1. Introduction and scope

This procedure covers installation and deployment of stream temperature dataloggers.

2. Principle of the method

Each temperature datalogger must be setup with consistent details such as time intervals, site naming conventions, GMT and absolute start time. Once setup is complete the datalogger is placed within a white plastic tube to shield it from direct sunlight and attached to permanently fixed metalwork in the stream.

3. Reference materials

N/A

4. Reagents

N/A

5. Equipment

Computer with access to FLEObs database with Tinytag Explorer software version 4.8 installed
Tinytag Aquatic 2 dataloggers
Inductive download pad ACS 3030
Angle Iron
Dexion
White plastic shielding
13mm spanners
Stainless steel bolts and locking nuts (M6 bolt 80mm length (X1), M8 set screw 30mm (X3), M6 nylon self locking nuts (X1), M8 nylon self locking nuts (X2), M8 nuts (X1), M8 Spring washers (X2), M6 penny washers (X1), M8 penny washers (X3) (number in brackets is the number required per installation)
Sledge hammer
Pinch bar
Eye protection and gloves
MR-88 anchor system
Hand held drive steel HDR-88
Iron chain links (weighting)
5mm wire
Camera for site photos

6. Environmental control

N/A

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7. **Interferences**

N/A

8. **Sampling and sample preparation**

N/A

9. **Analytical procedure**

9.1 **Site selection**

9.1.1 Select the site, by ensuring the logger will be in a position which means it will be collecting data which is representative of the stream water through the section, for example:

- In the main flow, avoiding any inflows.
- In a position which will remain submerged throughout the year.
- In a position which has a flow of water through the area (avoiding slack water or stagnant pools)

9.1.2 Consideration of access issues in terms of being able to install and download the loggers with the minimum of risk to staff is also a factor in selecting the site, along with access agreements from landowners.

9.1.3 The nature of the stream substrate is also worth considering in terms of being able to fix the equipment to the bed (avoid bedrock and blanket peat where possible).

9.2 **Installation: wadeable gravel bed rivers**

9.2.1 Using a sledgehammer knock a pinch bar into the stream substrate to test bed suitability. Drive the pinch bar into the bed as far as possible rotating the bar as it goes in to open up the hole. When a hole has been made to a suitable depth, (approximately 1 metre) slide the angle iron down the pinch bar and push into the hole as the pinch bar is removed. Knock the angle iron into the stream bed using a sledgehammer, taking care to protect eyes when doing so. Ideally the angle iron will be placed so that the surface with the holes drilled in it is perpendicular to the flow of water. Ideally knock the angle iron in to just below the bottom drill hole or deeper to secure it.
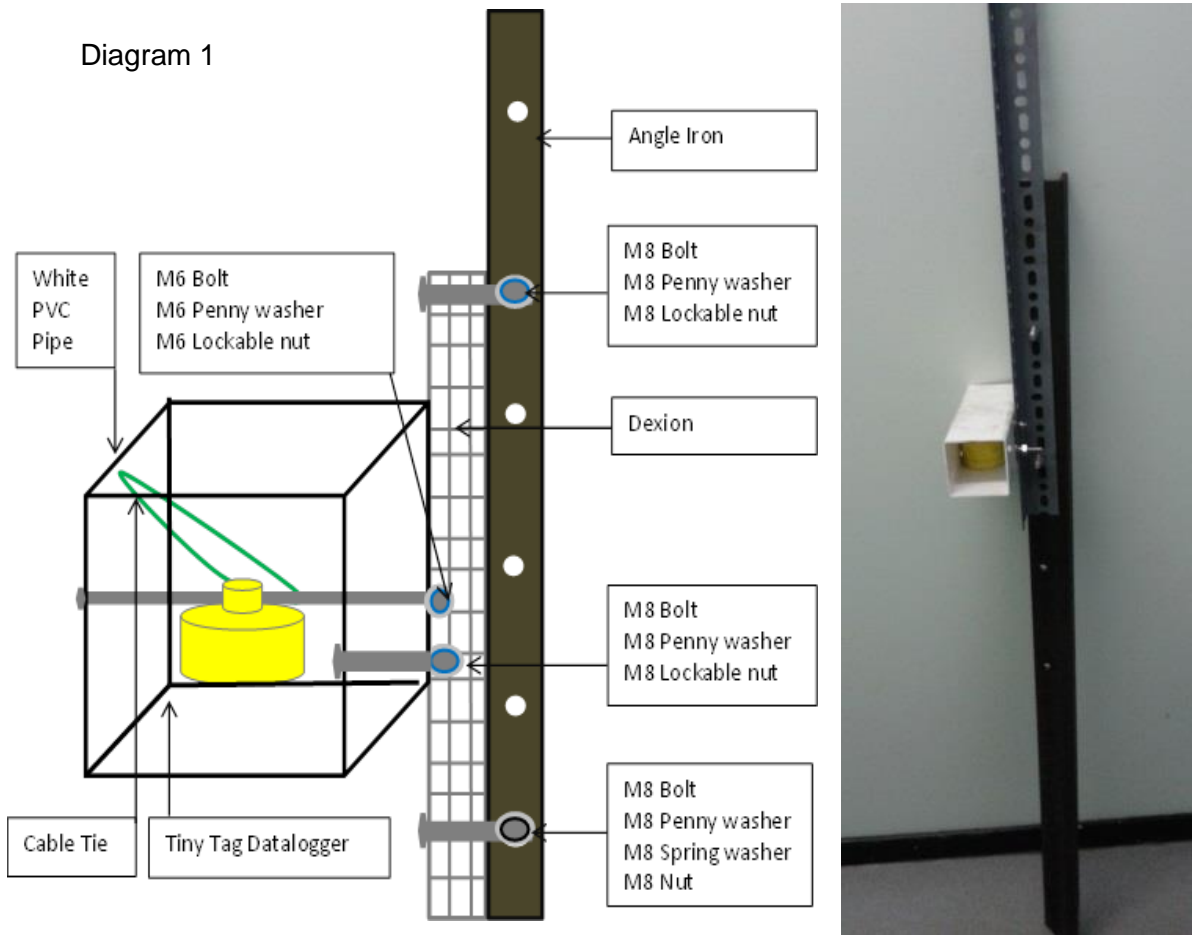
9.2.3 Check the length of dexion against the angle iron secured in the bed and identify which hole the bottom hole of the white box will be attached to. Typically it should be at or near the bottom of the dexion so that when assembled and attached to the angle iron the box will be just above the stream bed.

9.2.4   For 9.2.4 to 9.2.6 see Diagram 1 below. The white box is attached to shield the logger from direct solar radiation and thereby prevent over-heating of the logger with associated positive bias of measurements. Place the logger into the box and thread a long M6 bolt with a washer at the head from the outside of the box, through the hole at the top of the logger and secure first with a washer and then a lockable M6 nut to the dexion. The bolt should be tightened so that it is secure but not to the point where the plastic of the box "bows." The addition of a cable tie or two joined together to secure the logger against the outer edge of the box (thus avoiding any abrasion with the nut on the inside) can then be added.

9.2.5   Following this the bottom of the box should be attached with an M8 bolt (hole is   drilled specifically to fit this size), a penny washer and a lockable nut. The bolt should be attached from the inside of the box directly onto the dexion and secured.

9.2.6   The dexion can then be attached to the angle iron by two M8 bolts, one secured with a lockable nut and one secured with a normal nut and a split washer. It can be useful to have the bolt nearest the top of the angle iron to be secured with the lockable nut as these take longer to loosen and it is more comfortable if it can be done with hands out of the water.

Diagram 1

White PVC Pipe

M6 Bolt
M6 Penny washer
M6 Lockable nut

Angle Iron

M8 Bolt
M8 Penny washer
M8 Lockable nut

Dexion

M8 Bolt
M8 Penny washer
M8 Lockable nut

M8 Bolt
M8 Penny washer
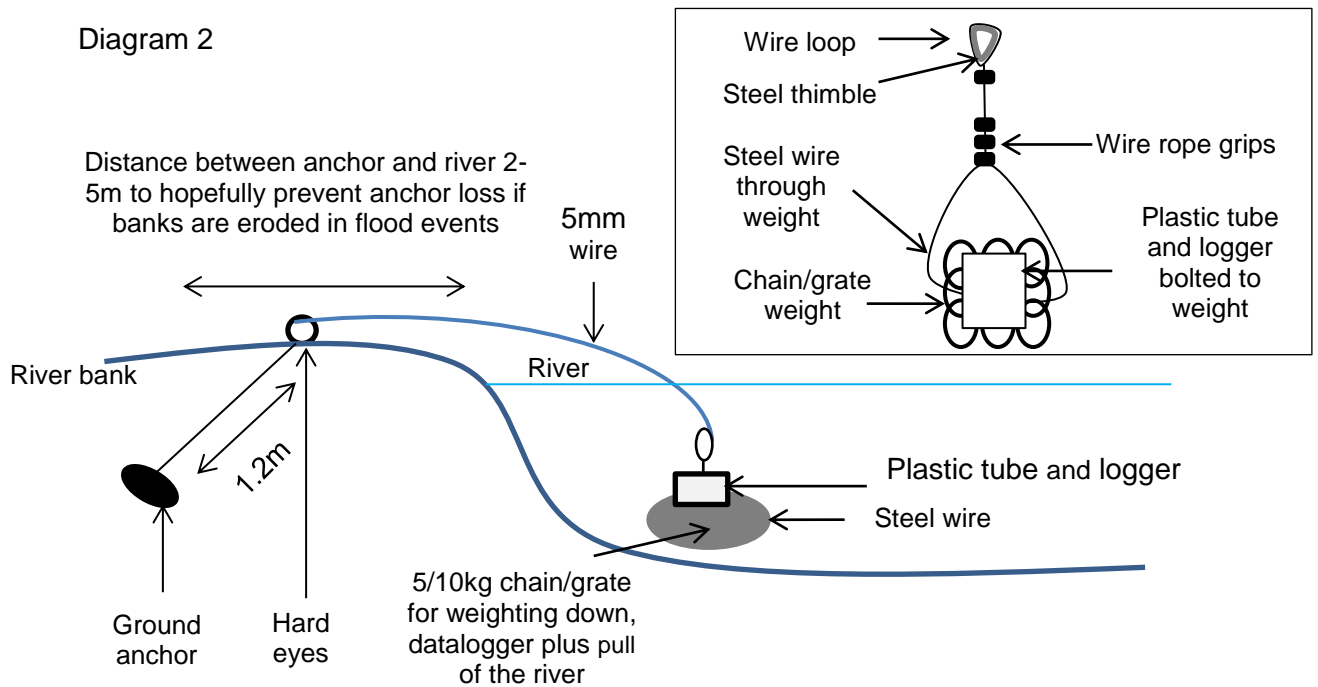M8 Spring washer
M8 Nut

Cable Tie

Tiny Tag Datalogger

9.3 Installation deep rivers / rivers where access is problematic

9.3.1 This method is designed for sites where the channel is too deep or access is too steep to allow you to safety enter and recover dataloggers, as per the primary method.

9.3.2 Select the site as per 9.1

9.3.3 Drive the anchor into the bank to a depth of 1.2m using the sledgehammer and hand held drive steel. The anchor should be driven into the bank between 2-5m from the river depending upon the bank material (Diagram 2 shows the set up).

9.3.4 Measure the length of wire required – this needs to be long enough to reach from the anchor to the bottom of the river without becoming taught.

9.3.5 Fasten the wire through the hard eye of the anchor with two wire rope grips.

9.3.6 Fix the logger into the white plastic tube and bolt to the weight with the M6 bolt and locking nut as per 9.2.4.

9.3.7 Loop the steel wire through the weight, fix the wire together with the rope grips. Make sure to leave enough wire to create the second loop. *N.B This may have already been done for you by MSS.*

9.3.8 Create a loop in the end of the steel wire (after the first set of rope grips), fit the thimble and close the loop with the rope grips. *N.B This may have already been done for you by MSS.*

9.3.9 Fasten the wire through the loop attached to the weight with two wire rope grips and lower into the river.

Diagram 2

Distance between anchor and river 2-5m to hopefully prevent anchor loss if banks are eroded in flood events

5mm wire

Wire loop

Steel thimble

Steel wire through weight

Wire rope grips

Plastic tube and logger bolted to weight

Chain/grate weight

River bank

River

1.2m

Ground anchor

Hard eyes

5/10kg chain/grate for weighting down, datalogger plus pull of the river

Plastic tube and logger

Steel wire

9.4   Initial Launch Sequence (before deployment) at Site

9.4.1   **Note that laptops should be set to GMT prior to logger launch.** Attach the inductive download pad ACS 3030 (the surface of this and the logger should be dry) to the laptop and launch the Tinytag explorer software.

9.4.2   Select the **green Play** button which is selected to set the logger running again. A window will appear with options for the new program.

9.4.3   Under "**Description**" you can name the logger. It is important to use the site name provided for each grid reference. Sites in the Scotland River Temperature Monitoring Network will be allocated a sequential number starting at one. Collaborators will be given a batch of consecutive numbers to cover their catchment and the site names will be assigned to specific grid references. However which logger (serial number) goes to which site does not matter as long as the information is recorded on the field datasheet (B 919). **Note** that it is important to record the actual grid reference for the site on the field datasheet as it is unlikely to match those suggested. The name entered under "**Description**" will be catchment_scotx (e.g. Dee_scot1).

9.4.4   Under "**Select logging interval**," set to 15 minutes.

9.4.5   In advance of deployment under "**Start Options**" select "**absolute start time**" and set the start time to 1.5 hours (rounded up to the nearest 15 minutes) ahead of the current time.

9.4.6   Under **"Measurements"** the default setting is Temperature and **"at the end of each interval"** and it should not be necessary to change this.

9.4.7   Under "**Stop Options**" "stop when full" is the default setting and should not be   adjusted

9.4.8   Under Alarms "**no alarms enabled**" is the default setting and should not be adjusted.

9.4.9   Once the correct settings have been selected the **LAUNCH** button should be selected. A summary of the program launched is displayed and you can then disconnect the logger and redeploy in the stream. With Tinytag Aquatic 2 dataloggers it is possible to check the logger program is working by looking at the base of the logger where an intermittent red flashing light should appear. With Tinytag plus 2 dataloggers a flashing green light indicates that the unit is working where as a red light indicates a fault.

9.4.10 Information to be recorded on installation and downloading is as the Record sheet B 919. Site photographs showing the landscape can be very useful in locating a site that is subsequently difficult to find.

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9.5 Initial Launch Sequence (before deployment) for Launch at Base

9.5.1 **Note any computer used to launch a datalogger should have its internal clock set to GMT prior to logger launch.**

9.5.2 The launch sequence and naming convention is as in 9.3. However the "**absolute start time**" should be set to allow enough time to get to the site and have at least 1.5 hours after deployment in the stream before the logger starts recording. It is imperative that the deployment to the stream time and date are recorded accurately (on the field record sheet), again in GMT, allowing for corrections to be applied to the data following download.

9.6 Moving a monitoring site

9.6.1 A monitoring site may need to be moved to a new site for one or more of the following reasons, note the list is indicative only and not exhaustive if in any doubt contact the FL Environment Group for advice: equipment washout, substrate constantly covering the logger and most importantly the logger being exposed to the air in low flow conditions.

9.6.2 Should the monitoring site be moved for whatever reason a new field datasheet should be completed with the revised information.

10. Calculation of results

Not applicable.

11. Precision, bias and limit of detection

Not applicable.

12. Reports

Not applicable.

13. Safety

RA FL02, RA FL05, RA FL06, RA FL09, FE/R/63

14. Literature references

Not applicable.