE: *Asellus* must be recorded as absent if none are found

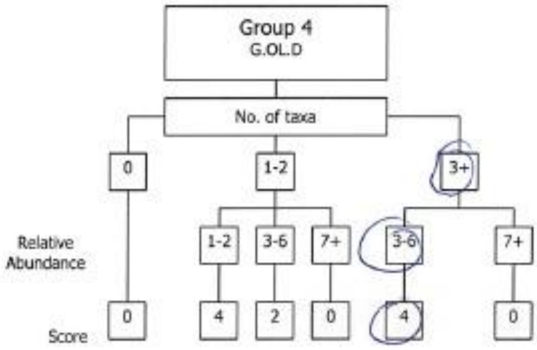
NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

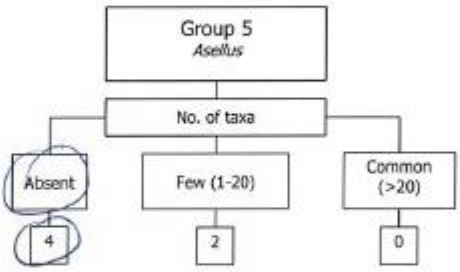
Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.











Step 2

a) Index Score Group 1	8
b) Index Score Group 2	6
c) Index Score Group 3	4
d) Index Score Group 4	4
e) Index Score Group 5	4

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e)	26	Average Index Score (AIS) TIS/5 (5 for 5 groups)	5·2	**SSR Score** (AIS x 2)	10·4

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk	10·4	> 6.5 – 7.25 Indeterminate Stream may be at risk		<6.5 Stream at risk	

Surveyor (signed): Aisling Ryan Name (print): Aisling Ryan Date: 8 / 10 / 2014

Cloonacool and Environs WWTP : A0350-01
(Q4 in 2013)

River: Moy	**Code:** 34M02	**Date:** 8-10-2014	**Time:** 15.35 hrs
Station no. 0200 (U/S of WWTP outfall)	**Location:** 25-30m d/s Bridge		**Grid (6 figure):** IG49314, IG16793
	Stream Order: 5		**Stream flow:** Riffle / Riffle/Glide / Slow flow

Field Chemistry	
DO%	102%
DO mg/l	
Temp (°C)	9.9°C
Conductivity	
pH	
Bank width (cm)	12-15m
Wet width (cm)	12-15m
Avg Depth (cm)	0.35m
Staff gauge	

Velocity	**Colour**
Torrential	None
Fast	Slight
Moderate	Moderate
Slow	High
Very slow	

Clarity	**Discharge**
Very clear	Flood
Clear	Normal
Slightly turbid	Low
Highly turbid	Very Low
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:
Bedrock
Boulder (>128mm)
Cobble (32-128mm) ✓✓
Gravel (8-32mm) ✓
Fine Gravel (2-8mm) ✓
Sand (0.25-2mm) ✓
Silt (<0.25mm)

Slope: Low – Medium – High – Very High

Geology: Calcareous-Siliceous-Mixed

Substratum Condition: Calcareous-Compacted-Loose-Normal

Substratum: Stoney bottom-Muddy bottom-Mud over stones

Degree of siltation: Clean-Slight-Moderate-Heavy

Depth of mud: None: <1cm: 1-5cm: 5-10cm: >10cm

Litter: None – Present – Moderate - Abundant

Filamentous Algae: None – Present – Moderate - Abundant

Main land use u/s: Pasture, Bog, Forestry, Urban, Tillage, Other

Sample retained: Y/N

Shading: High – Moderate – Low – None

Cattle access Y: upstream – downstream or N

Photo: Y / N

Sewage Fungus: None – Present – Moderate - Abundant

Sampled in Minutes:
Pond net x 2 1/2 mins
Stone wash x 1/2 min
Weed sweep x

General Comments:
Sampled approximately 25-30 m d/s of Bridge. Storm water overflow pipe joins the final effluent pipe and enters the river. Coke test & MLSS carried out twice a month. Ferric dosing on site. 3x per week.

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

Relative Abundance	
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

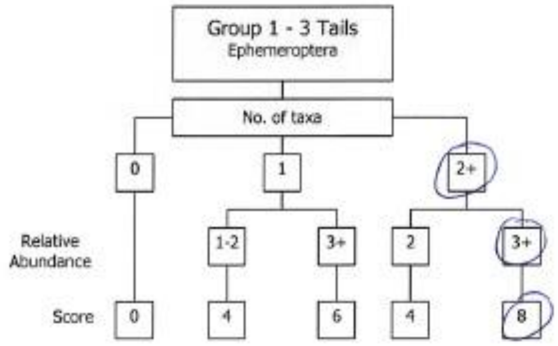
Ephemeroptera:		**Plecoptera:**	
Ecdyonurus Ab	2	*Leuctra* Ab	0
Rhithrogena Ab	2	*Isoperla* Ab	1
Heptagenia Ab	2	*Protonemura* Ab	
Ephemerella Ab	2	*Amphinemura* Ab	
Caenis Ab	2	*Perla* Ab	
Paraleptophlebia Ab		*Dinocras* Ab	
Ephemera danica Ab		Other Plecop Ab	
Other Ephem Ab		Other Plecop Ab	
Total no. of taxa: 5 / Total Relative Abundance	10	Total no. of Taxa: 1 / Total Relative Abundance	1

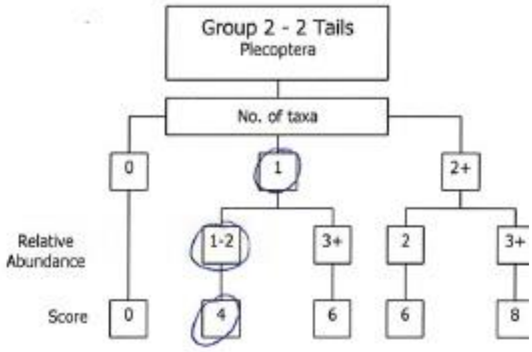
Trichoptera:		**G.OL.D:**				***Asellus*:**	
Hydropsychidae Ab	1	*Lymnaea* (G) Ab		Chironomidae (D) Ab	1	Absent	✓
Polycentropodidae Ab		*Potamopyrgus* (G) Ab	1	*Chironomus* (D) Ab		Few (1-20)	
Rhyacophila Ab	1	*Planorbis* (G) Ab		Simuliidae (D) Ab		Common (>20)	
Philopotamidae Ab		*Ancylus* (G) Ab		*Dicranota* (D) Ab			
Limnephilidae Ab		*Physa* (G) Ab		Tipulidae (D) Ab	1		
Sericostomatidae Ab		*Lumbriculus* (Ol) Ab	1	Ceratopogonidae (D) Ab			
Glossosomatidae Ab		*Eiseniella* (Ol) Ab	1	Other GOLD Ab			
Lepidostomatidae Ab		Tubificidae (Ol) Ab	1				
Other Trichoptera Ab							
Total no. of Taxa: 2 / Total Relative Abundance	2	Total no. of Taxa	6	Total Relative Abundance	6		

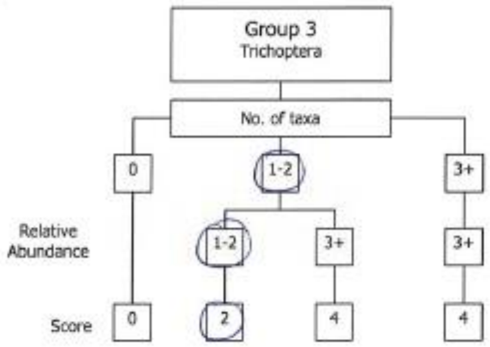
NOTE: *Asellus* must be recorded as absent if none are found

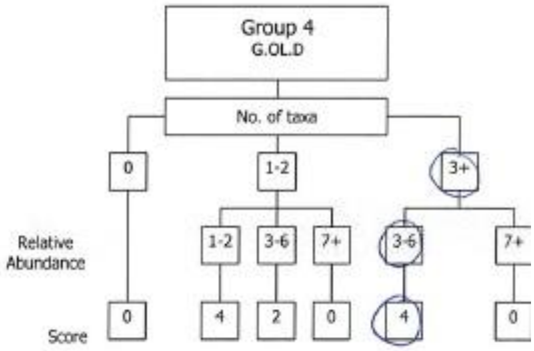
NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

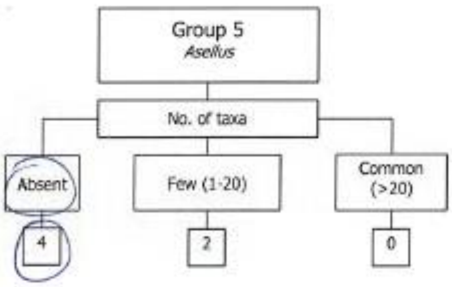
Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.











Step 2

a) Index Score Group 1	8
b) Index Score Group 2	4
c) Index Score Group 3	2
d) Index Score Group 4	4
e) Index Score Group 5	4

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e): 22	Average Index Score (AIS) TIS/5 (5 for 5 groups): 4.4	**SSR Score** (AIS x 2): 8.8

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk: 8.8	> 6.5 – 7.25 Indeterminate Stream may be at risk:	<6.5 Stream at risk:

Surveyor (signed): Aisling Ryan Name (print): AiSLinG RyAN Date: 8 / 10 / 2014

River: Bredagh	Code: 40B02	Date: 27/02/2013	Time: 16:15
Station no. 0200	Location: MOGLASS BRIDGE		Grid (6 figure): 258225 442596
	Stream Order: 2		Stream flow: ~~Riffle~~ Riffle/Glide ~~Slow flow~~

Field Chemistry	
DO%	99.8
DO mg/l	9.1
Temp (°C)	18.0
Conductivity	87
pH	7.1
Bank width (cm)	250
Wet width (cm)	150
Avg Depth (cm)	15
Staff gauge	
Velocity	**Colour**
Torrential	None
Fast	Slight
Moderate	Moderate
Slow	High
Very slow	
Clarity	**Discharge**
Very clear	Flood
Clear	Normal
Slightly turbid	Low
Highly turbid	Very Low
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:
Bedrock
Boulder (>128mm)
Cobble (32-128mm) 50.0%
Gravel (8-32mm) 30.0%
Fine Gravel (2-8mm) 20.%
Sand (0.25-2mm)
Silt (<0.25mm)

Slope: Low – Medium – High – Very High

Geology: Calcareous-Siliceous-Mixed

Substratum Condition: Calcareous-Compacted-Loose - Normal

Substratum:
Stoney bottom-Muddy bottom-Mud over stones

Degree of siltation: Clean-Slight-Moderate-Heavy

Depth of mud: None: <1cm: 1-5cm: 5-10cm: >10cm

Litter: None – Present – Moderate - Abundant

Filamentous Algae:
None – Present – Moderate - Abundant

Main land use u/s:
Pasture Urban
Bog Tillage
Forestry Other

Sample retained: Y / N

Shading: High – Moderate – Low – None

Cattle access Y: upstream – downstream or N

Photo: Y / N

Sewage Fungus:
None – Present – Moderate - Abundant

Sampled in Minutes:
Pond net x 2 min
Stone wash x 1 min
Weed sweep x 0

General Comments:
Water was high colour

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

Relative Abundance	
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

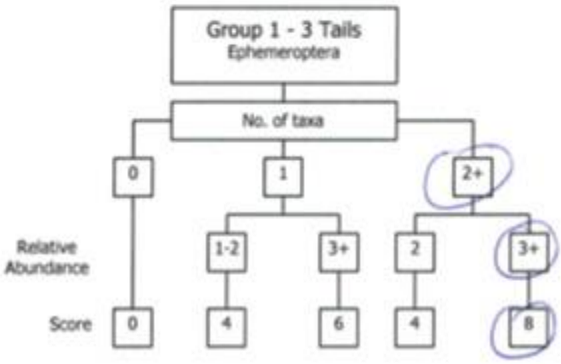
Ephemeroptera:		Plecoptera:	
Ecdyonurus Ab	1	*Leuctra* Ab	4
Rhithrogena Ab		*Isoperla* Ab	
Heptagenia Ab		*Protonemura* Ab	
Ephemerella Ab	2	*Amphinemura* Ab	
Caenis Ab		*Perla* Ab	
Paraleptophlebia Ab		*Dinocras* Ab	
Ephemera danica Ab		Other Plecop Ab	
Other Ephem Ab		Other Plecop Ab	
Total no. of taxa	2	Total no. of Taxa	1
Total Relative Abundance	3	Total Relative Abundance	4

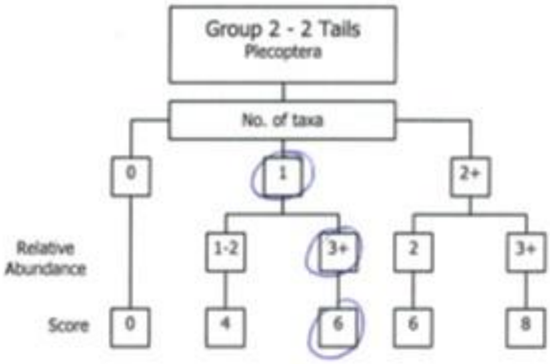
Trichoptera:		G.OL.D:				*Asellus*:	
Hydropsychidae Ab	1	*Lymnaea* (G) Ab		Chironomidae (D) Ab	1	Absent	✓
Polycentropodidae Ab	1	*Potamopyrgus* (G) Ab		*Chironomus* (D) Ab		Few (1-20)	
Rhyacophila Ab	1	*Planorbis* (G) Ab		Simuliidae (D) Ab	1	Common (>20)	
Philopotamidae Ab		*Ancylus* (G) Ab		*Dicranota* (D) Ab	1		
Limnephilidae Ab		*Physa* (G) Ab		Tipulidae (D) Ab			
Sericostomatidae Ab		*Lumbriculus* (Ol) Ab		Ceratopogonidae (D) Ab			
Glossosomatidae Ab		*Eiseniella* (Ol) Ab		Other GOLD Ab			
Lepidostomatidae Ab		Tubificidae (Ol) Ab	1				
Other Trichoptera Ab							
Total no. of Taxa	3	Total no. of Taxa	4				
Total Relative Abundance	3	Total Relative Abundance	4				

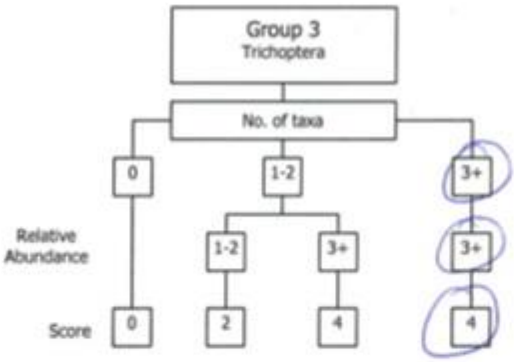
NOTE: *Asellus* must be recorded as absent if none are found

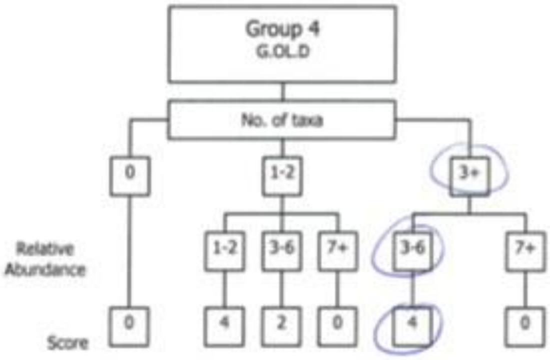
NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

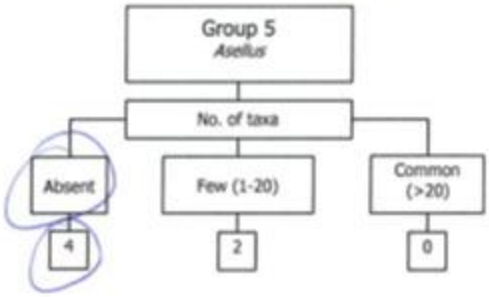
Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.











Step 2

a) Index Score Group 1	8
b) Index Score Group 2	6
c) Index Score Group 3	4
d) Index Score Group 4	4
e) Index Score Group 5	4

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e) 26

Average Index Score (AIS) TIS/5 (5 for 5 groups) 5.2

SSR Score (AIS x 2) 10.4

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk ✓

> 6.5 – 7.25 Indeterminate Stream may be at risk

<6.5 Stream at risk

River: BREDAGH	**Code:** 40B02	**Date:** 24/02/2013	**Time:** 16:55
Station no. 0400	**Location:** Bridge in MOVILLE		**Grid (6 figure):** 261059 438402

Stream Order: 3

Field Chemistry	
DO%	96.0
DO mg/l	8.9
Temp (°C)	18.0
Conductivity	237
pH	8.1
Bank width (cm)	600
Wet width (cm)	550
Avg Depth (cm)	20
Staff gauge	

Velocity	Colour
Torrential	None
Fast	Slight
Moderate	Moderate
Slow	High
Very slow	
Clarity	**Discharge**
Very clear	Flood
Clear	Normal
Slightly turbid	Low
Highly turbid	Very Low
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:

Bedrock	
Boulder (>128mm)	7.5
Cobble (32-128mm)	32.5
Gravel (8-32mm)	20.0
Fine Gravel (2-8mm)	20.0
Sand (0.25-2mm)	10.0
Silt (<0.25mm)	10.0

Slope: Low – Medium – High – Very High

Geology: Calcareous-Siliceous-Mixed

Substratum Condition: Calcareous-Compacted-Loose - Normal

Substratum: Stoney bottom-Muddy bottom-Mud over stones

Degree of siltation: Clean-Slight-Moderate-Heavy

Depth of mud: None: <1cm: 1-5cm: 5-10cm: >10cm

Litter: None – Present – Moderate – Abundant

Filamentous Algae: None – Present – Moderate - Abundant

Main land use u/s: Pasture, Bog, Forestry, Urban, Tillage, Other

Sample retained: Y/N

Stream flow: Riffle, Riffle/Glide, Slow flow

Shading: High – Moderate – Low - None

Cattle access Y: upstream – downstream or N

Photo: Y / N

Sewage Fungus: None – Present – Moderate - Abundant

Sampled in Minutes:
Pond net x 20 min
Stone wash x 1.0 min
Weed sweep x —

General Comments:
River smell is significant. A lot of slime and sewage fungus clogging the net. Chironomus ID confirmed here.

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

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- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

Relative Abundance	
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

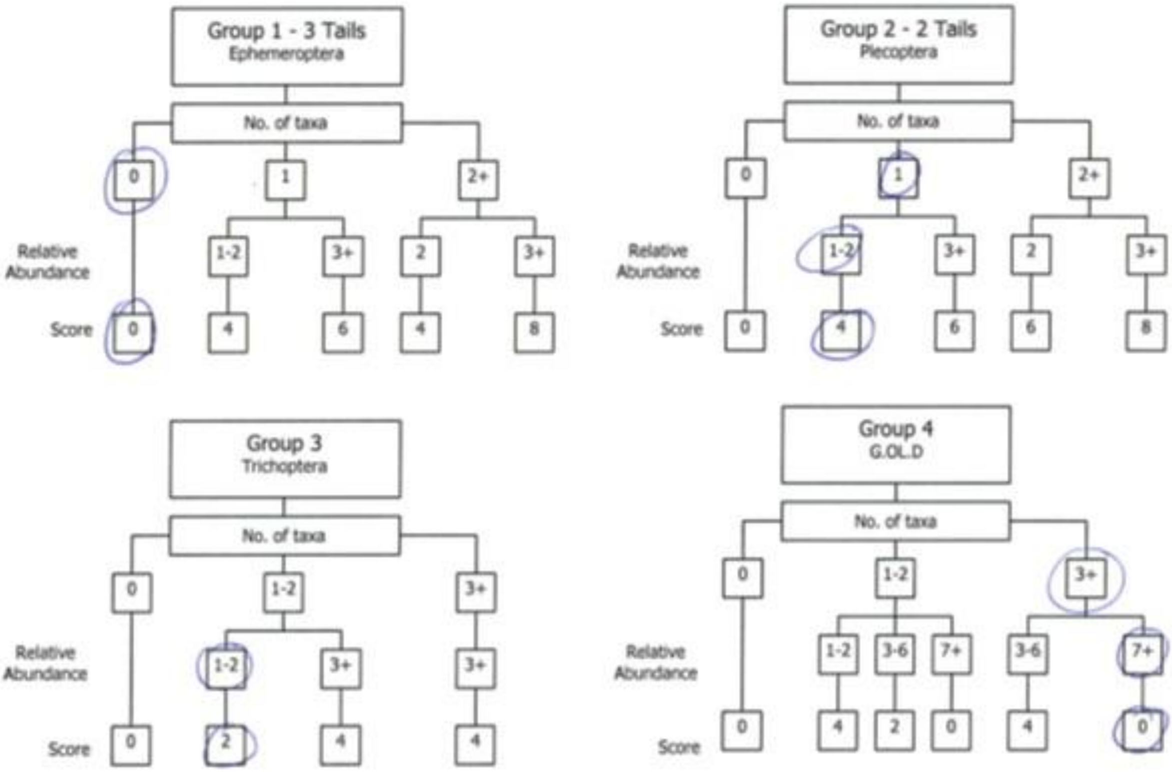
Ephemeroptera:		Plecoptera:	
Ecdyonurus Ab		*Leuctra* Ab	2
Rhithrogena Ab		*Isoperla* Ab	
Heptagenia Ab		*Protonemura* Ab	
Ephemerella Ab		*Amphinemura* Ab	
Caenis Ab		*Perla* Ab	
Paraleptophlebia Ab		*Dinocras* Ab	
Ephemera danica Ab		Other Plecop Ab	
Other Ephem Ab		Other Plecop Ab	
Total no. of taxa: 0	Total Relative Abundance: 0	Total no. of Taxa: 1	Total Relative Abundance: 2

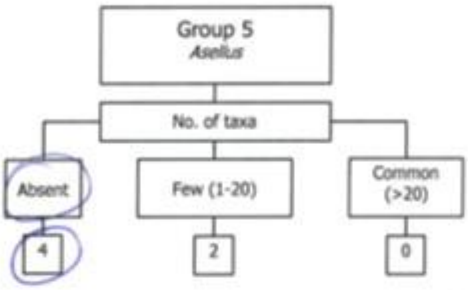
Trichoptera:		G.OL.D:				*Asellus*:	
Hydropsychidae Ab		*Lymnaea* (G) Ab		Chironomidae (D) Ab	1		
Polycentropodidae Ab		*Potamopyrgus* (G) Ab	1	*Chironomus* (D) Ab	1	Absent	✓
Rhyacophila Ab	1	*Planorbis* (G) Ab		Simuliidae (D) Ab		Few (1-20)	
Philopotamidae Ab		*Ancylus* (G) Ab	1	*Dicranota* (D) Ab		Common (>20)	
Limnephilidae Ab		*Physa* (G) Ab		Tipulidae (D) Ab			
Sericostomatidae Ab		*Lumbriculus* (Ol) Ab		Ceratopogonidae (D) Ab			
Glossosomatidae Ab		*Eiseniella* (Ol) Ab		Other GOLD Ab	1		
Lepidostomatidae Ab		Tubificidae (Ol) Ab	5				
Other Trichoptera Ab							
Total no. of Taxa: 1	Total Relative Abundance: 1	Total no. of Taxa: 6		Total Relative Abundance: 10			

NOTE: *Asellus* must be recorded as absent if none are found

NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.





Step 2

a) Index Score Group 1	0
b) Index Score Group 2	4
c) Index Score Group 3	2
d) Index Score Group 4	0
e) Index Score Group 5	4

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e) 10

Average Index Score (AIS) TIS/5 (5 for 5 groups) 2

SSR Score (AIS x 2) 4

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk ☐

> 6.5 – 7.25 Indeterminate Stream may be at risk ☐

<6.5 Stream at risk ☑