# CEH Wallingford
# Year 2000 Fish Habitat Data Collection
# Training Manual (Draft)

Date: 21 April 2000
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# Contents

# 1. Introduction

## 1.1. Background to this year's fieldwork campaign

Our fieldwork this year is in support of two research projects. The larger one is a national R&D contract for the Environment Agency entitled "Further Validation of PHABSIM for the Habitat Requirements of Salmonid Fish". There will also be much less fieldwork (some concurrent with the first project), on our CEH Integrating Fund project, entitled "Bioenergetic Response to Habitat of Salmon and Trout juveniles".

The aims of both projects are quite similar, to obtain a greater understanding of the physical factors affecting the distributions of young salmonid fish at the reach scale. The main difference is that in the latter, the bioenergetics project involves the collection of fewer points in more detail: allowing a better spatial description of habitat use.

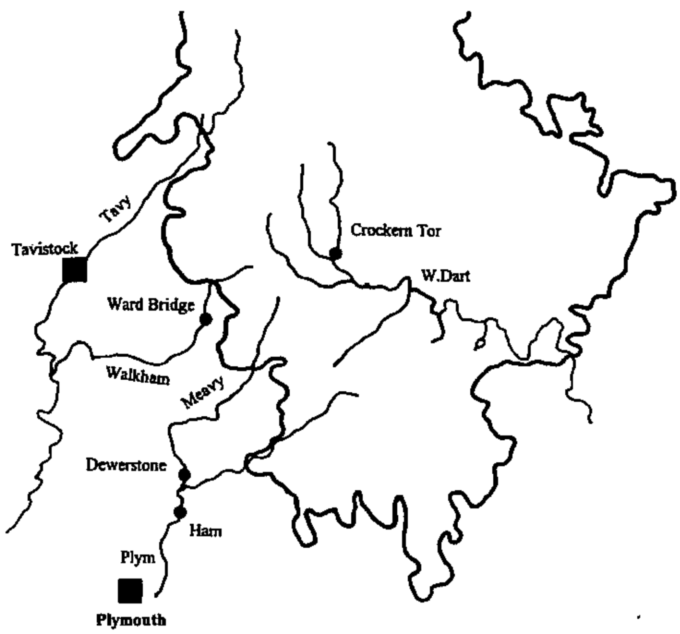
Each survey will consist of either 4 or 6 staff from CEH Wallingford working in collaboration with a team from CEH Dorset. We commonly work in teams of two.

The key surveys will be undertaken three times in each of two river catchments: with 3-4 separate sites in each catchment. Each of these surveys will last up to eight days. Further, shorter surveys of 1-2 days will also be required.

As an example, in 1999 in Devon, we sampled four sites across Dartmoor, selected to offer a range of different habitat types and river sizes. One was designated the main site at which we collected data along a greater length of river than at the other sites, this is also the site at which we undertake some PHABSIM modelling.

| ***River*** | ***Site*** | ***Length (m)*** | ***Altitude*** | ***Dominant habitat types*** |
|---|---|---|---|---|
| *Walkham* | *Ward Bridge* | *400* | *145* | *Rapids, Riffle, Run, Glide* |
| *Meavy* | *Dewerstone* | *150* | *100* | *Rapids, Boil* |
| *Plym* | *Ham* | *150* | *35* | *Run (deep)* |
| *West Dart* | *Crocken Tor* | *300* | *343* | *Run, Riffle* |

A similar approach will be adopted this year.




## 1.2. General Information

It is important to remember that the field teams will be working in all weather, rain, sleet, snow and hopefully sunshine. With this mind it is advisable to make sure that each person comes prepared for all eventualities. Waterproofs and waders will be provided, but bringing your own warm clothing is essential, thick socks, hats and gloves and a number of clothing layers are suggested. Sun-block and insect repellent will also be provided, but it is recommended if you are likely to burn or sensitive to bites to bring your own. Each day we need to each obtain a packed lunch, this usually means going to the supermarket at the beginning of the week, and at other times as required. Its useful to bring a lunchbox, a water bottle and small rucksack are also handy. It is very important that whenever possible, these supermarket trips are in the evening after work, rather than first thing in the morning. So it is important to plan ahead; finding yourself in the middle of nowhere with no lunch isn't very nice.

# 2. Data Collection procedures

## 2.1. General information checklist for each team

- We have weatherwriter clipboards: take one per team and look after it!
- Always write in pencil (never pen), make sure you have an adequate supply and a sharpener.
- One person works in the river collecting data, the other person remains on the bank recording the information.
- At a site, the teams generally work in an upstream direction
- Make sure you have an adequate supply of the correct survey sheets, you MUST fill them in completely and VERY neatly/clearly
- The date and time that each sheet is started and finished should be recorded, plus any breaks (e.g. cigarette breaks for Ian): from this we interpolate the time of each reading

## 2.2. Habitat Availability Surveys

*Site preparation*

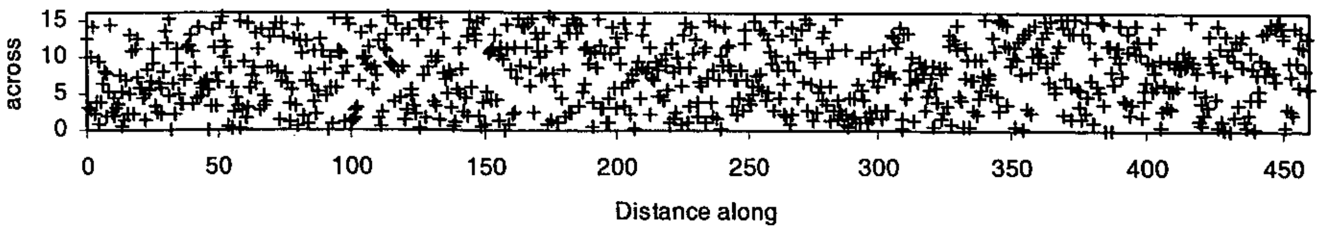
To determine the extent to which fish habitat choice is affected by what physical habitats are available in a reach, we must first sample habitat availability. This is undertaken at each site.

The physical habitat sampling procedure used here has been designed to be point-based rather than transect-based, to avoid any subjectivity in data collection. It covers the entire river target area sampled during the fish observation surveys. The procedure adopts a fixed-interval approach in the longitudinal dimension (i.e. along the river), and a random sampling approach in the transverse dimension. (i.e. across the river). An example of the calculation is presented below, as is a graphical representation of the sampling density at Ward Bridge in Figure 5.1. The protocol is as follows:

1. Collate river width measurements from habitat mapping survey, calculate mean (MeanW) and maximum (MaxW) width, and total target area length (TL),
2. Based on past experience, calculate required number of sample points in river (RSP),
3. Calculate RSP * (MaxW/MeanW) to give total number of potential sample points required (TSP),
4. Calculate TSP / TL to give sampling intensity per metre (SI),
5. Round SI down to a manageable number,
6. Calculate a series of TSP random numbers between zero and MaxW. These are distances across the river (DistAC),
7. Create survey sheets with distance upstream (DistUS, in multiples of SI) and DistAC, plus space for all observed data to be written in,
8. Undertake survey, collecting data at each point defined by DistUS, DistAC, measured using tape measures.
9. Discharge measurement

*Example: Ward Bridge Site*
MaxW = 15.4, MeanW = 9.8
TL = 300m
RSP = 300

TSP = 480
SI = one point every 0.6 m of river




*Example of pre-selected data points for collection of habitat availability data collection*

The Required Sample Points (RSP) will be 400 for the main site and 100-120 for each subsidiary site.

Note that it this procedure requires the fieldworker to estimate in advance how much river will be surveyed by the snorkelling team. While this is always impossible to estimate precisely, it is important to be reasonably accurate to avoid un-necessary expenditure of time collecting habitat availability data or the converse (even worse), the collection of too few data points.

Where possible, survey sheets with distance upstream and distance across are pre-printed from a spreadsheet, however in some cases, (e.g. for the first survey) this may not be possible

*Marking out a site*

Once the sampling interval has been calculated, this will remain the same for each of the three surveys at that site. The next step on the first survey is to mark out the site, this is very important and not to be neglected. A bank for upstream measurement needs to be established, with the best access to the river: it does not really matter whether it is the left or right bank, as long as we know which it is (left and right bank are determined by looking downstream). A zero point is established, using a marker peg, this can be a wooden stake if the site is out in the wilds and unlikely to have passers-by, or a metal anchormark if things are busier (e.g. a footpath alongside the bank). All upstream measurement is taken from this point, so it is very important to be able to re-locate it in subsequent surveys: even if vegetation has grown up etc. A good plan is to mark the ground around the peg with spray paint, along with any close objects like a tree. From this point, tape measures are used to measure out 50m units upstream, each 50m point is marked with a wooden stake, and the distance upstream written on the stake (don't forget your sledgehammer). This means that when a survey has to span more than one day, we don't have to measure back to the zero point each subsequent morning.

*Surveying*

At each sample point an number of observations are recorded which are:

- Water depth
- Mean column water velocity
- Angle of surface water flow (using a 12 hour clock system where 12 o'clock is directly upstream)
- Substrate (bed material) (see below) around a 30cm radius of the sample point.
- Overhanging cover less than 0.5m from the surface of the water, for example undercut bank.

- Overhanging cover greater than 0.5m from the surface of the water, this could include branches.
- Distance to nearest instream cover (see heading "Instream cover distance" below.)
- Type of instream cover (see heading "Instream cover distance" below.)
- Surface flow type (see table below)

**Substrate Coding Scheme:**

0 Organic detritus
1 Rooted vegetation annotated by (in place of '0') qualify by;
  T= terrestrial (only likely during floods)
  A= aquatic
2 Clay (cohesive)
3 Silt (non-cohesive)
4 Sand (0.062mm-2mm)
5 Gravel (Fine - 2mm-8mm)(Coarse - 9mm-64mm)
6 Cobble (Fine – 64mm-128mm) (Coarse – 65mm-250mm)
7 Boulder
8 Bedrock
9 Man-made (concrete)

Suitability index coding is written as **DaSb.Z**

**D** = dominant substrate
**a** = (either 0 if fine or coarse are irrelevant or if relevant F (fine) C (coarse) only relevant to gravel or cobble.
S = sub-dominant (if none is evident then use X to indicate 100 dominant substrate)
**b** = (either 0 or if relevant F (fine) C (coarse) only relevant to gravel or cobble.
**Z** = proportion of the dominant substrate expressed in tens ie 1=10%, 0 = 100%.

**Example 5c5f.6 = coarse grave (60%), fine gravel**

*Overhanging cover*
refers to whether the sample point has overhanging cover which is less than 0.5m above the sample point or higher than 0.5m, and should be written either Y or N.

*Instream Cover distance and cover type:*
This again refers to the sample point location. For each point we need to record the distance from the sample point to the nearest available cover within the river. This distance is measured in metres and is an estimate by eye. When we refer to cover we are interested in available cover for a fish that is roughly 15cm in length, so anything that could hide a fish of this size.

The cover types are listed below.

**R** = Rock / boulder
**T** = Tree / bush root growing on bank
**W** = Instream weed
**B** = Bank / undercut

**L** = Log / branch in river

*Surface flow type:*
The following definitions and codes are used, (taken from the EA River Habitat Survey).

(A video is available: what fun)

| Code | Flow type | Common name | Notes |
|---|---|---|---|
| FF | Free fall | Waterfall | Clearly separated from back wall |
| CH | Chute | | Low curving fall in contact with substrate |
| BW | Broken standing wave | Rapids | White water tumbling wave must be present |
| UW | Unbroken standing wave | Riffle | Upstream facing wavelets, not broken |
| RP | Ripple | Run | No waves but general flow direction is downstream with disturbed rippled surface |
| SM | Smooth | Glide | Perceptible downstream movement is smooth (no eddies) |
| UP | Up welling | Boil | Heaving water as up welling breaks the surface |
| NP | No perceptible flow | Pool, Ponding marginal dead water | No net downstream flow |

**2.3. Fish Location Surveys**

Each reach of river is snorkelled by a team from CEH Dorset. Their objective is to snorkel upstream identifying fish and observing their habitat use. Each fish is observed for one minute and the location of the fish marked by the snorkeller. Each marker will have a number associated with it. Each snorkeller will have an underwater "slate" with waterproof paper attached to their forearm and will record the number of each marker placed, along with fish species, size and activity, once these slates are full they will be given to a member of the CEH Wallingford team following up behind. It is the responsibility of this team to follow this crew upstream, always allowing a sensible gap to the snorkeller, obviously this distance will depend on the size of the river being surveyed.

The markers will be placed throughout the stream so it is important to keep your eyes peeled for markers under rocks, weed beds, roots and sometimes partially buried. Each marker will have a length of bright tape attached to it to make it clearly visible. On arrival at a weight a series of observations will need to be recorded, these are

- Marker number
- Angle of weight (using the clock system, - denotes angle fish was facing)
- Distance to cover
- Type of cover

- Water depth
- Mean column velocity
- Substrate
- Overhanging cover
- Surface flow type

To make sure that weights dropped by the snorkeller are not missed it is essential to check the slates continually to compare with the weights that you have identified. Once you have finished recording the information at one marker, remove it from the stream, we have some modified barbecue tongs made for this purpose.

In some cases, the snorkellers will be undertaking surveys at night. In this case it really isn't possible for us to see the markers at night, so we need to get up very early in the morning to retrieve the markers and make the measurements.

After the end of each day's fieldwork, it is important to recover ALL the marker weights which end up strewn along the river bank. It's usually the Wallingford crew that end up tidying up, in which case it is important to make sure the markers are all returned to the snorkellers by the next morning.

*Additional checklist for team 1 (fish habitat use measurement)*
Team 1 will be concerned with collecting data for the fish location survey and will follow up behind the CEH Dorset snorkelling team.

- Fish sheets have no numbers in to start with (habitat availability sheets have distances pre-written in)
- It is vital to obtain promptly the "slate" sheets from the snorkeller's assistant:
    - for daytime surveys, collect them one sheet at a time
    - following on from night-time surveys, collect all the slate sheets before going out the next morning
    - check that each sheet has the snorkeller name, date, plus start and finish time of each snorkeller written on the back of it.
    - tick off the marker weight numbers as you find them: you must not miss a marker

### 2.4. PHABSIM survey

At each main site a number of transects will be identified and located with permanent anchor-marks to represent different habitat types within the reach. At each of the transects the following data needs to be collected:

- A topographic survey of the channel morphology (bed elevation) at each cross section, relative to the fixed cross section headpins. The investigator should ensure an adequate number of readings (commonly 14-20 evenly-spaced points across base of the channel (between left and right bottom of bank) to describe the channel cross section.

- A record of channel index parameters (substrate and cover) at each of the points where bed elevation was taken above (see section 2.2). PHABSIM considers substrate and / or cover to be unchanged throughout the flow range.

- At each flow, water depth should be taken at each of the above points using the wading rod.
- For each set of linked cross sections, a closed survey loop through all the headpins showing elevation and distance should be surveyed.
- At each flow, a survey of water surface levels at each cross section, relative to the cross section headpins. Repeated staff readings on the left, centre and right of the channel provide best accuracy.
- At one or more flows, mean column velocities across each cross section, taken at bed elevation points as above. Measurements are taken at usually three flows, but conditions in the field may not allow this. It is important to current meter at least one cross section at all flows so that discharge can be calculated.
- At each flow, the surface flow type at each habitat point.

## 2.5. Fish location surveying and high-resolution topography surveying

**Team 3** (only applies to fieldwork carried out in Wales)

Team 3 will be primarily concerned with surveying exact fish locations using a Total Station, and surveying bed topography for multidimensional hydraulic modelling. This is undertaken at just one site.

On the first trip the team will need to set out the site, setting up control points using anchor marks, and surveying these. Topography is also only surveyed once. On all trips, CEH Dorset shall be undertaking a day and night-time snorkelling survey at the main site. For a designated length of river within this site: likely to be the bottom 100m (the site is around 400m long), in addition to all of the standard fish survey procedures documented above, the exact location of each marker is recorded using the total station.

Team 3 will also collect bed velocities at the fish locations: in addition to mean column velocities.

Team 3 will also undertake standard fish and habitat availability surveys to fill in any busy periods which Teams 1 and 2 cannot cover.

Further special training will be provided for the lucky members of Team 3.

# 3. Equipment

## 3.1. Current meter, electro-magnetic / propeller current meter

We will be using an electro-magnetic current meter which follows the principle that when a fluid conductor (eg water) moves through an magnetic field (in this case produced by a coil within the probe), it produces a voltage which is detected by the two sensors on the probe. This is converted into a velocity in m/sec on the display unit. The probe is connected to a wading rod, and can be adjusted to allow the probe to be moved up or down depending on the water depth, once in the correct position the probe is tightened into position using the locking bolt. It is important to note than on the newer Valeport probes, the bolt must be done up quite tightly to stop the probe sliding down, a good technique is to twist the rod while tightening the bolt.

We are mostly interested in mean column velocities in this study. Under the assumption that water velocity varies logarithmically from zero at the streambed to a maximum near the stream surface, the mean occurs at about four-tenths of the depth (0.4x), as measured upwards from the streambed. It is important to realise that you measure the velocity from 0.4x from the streambed (NOT from the stream surface!!). The table below indicates some examples of probe depth settings.

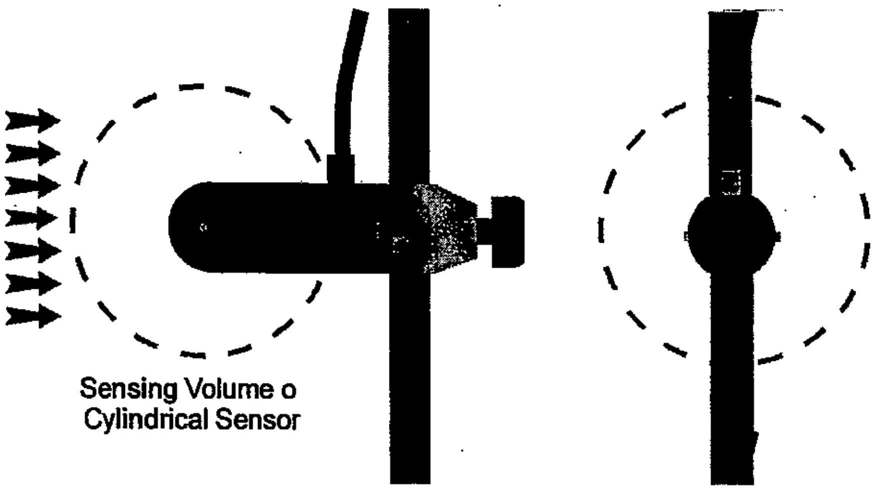
| Water Depth (m) | Probe Depth (m) |
|---|---|
| .10 | .04 |
| .27 | .11 |
| .32 | .13 |
| .49 | .20 |
| .50 | .20 |

However if the water column is greater than 1m in depth, velocity needs to be recorded at both 0.2x and at 0.8x of the depth.

The wading rod has incremental markings along it, yellow lines indicating 5cm increments (5,15,25cm) and red lines indicating 10cm increments (10,20,30 etc). Note that on the IH wading rods the first ring is at 5cm. There are also IFE wading rods which have ring markers down to 1cm: we are unlikely to need to use these, but may need to in the event of equipment breakage, so it is important to know the difference.

The volume of water being sensed is a spherical volume around the sensor to a diameter of about 120mm. This means that the person operating the current meter needs to make sure that he/she are stood at least one pace behind the probe and slightly to one side so that the standing wave created in front of their feet/legs is not effecting the velocity reading. It is important to make sure that the probe is aligned into the surface flow and to realise that the probe will detect negative flow values, which should always be recorded.

It is important to make sure that when two current meters are being operated in the same reach, that a distance of 1.5 meters is always maintained between the two so that electrical interference is avoided.




The unit is powered by 8 C cell batteries. A text message will appear in the top right hand corner when batteries are low, at which time new batteries should be inserted. The operating system within the control unit will be explained on the training day, but basically the sensor senses the velocity twice every second and averages this, this information is displayed on the control unit in the bottom left of the screen. To the right of that at the end of the averaging period, usually set at 25 seconds, the unit will establish the average velocity over the 25 seconds, which is the result that we want recorded.

### 3.2. Propeller current meter

The second type of current meter we will be using is a BFM002 Valeport impeller current meter. It follows the principle in that the rotation of the impeller causes magnets mounted in the impeller hub to open and close a reed switch, which generates pulses or a reading of flow in m/s. As with the electro-magnetic current meter, the impeller is mounted on a wading rod which is engraved in centimetres and colour coded for 1cm, 5cm and 10cm. Again the impeller is positioned at 0.4x of the water depth.

# 4. Health and Safety

The following notes are based on the one page guide which all workers should carry with them for reference. It is meant as a practicable guide in health and safety when working in and around rivers or water bodies, it is not all encompassing. All fieldworkers should have read the more detailed PHABSIM Health and Safety guidance notes, apply common sense, and above all, if not sure, ASK!

## 4.1. Health

1. Make sure that any exposed cuts and abrasions are securely covered with a waterproof dressing. Wear protective clothing, particularly waterproof gloves, wherever possible.

2. After working in rivers and in particular in or around bodies of still or slow moving water, canals, ponds, always **wash your hands and forearms thoroughly with soap and water**. This is particularly important before **eating, drinking** or **smoking**.

3. Avoid rubbing your eyes, nose or mouth with your hands while working in rivers.

4. Be aware of the early stages of Leptospirosis, and inform your local GP of your potential contact with the disease.

5. Keep your coverage against Tetanus and Hepatitis up to date.

## 4.2. Safety

6. Movement around / in / out of rivers – always place your feet carefully, look where you are going, beware of sudden changes of depth (use a wading rod to test)
   See further notes on **PHABSIM Health & Safety guide**

7. Work in-groups of no less than two people where possible, one of which should be a qualified first aider.

8. Where possible always inform project manager / line manager of your itinerary and your expected arrival and departure and carry a mobile phone / satellite phone in case of emergencies.

9. Always wear suitable clothing for the local terrain and the possible weather extremes.

10. When working in water that is deeper than 30cm, in fast flowing rivers, always wear a life jacket. You also may wear one at ANY time you choose when working in or near rivers. Life jacket auto inflation systems should always be checked prior to arrival on site by either MJD/IMG/CL.

**Accommodation details**

For people coming to Wales, accommodation has already been booked. We will be staying at:

Bishops Meadow Lodge
Hay Road, Brecon,
Powys, LD3 9SW
Tel: 01874 622051.

The cost of the accommodation is £30.00 per night, all rooms are en-suite with a licensed restaurant and bar, plus for those who wish to unwind after a stressful day of hard work there is a swimming pool.

# 5. Appendix

## 5.1 Habitat availability survey sheet (example)

## 5.2 Fish location point survey sheet (example)

## 5.3 Fish slate sheet (example)

| at Availability Survey | | | | Start time: 9.40 | | | | Finish time 10.35 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Walkham Ward Bridge D/S | | | | Recorder PAUL. | | | | Measurer IAN | | | |
| 27-7-99 | | | | Current meter type: | | | | | | | |

| | Dist Along River | Dist Across River | Mean column v | Water Depth | Angle of flow o'clock | Substr (x0y.z) | o/h cover <0.5 | o/h cover >0.5 | instr cover dist | instr cover code | RHS surf flow type | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24.00 | 2.93 | 0.444 | 15 | 12 | 7CX0.0 | ✓ | | ·05 | R | RP | |
| 2 | 24.60 | 9.63 | TOO WIDE | | | | | | | | | |
| 3 | 25.20 | 4.99 | ON ROCK | | | | | | | | | |
| 4 | 25.80 | 2.24 | -.025 | 48 | 10 | 7F6C.6 | ✓ | | .4 | R | RP | |
| 5 | 26.40 | 6.01 | 0.409 | 22 | 12 | 7F5C.8 | ✓ | | .3 | R | RP | |
| 6 | 27.00 | 6.23 | 0.002 | 16 | 12 | 7F5C.8 | ✓ | | .05 | R | RP | |
| 7 | 27.60 | 2.39 | 0.524 | 29 | 3 | 7CX0.0 | ✓ | | ·5 | R | BW | |
| 8 | 28.20 | 10.34 | TOO WIDE | | | | | | | | | |
| 9 | 28.80 | 1.92 | 0.444 | 50 | 12 | 6F6C.8 | ✓ | | ·6 | R | RP | |
| 0 | 29.40 | 14.02 | TOO WIDE | | | | | | | | | |
| 1 | 30.00 | 13.31 | TOO WIDE. | | | | | | | | | |
| 2 | 30.60 | 2.47 | 0.544 | 49 | 12 | 6C7F.7 | ✓ | | ·1 | R | RP | |
| 3 | 31.20 | 7.15 | ON ROCK | | | | | | | | | |
| 4 | 31.80 | 15.14 | TOO WIDE. | | | | | | | | | |
| 5 | 32.40 | 0.94 | 0.537 | 37 | 11 | 7CX0.0 | ✓ | | ·1 | R | UW | |
| 6 | 33.00 | 2.58 | 0.560 | 46 | 1 | 7CX0.0 | ✓ | | .4 | R | BW | |
| 7 | 33.60 | 0.33 | -.054 | 11 | 2 | 5C6F.7 | ✓ | | ·2 | R | RP | |
| 8 | 34.20 | 2.89 | ON ROCK. | | | | | | | | | |
| 9 | 34.80 | 13.74 | TOO WIDE. | | | | | | | | | |
| 0 | 35.40 | 9.11 | TOO WIDE. | | | | | | | | | |
| 1 | 36.00 | 13.05 | TOO WIDE | | | | | | | | | |
| 2 | 36.60 | 10.13 | TOO WIDE. | | | | | | | | | |
| 3 | 37.20 | 9.72 | TOO WIDE | | | | | | | | | |
| 4 | 37.80 | 4.88 | 0.340 | 23 | 12 | 6C5C.5 | ✓ | | ·2 | R | RP | |
| 5 | 38.40 | 6.96 | -.035 | 25 | 12 | 7CX0.0 | ✓ | | ·6 | R | SM | |
| 6 | 39.00 | 6.13 | -.028 | 25 | 12 | 7CX0 0 | ✓ | | ·2 | R | SM | |
| 7 | 39.60 | 11.00 | TOO WIDE. | | | | | | | | | |
| 8 | 40.20 | 2.17 | -.061 | 34 | 10 | 7C5F.6 | ✓ | | ·3 | R | SM | |
| 9 | 40.80 | 7.50 | ON ROCK | | | | | | | | | |
| 0 | 41.40 | 6.30 | 0.013 | 56 | 12 | 7CX0.0 | ✓ | | ·3 | R | SM | |
| 1 | 42.00 | 0.93 | 0.201 | 36 | 1 | 7C5F.9 | ✓ | | ·2 | R | RP | |
| 2 | 42.60 | 9.44 | TOO WIDE. | | | | | | | | | |
| 3 | 43.20 | 2.22 | 0.468 | 21 | 2 | 6F7F.6 | ✓ | | ·1 | R | RP | |
| 4 | 43.80 | 15.24 | TOO WIDE | | | | | | | | | |
| 5 | 44.40 | 12.72 | TOO WIDE. | | | | | | | | | |
| 6 | 45.00 | 8.67 | TOO WIDE. | | | | | | | | | |
| 7 | 45.60 | 0.75 | -.025 | 14 | 12 | 5OX0.0 | ✓ | | ·1 | R | SM | |
| 8 | 46.20 | 4.79 | -.010 | 34 | 12 | 7CX0.0 | ✓ | | ·05 | R | SM | |
| 9 | 46.80 | 4.20 | 0.096 | 24 | 12 | 7CX0.0 | ✓ | | ·05 | R | SM | |
| 80 | 47.40 | 13.28 | TOO WIDE. | | | | | | | | | |

| sh Location Point Survey | | | | | EAF3 OR | | INT FUND (circle) | | | Start | | Finish | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| te | WARD BRIDGE | | | | | | Snorkeller 1 | | | | | | |
| ate | 27-7-09 | | | | | | Snorkeller 2 | | | | | | |
| ersonnel | PS. IG. | | | | | | Snorkeller 3 | | | | | | |
| urrent meter | | | | | | | Measurement | | | | START 11.03 FINISH 12.3 | | |
| int mber | Distance Along | Mean column velocity | Nose vel (int fund only) | Depth | Weight angle clock | Flow angle clock | Substr (DaSb.z) | o/h cov <0.5 | o/h cov >0.5 | instr cover dist | instr cover type | RHS surfflow type | veg code / behind rock |
| 05 | 77.5 | 0.409 | | 24 | 11 | 12 | 6F5C.7 | ✓ | | .8 | T | RP | 11 03 |
| 4 | 78.1 | 0.045 | | 23 | 10 | 12 | 6F5C.7 | ✓ | | .3 | R | RP | |
| 09 | 79.4 | 0.332 | | 18 | 1 | 12 | 6F5C.6 | ✓ | | .4 | R | RP | |
| 03 | 79.8 | 0.184 | | 11 | 11 | 12 | 6C6F.6 | ✓ | | .3 | R | RP | |
| 24 | 80.7 | -.019 | | 14 | 1 | 11 | 6CX0.0 | ✓ | | .6 | R | RP | |
| 01 | 82.1 | 0.552 | | 16 | 1 | 1 | 6C6F.8 | ✓ | | .5 | R | RP | |
| 20 | 84.8 | 0.231 | | 15 | 1 | 1 | 6CX0.0 | ✓ | | .25 | R | BW | |
| 11 | 83.6 | -.070 | | 20 | 10 | 2 | 5C40.6 | ✓ | | .2 | R | RP | |
| 17 | 85.1 | 0.433 | | 22 | 1 | 12 | 7F6C.8 | ✓ | | .05 | R | RP | |
| 5 | 84.9 | -.105 | | 24 | 1 | 12 | 7CX0.0 | ✓ | | .05 | R | CH | 11 32 |
| 16 | 85.3 | 0.333 | | 16 | 1 | 12 | 6F7F.8 | ✓ | | .05 | R | RP | |
| 13 | 86.6 | 0.708 | | 15 | 6 | 12 | 6F6C.6 | ✓ | | .4 | R | RP | |
| 2 | 88.8 | 0.322 | | 18 | 1 | 11 | 7F40.8 | ✓ | | .3 | R | RP | |
| 8 | 88.3 | 0.345 | | 33 | 7 | 12 | 6F5F.8 | ✓ | | .7 | R | RP | |
| 59 | 89.5 | -.051 | | 21 | 3 | 12 | 6F6C.8 | ✓ | | .4 | R | RP | |
| 9 | 90.1 | -.029 | | 13 | 12 | 12 | 5F40.6 | ✓ | | .3 | R | RP | |
| 10 | 90.8 | 0.155 | | 23 | 3 | 2 | 5C7F.9 | ✓ | | .2 | R | RP | |
| 17 | 91.9 | 0.181 | | 7 | 12 | 12 | 5C5F.7 | ✓ | | .4 | R | RP | |
| 4 | 92.6 | 0.657 | | 21 | 11 | 11 | 7CX0.0 | ✓ | | .05 | R | RP | |
| 7 | 92.9 | 0.139 | | 24 | 2 | 12 | 6C40.8 | ✓ | | .2 | R | RP | |
| 8 | 94.0 | 0.387 | | 28 | 1 | 12 | 6C40.8 | ✓ | | .5 | R | RP | 11 52 |
| [illegible] | 95.7 | 0.056 | | 28 | 1 | 12 | 405F.5 | ✓ | | .05 | R | RP | |
| 7 | 95.6 | 0.057 | | 43 | 12 | 12 | 6C40.7 | ✓ | | .3 | R | RP | |
| 1 | 95.2 | 0.369 | | 34 | 7 | 12 | 7F40.8 | ✓ | | .4 | R | RP | |
| 8 | 95.6 | 0.057 | | 43 | 12 | 12 | 6C40.7 | ✓ | | .3 | R | RP | |
| 9 | 95.6 | 0.014 | | 33 | 4 | 12 | 6C40.9 | ✓ | | .3 | R | RP | |
| 6 | 96.1 | 0.362 | | 30 | 9 | 12 | 6C40.8 | ✓ | | .3 | R | RP | |
| 0 | 94.9 | 0.277 | | 32 | 3 | 12 | 7F5C.7 | ✓ | | .2 | R | RP | |
| 58 | 93.9 | 0.036 | | 15 | 1 | 11 | 6C40.6 | ✓ | | .5 | R | RP | |
| 3 | 93.8 | -.005 | | 10 | 9 | 9 | 6F6C.7 | ✓ | | .3 | R | RP | 12.07 |
| 15 | 96.1 | -.024 | | 5 | 12 | 12 | 6C6F.5 | ✓ | | .3 | R | SM | |
| 40 | 96.3 | -.026 | | 19 | 11 | 12 | 6C7C.9 | ✓ | | .05 | R | SM | |
| 98 | 96.5 | -.027 | | 13 | 11 | 12 | 6C7C.9 | ✓ | | .05 | R | SM | |
| 76 | 98.4 | -.020 | | 11 | 4 | 12 | 6C6F.8 | ✓ | | .01 | R | SM | |
| 3 | 97.3 | 0.129 | | 20 | 1 | 1 | 7CX0.0 | ✓ | | .05 | R | RP | |
| 4 | 99.2 | 0.034 | | 36 | 2 | 12 | 5F40.6 | ✓ | | .2 | R | RP | |
| 2 | 81.0 | -.050 | | 10 | 6 | 12 | 7CX0.0 | ✓ | | .1 | R | RP | |
| 2 | 89.1 | 0.076 | | 15 | 1 | 12 | 7FX0.0 | ✓ | | .01 | R | RP | |
| | | | | | | | | | | | | | |
| | | | | 19 | | | 25 | | | | | | |

09.00 → 10.30 1

SITE: WARDBRIDGE DATE: 21. 7. 99

| MARKER NO. | T | S | LENGTH | D. OFF BOTTOM | ACTIVITY F/R |
| --- | --- | --- | --- | --- | --- |
| [illegible] | ✓ | | 12 | 3 | F |
| 014 | | ✓ | 8.5 | 0 | R |
| 010 | | ✓ | 15 | 0 | R |
| 011 | ✓ | | 15 | 2 | R |
| 017 | | ✓ | 4 | 0 | F |
| 015 | ✓ | | 10 | 1 | R |
| 006 | | ✓ | 8 | 0 | R |
| 012 | | ✓ | 9 | 0 | R |
| 012 | | ✓ | 4.5 | 0 | F |
| 018 | | ✓ | 8.5 | 0 | F |
| 062 | | ✓ | 8 | 0 | R |
| 059 | | ✓ | 4 | 0 | F |
| 069 | | ✓ | 4 | 1 | R |
| 090 | | ✓ | 8 | 0 | R |
| 097 | | ✓ | 4 | 0 | F |
| 088 | | ✓ | 4.5 | 0 | F |
| 087 | | ✓ | 4.5 | 0 | R |
| 00 | ✓ | | 35 | 10 | R |
| 061 | | ✓ | 8 | 0 | R |
| 099 | | ✓ | 8 | 0 | R |