GEOPACKS

THE GEOGRAPHY SPECIALISTS

Operation Manual

Stream Flowmeters

Geopacks Flowmeter (MFP51)
Geopacks Advanced Flowmeter (MFP126)

CONTENTS

1.0 Key Components

1.1 Impeller Stick

The impeller stick is used for measuring water velocity and consists of:

- An IMPELLER and coupled SENSOR in which a switch opens and closes as the impeller is rotated by the flow of water

- Four 250 mm long tube sections which slot together to make a 1m stick

- Three "riser rods" which when slotted singly or in combination, allow the impeller to be elevated above the stream bed at fixed heights – 250 mm, 125 mm and 75 mm or combinations of these

- A 1m long cable which connects to a flowmeter (see below)

1.2 Basic Flowmeter

The basic Flowmeter is an electronic device that counts signals (pulses) from the impeller stick proportional to velocity. The total number of counts per unit of time (normally one minute) can be converted into a velocity value by referring to a calibration chart or using a formula. The unit has the following features:

- An LCD (liquid crystal display) counter;

- A socket for the jack plug connection

- A three way switch on which the switch positions are:
  - **NEUTRAL** – centre switch position
  - **START** – flick the switch DOWN
  - **STOP** – flick back to centre
  - **RESET** (to zero) – UP to the top position
  - **NEUTRAL** – centre position again

The act of inserting the jack plug from the impeller stick turns the meter ON. Having inserted the jack the value in the LCD should read 0. If greater than 0, move the switch to the UP position and rotate the impeller fractionally to close the relay to reset at 0, and then move the switch to the neutral position.

1.3 Advanced Flowmeter

The LCD display on this instrument gives an average velocity in m/s or mph for WATER. There is no need to time your measurements using this instrument; nor do you have to use a calibration chart. To operate the instrument:

- Select a stream flow impeller.
- Insert the jack plug from the flow impeller into the socket.
- Select "WATER" and "mph" or "ms^{-1}" with the rotary dial
- Initiate motion of the sensor in the water
- Switch the instrument ON using the slide switch on the left side of the unit

The display should read "00.00" and there will be a flashing colon between the 00's. If the colon does not flash, replace the battery.

When using the impeller stick, the display will not change for 10 seconds, after which an average velocity will be shown in the units selected (mph or ms^{-1}). This delay is known as the Integration Time. The value shown will be held for 2 seconds (no flashing colon) then for a further 10 seconds until a new average is obtained. Naturally, a number of averages should be obtained to build up a full picture of flow rates at each point.

2.0 Operating Instructions

2.1 Impeller Stick with Basic Flowmeter

Slot the rods of the IMPELLER unit together and point the impeller up into the flow of moving water at the required depth (Figure 1a). Use one or more of the three “riser” rods to elevate the impeller off the stream bed if necessary (figure 1b).

Figure 1a Impeller Stick in the flow

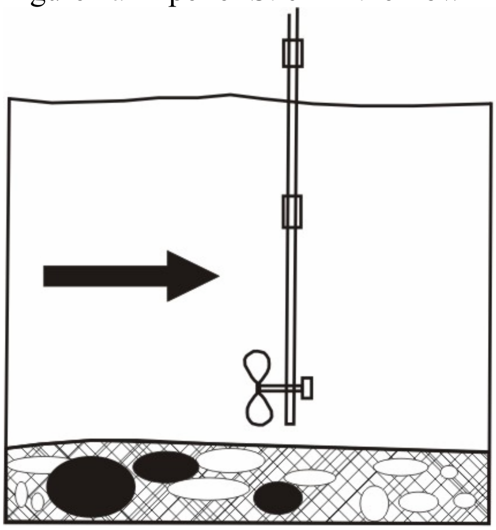
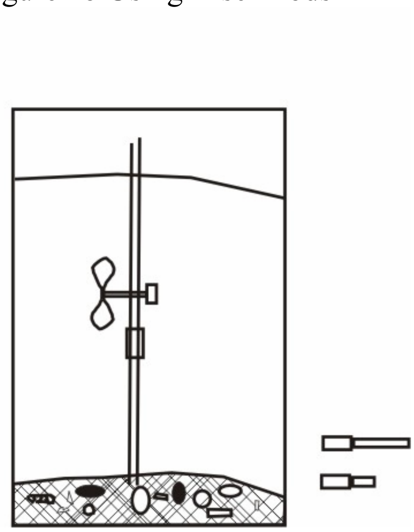


Figure 1b Using Riser Rods



When the impeller is turning at the correct depth (which will depend on the purpose of your measurements), flick the switch down to the start position and hold for 60 seconds (best to have a time keeper at hand!). Stop the count (CENTRE position) at the correct time and note the count value.

Determine the flow speed via the graph provided (see section 5.1, page 17 and Appendix III). Alternatively, the flow speed (V), in m/s is given by the following formula in which C is the number of counts per minute:

Water Velocity (V) m/s = 0.000854C + 0.05

Zero the counter – UPPER switch position (turn impeller slightly, if necessary, to close the impeller relay) and return to CENTRE switch position ready for further measurements.

2.2 Impeller with Advanced Flowmeter

- Connect the IMPELLER to the meter BEFORE turning the instrument on.
- Select WATER and mph or m/s and initiate movement by immersing the IMPELLER in moving water with the impeller pointing upstream.
- NOW switch the instrument ON with the switch on the left hand side of the unit. Note the flashing colon.

With the IMPELLER stick attached and “WATER” selected, the colon will flash for 10 seconds before a value is displayed; it will then stop flashing for 2 seconds before flashing again for 10 seconds and displaying a revised value. The values represent average velocity in either m/s or mph as selected; the 10 second period represents the period over which the average was taken (integration time).

The first reading will almost always be low and should de disregarded.

WARNING: do not change your selection without switching the instrument off and waiting 10 seconds before switching it back on again. Repeated operation of the ON/OFF and Selector Switches is likely to cause erroneous readings to be displayed.

If the colon fails to flash at all; change the battery. Battery life should be approximately 80 hours with a top quality PP3 9V alkali battery or equivalent. To change the battery, remove the sliding cover on the back of the case. Be careful not to lose the battery cover, as these cannot be replaced separately from the counter unit case.

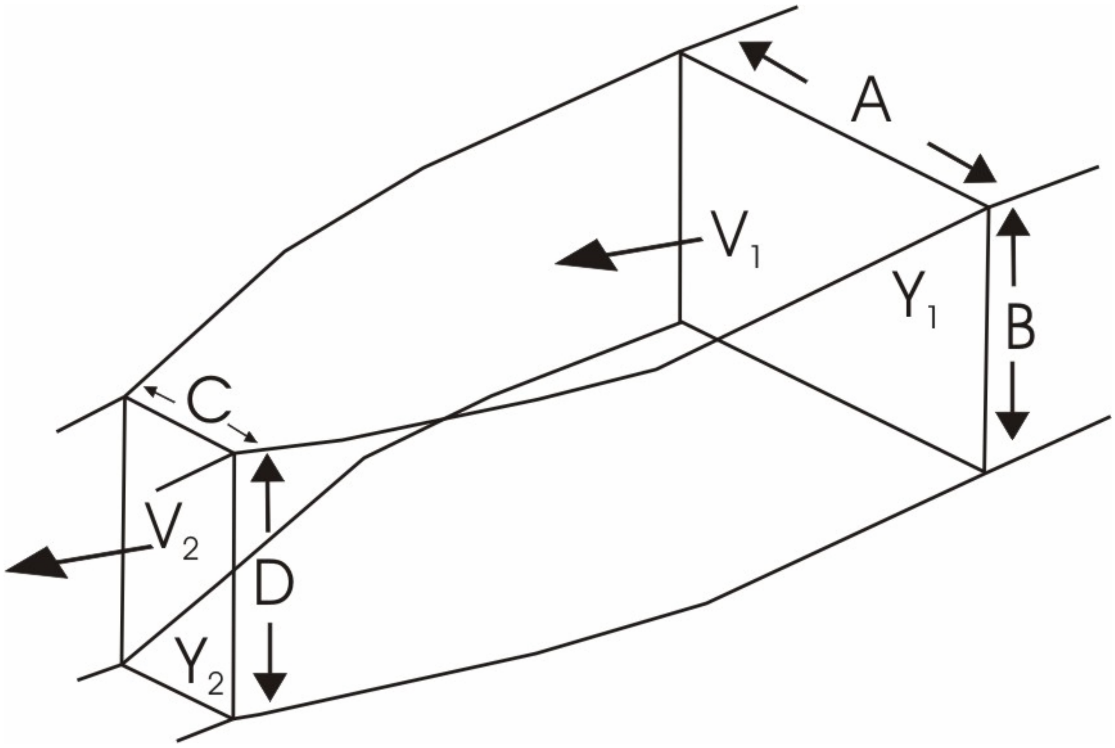
The unit should be kept dry and SHOULD NOT be immersed in water.

3.0 Stream Flow Velocity

3.1 Theoretical Background

A moving fluid exhibits certain important features. The flow velocity of a fluid depends upon the cross-sectional area of the flow and upon the quantity of fluid, which passes through that area in unit time. This is known as the DISCHARGE and illustrates the 'Principle of the Continuity of MASS'.

Figure 2 River Cross-sections and Flow Velocity



In the river channel depicted in Figure 2 the volume of water, which passes through section Y_1 in a second, is the DISCHARGE (Q) and will be given by:

$$Q = a . b. V_1$$

and similarly at section Y_2

$$Q = c . d. V_2$$

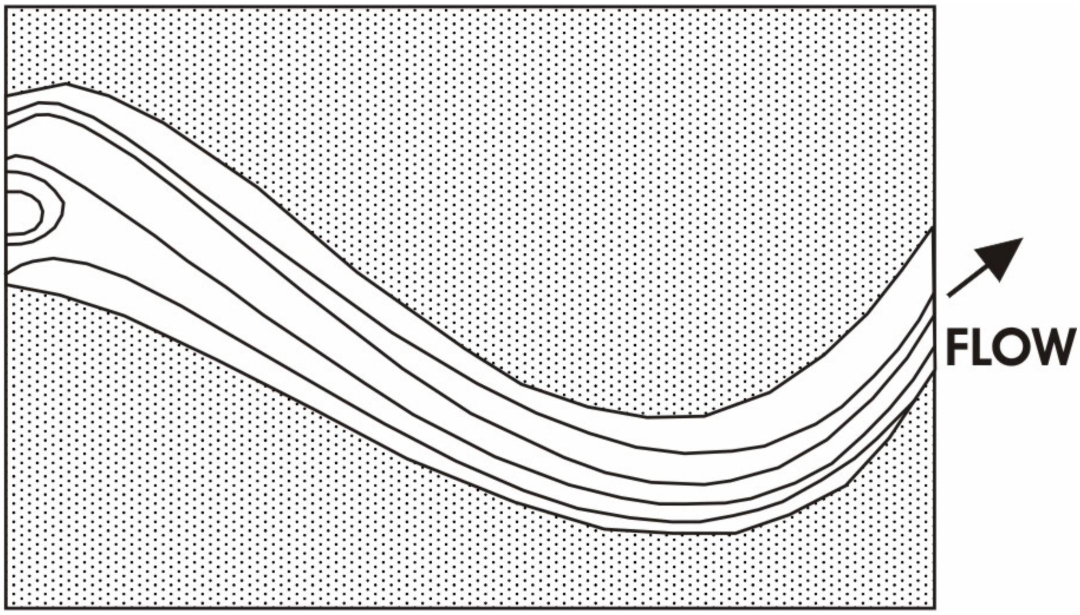
In these equations, a and c are the widths and b and d are the depths of the channel at the two sections, and V_1 and V_2 are the flow velocities. Since the same DISCHARGE (Q) passes through both of the sections then flow velocity relates to the difference between a . b and c . d (the cross-sectional area) ; i.e. if the channel becomes either narrower or shallower then the flow velocity increases and vice versa.

This principle explains many of the variations in the river channel morphology and in flow velocity. It is therefore important that this principle be understood by anyone undertaking serious fieldwork measurements in rivers. This could be demonstrated by measuring channel cross-sectional area and discharge at a number of different sections along a short stretch of river.

3.2 Describing Flows

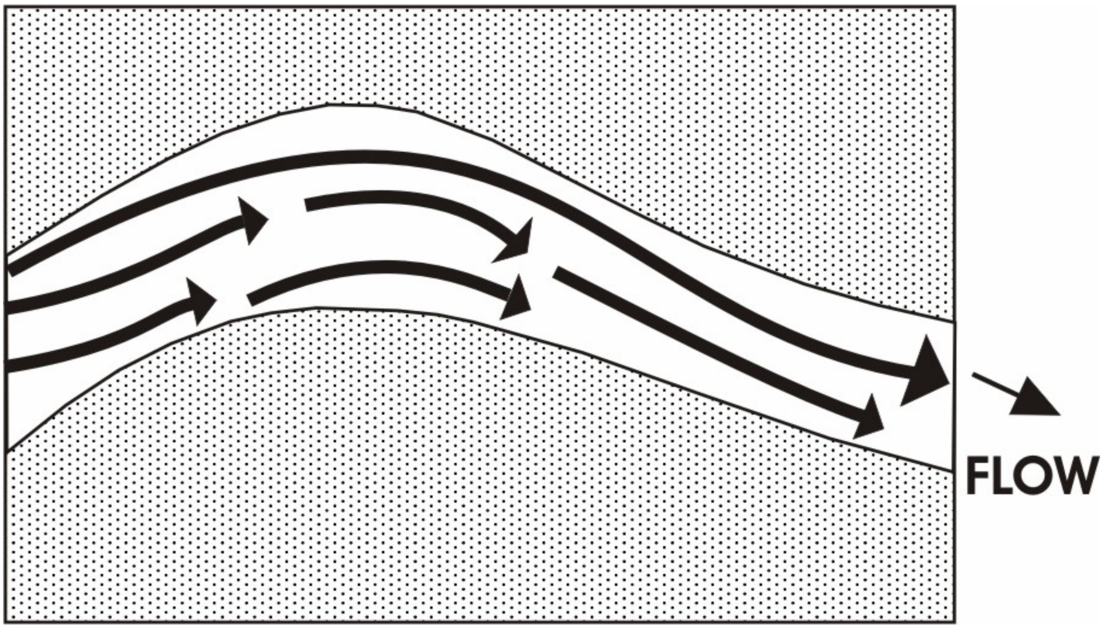
To understand the flow characteristics within streams of moving water it is helpful to construct STREAM LINES and VECTOR LINES. Figure 3 shows how Stream Lines depict possible paths of a single fluid particle.

Figure 3 Stream Lines in a flow around a meander



Vector Lines represent both the flow direction and velocity. The longer and broader the line the greater the flow velocity. Vector lines convey useful information about the stream flow characteristics.

Figure 4 Vector Lines in a flow around meander

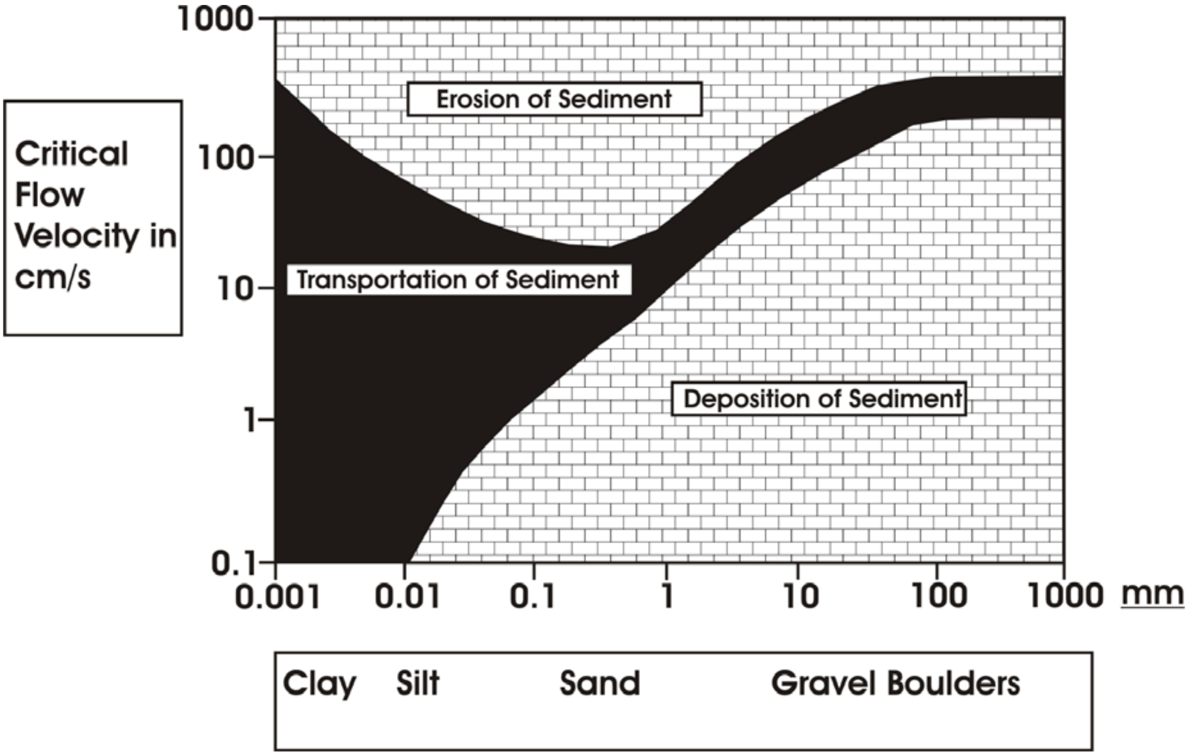


In this diagram the short thin arrows represent the slower areas of the stream and the long, thick lines the regions of faster flow.

3.3 Sediment Transport

The amount of sediment and maximum particle size that can be transported by moving water is related to the flow velocity. Therefore, measurements of velocity obtained using the flowmeter can be used to determine the maximum size of sediment particles, which may be transported by the flow (Figure 5).

Figure 5 Erosion Velocities for Water



The chart, which has been derived from a mass of accumulated observed data, shows that for a given flow velocity there are a range of behavioural possibilities for sediment particles lying on the bed, or entrained within the flow, of a stream. For example, at a measured flow velocity of 100 cm/s (1 m/s) silt and sand (through not compacted clay) will be eroded from the stream bed and transported downstream. At the same velocity, all sediment particles finer than 1mm, which were already in motion, will continue in motion. Where the stream velocity falls below 10 cm/s (0.1 m/s), due to, say, a widening of the channel, sediment particles greater than 1mm diameter will be deposited.

Thus, a stream flowmeter can be a valuable observation tool when used in sediment transportation studies. Observed flow velocities can be traced on the graph and the corresponding maximum particle size, which can be transported at the velocity, can be determined.

4.0 Studying Streams – Some fieldwork suggestions

4.1 Recording Stream Velocity

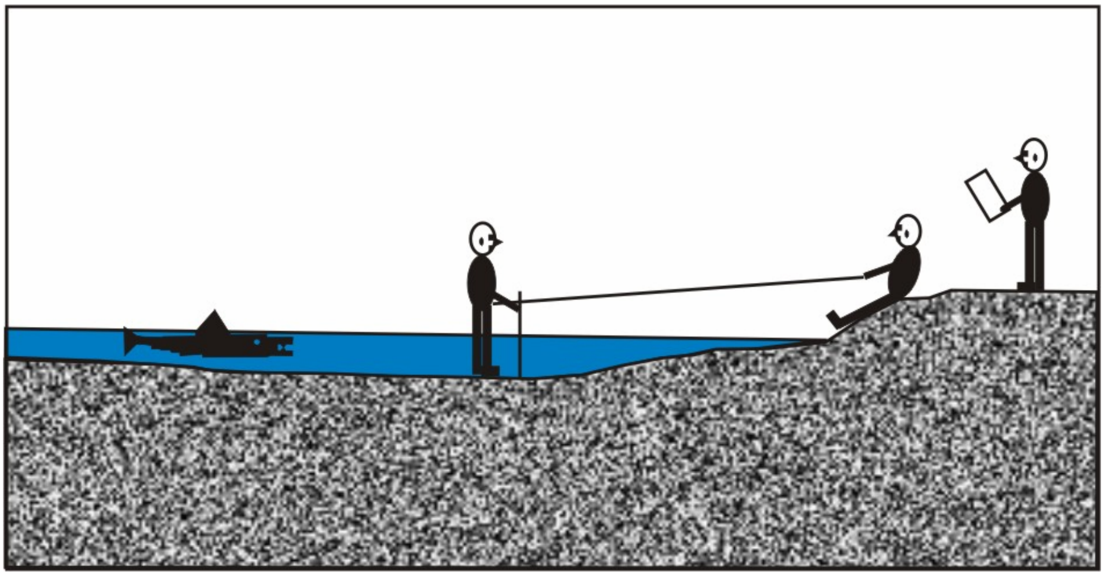
Equipment Needed:

Geopacks stream flowmeter
Stopwatch (if using Basic flowmeter)
Measuring tape
Ranging pole
Clipboard and pen
Data collection sheets

Working in groups of two or three, students make rapid progress provided they work efficiently, know their objectives and have thoroughly prepared the ground. For example, one student works in, or above the stream with the meter while a second student uses a stopwatch to control the velocity recording time. A third member of the group records the data, such as notes on the site, distance from the bank from which the measurements are being taken, also the depth of reading, recording time, and finally of course, the number of counts per minute or velocity.

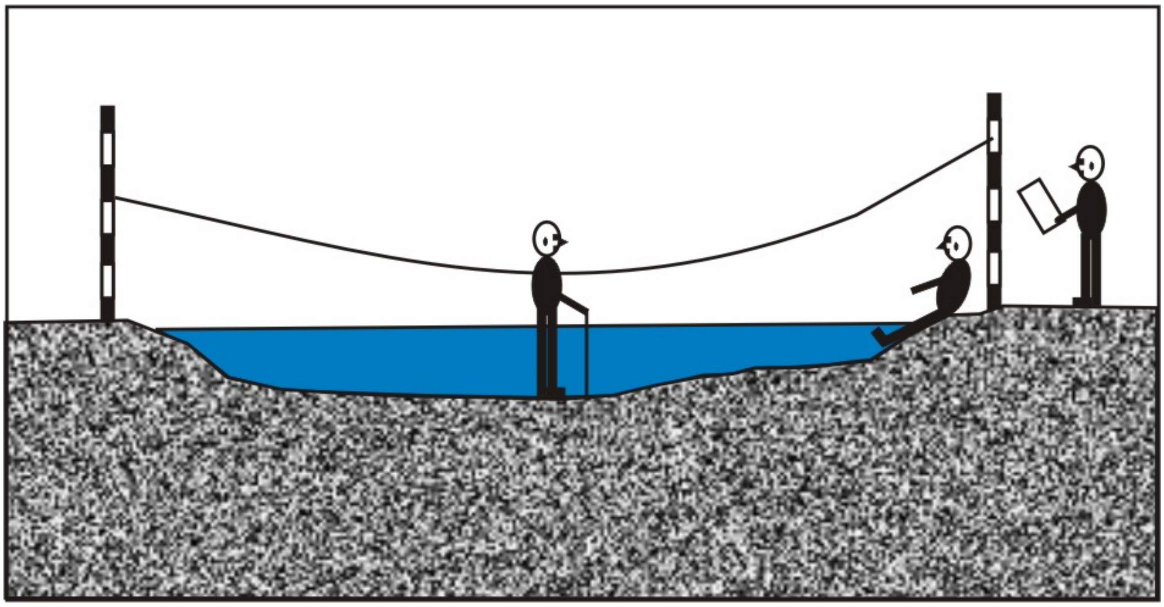
Measurements of the distance from the banks and the position of the meter in the stream are vital. For systematic collection of stream velocity data, the position of the meter readings should always be recorded with reference to one bank – DISTANCE OUT. For example, in larger channels this may be determined by attaching a tape to the waist or belt of the student working in the stream with the meter. By standing on the bank, and holding the tape out horizontally across the channel one person can determine the position of the meter from the bank.

Figure 6 – Measuring "Distance Out" using tape attached to student's belt



In smaller channels it maybe more convenient to stretch the tape measure across the channel horizontally from the bank to bank. The ends of the tape can be attached to ranging poles on the bank.

Figure 7 Measuring "Distance Out" using tape stretched between poles



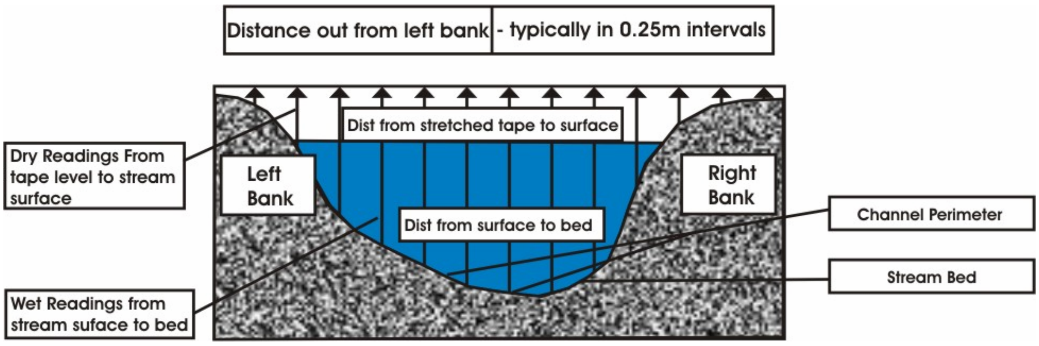
Depth of measurement (DISTANCE DOWN) can easily be measured if the flowmeter tubes are simply calibrated beforehand using tape or water-resistant paint or ink, or more accurately, by using a staff. In estimating water depth, please note that each section of the flowmeter stem is 250 mm long. Total water depth from surface to bed (sometimes called the WET READING) can be measured with the impeller stick if less than 1 metre. It is useful to have an elastic band or some other device on the impeller stick which can be moved up and down the stem to the water level. This allows a reasonably accurate estimate of depth to be made visually. Alternatively, if calculating the position of 0.6 of the depth (see section 4.3) for mean water column velocity measurement, the band can be moved to the appropriate position along the stem.

4.2 Plotting the Channel Cross-Section

This is essential for meaningful stream velocity recording. A plan or "map" of the stream cross-section at each point where measurements are to be made forms the basis for recording observations.

One method of measuring and plotting the channel form is by stretching a tape measure across the channel as described above. Depths can be measured vertically down from the tautly stretched tape to the stream bed (or channel perimeter) – see Figure 8. Measurements of channel widths and depths are then recorded using data sheet provided. At regular intervals along the tape, two measurements should be noted. Firstly, the distance from the tape to the ground or water surface known as the DRY READING. Secondly, the WET READING should be recorded. This is the depth of the water at each point. This depth can be measured using the calibrated stem of the flowmeter, but more accurately by using a rule or staff. The greater the number of measurements taken at each cross-section, the more accurate the representation of the channel.

Figure 8 – Measuring & Plotting the Channel Cross-Section



4.3 Calculating Stream Discharge

In section 3.1 it was demonstrated (Figure 2) that:

DISCHARGE (Q) = Cross-Sectional Area x Flow Velocity

So, if the cross section area of a channel was 1 m^2 and the rate of flow was measured at 1 m/s, then the Discharge Q would be 1 m^3/s (1 cumec). If, after heavy rain the channel area increased to 2 m^2 and the flow velocity to 1.5 m/s then the discharge (Q) would be 3 m^3/s or 3 cumec. Discharge is a very important variable. Unfortunately, it is not always easy to measure.

Figure 9a Semi-Circular Channel

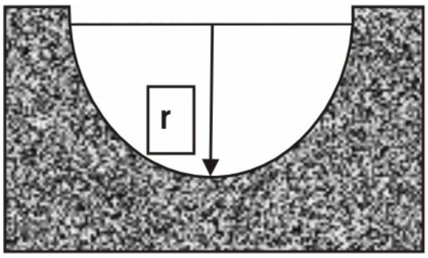
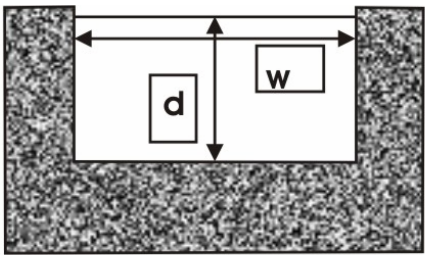


Figure 9b Rectangular Channel



Calculating discharge in the case of either the semi-circular channel (Figure 9a) or the rectangular channel (Figure 9b) is relatively simple.
In the semi-circular channel, if we take:

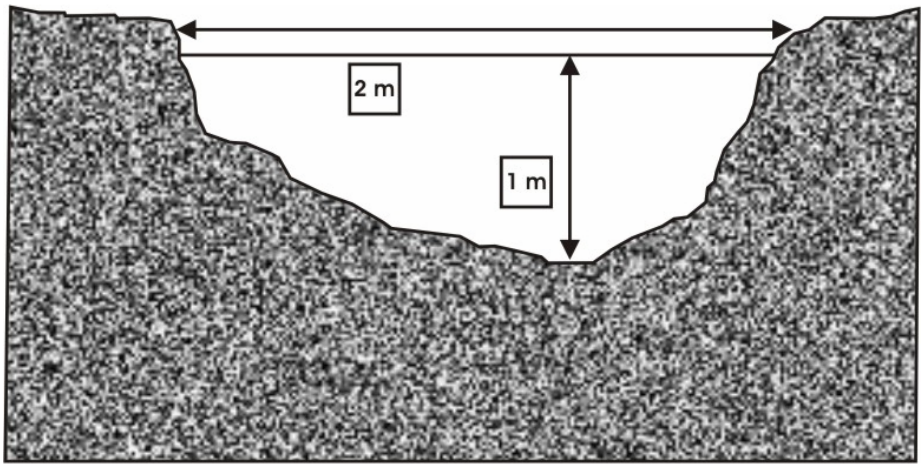
Radius of Channel (r)	=	1 m
Cross-sectional area (Δ)	=	$\pi^2 \div 2$
	=	1.57m^2
Mean Velocity (V)	=	1 m/s
Discharge (Q)	=	Δ x V
	=	1.57 m^3/s

Similarly, in the rectangular channel, if the:

Depth (d)	=	1 m
Width (w)	=	1.5 m
Cross-sectional (Δ)	=	1.5m^2
Mean Velocity (V)	=	1 m/s
Discharge (Q)	=	Δ x V
	=	1.50 m^3/s

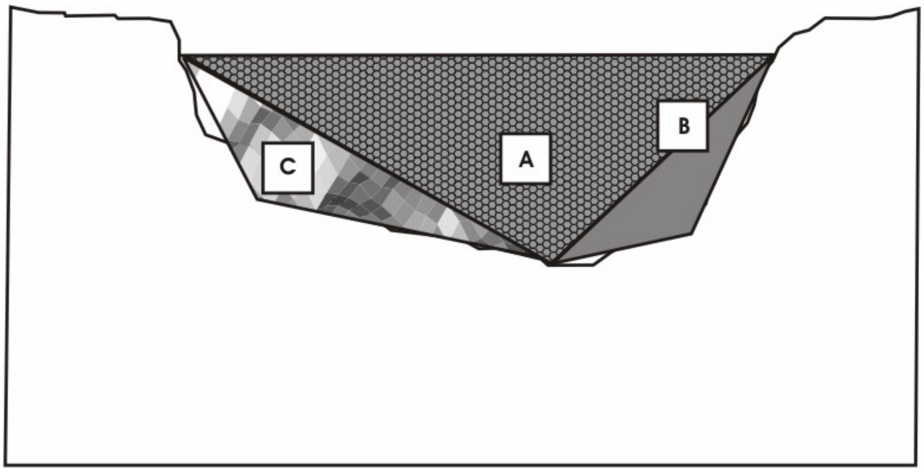
In a real-life situation, however, the channel geometry will be far from regular.

Figure10a Irregular Stream Channel Cross-Section



In these cases, the calculation of the cross-sectional area is more complex as the following example shows:

Figure 10b Calculating the Cross-Sectional Area of a irregular Channel



In this Example, the channel area beneath the water line has been divided into three triangular shapes. The largest triangle is whole, while the other two approximate the geometry of the area which they respectively cover by a judicious mix of inclusion and exclusion. By finding the area of each triangle by the formula:

Area of Triangle = (Length of Base) x (Half the Height)

It is possible to calculate the cross-sectional area of the channel by summing the areas of the triangles (the values used are notional, for illustration only):

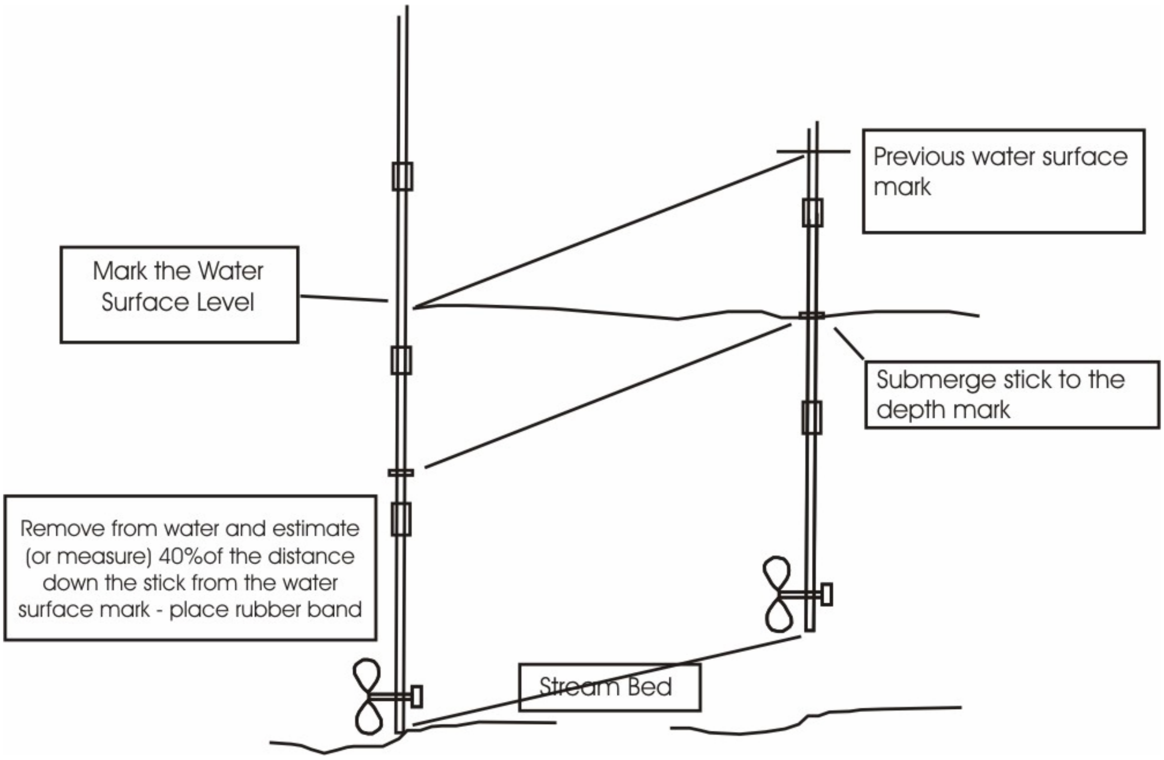
Area of triangle A	=	1.00 m^2
Area of triangle B	=	0.15 m^2
Area of triangle C	=	0.30 m^2
Total Channel Area	=	1.45 m^2

Unfortunately, there remains the problem of measuring the flow velocity in the channel. Because of friction with the bed and banks (the WETTED PERIMETER) and because of internal turbulence, stream velocity varies from point to point. Large numbers of observations under controlled conditions suggest that in water depths of less than 0.6m, a reliable average velocity can be recorded at a point, which is **0.6 of the depth of the water below the surface.** At this depth the faster surface flow is averaged out against the slower bed flow and this figure is an acceptable EMPIRICAL GUIDELINE (i.e. one derived from observation and experiment under a variety of circumstances).

A quick way of finding 0.6 of the depth requires a special piece of equipment – a rubber band! Follow this simple procedure:

Step 1	rest impeller base on stream bed.
Step 2	mark the water surface level with finger and thumb.
Step 3	remove stick from the water keeping water surface mark.
Step 4	visually estimate (or measure) 0.4 of the distance down the stick between the water surface mark and the base.
Step 5	place a mark (e.g. rubber band) at this point.
Step 6	submerge the impeller stick to this point on the stem.
Step 7	the impeller will be approximately at the 0.6 of the depth from the surface down.

Figure 11 Finding 0.6 of the depth



But the problems aren't over yet! In the semi-circular and rectangular channel sections shown in Figures 9a and 9b, an impeller placed in the centre of the channel at 0.6 of the depth, would give a reasonable average flow velocity. In the real-life section shown in figure 10b, the channel geometry is much less regular. Where should the mean velocity be measured? The most likely choice would probably be in the vicinity of the label letter "A"

Thus, if the flow velocity (V) at this point was recorded as being 1 m/s and with a cross-sectional area of 1.45 m^2 then the DISCHARGE (Q) would be 1.45 m^3/s

To do the job properly however, it would be necessary to make a series of average flow velocity measurements, and this would require the channel cross-section to be subdivided into a series of columns like those in Figure 12.

Figure 12 Constructing Water Columns in a Stream Cross-Section

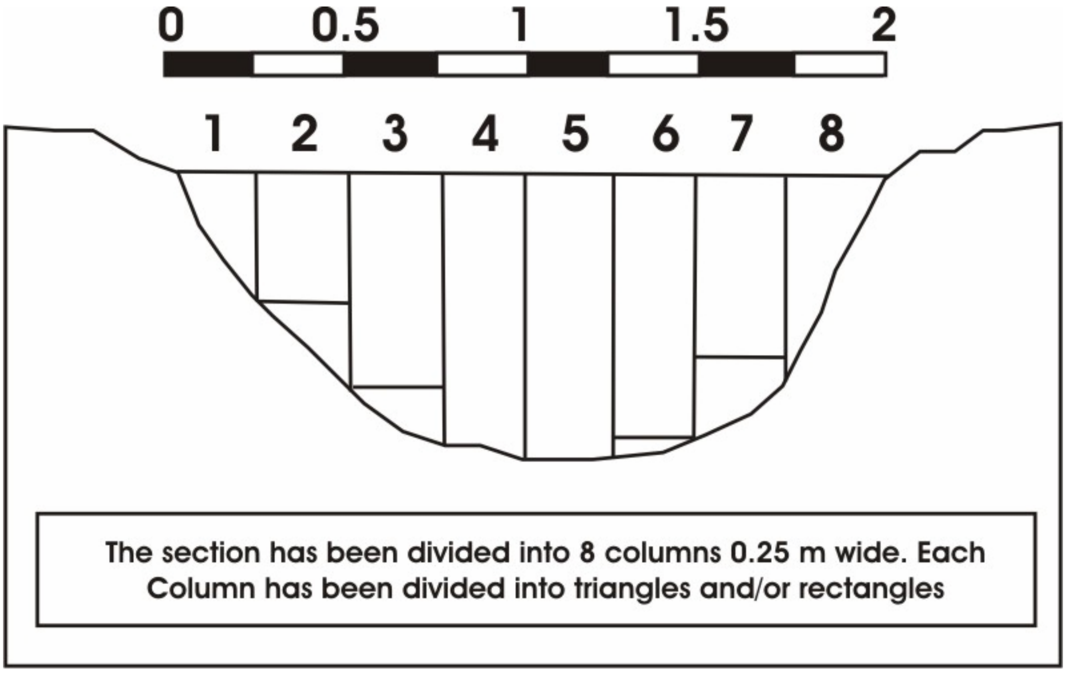


Figure 12 shows a stream cross-section which is 2 m wide. The section has been subdivided into columns (WATER COLUMNS) 0.25 m wide. According to the geometry of the channel, each column consists of a triangle and/or a rectangle. The area of each column has been calculated using the techniques described earlier and using the scale provided on the diagram. At an appropriate point within each column, the flow velocity would be measured with an impeller. A set of hypothetical velocities and the area measurements are displayed in Table 1, along with the calculations necessary to determine DISCHARGE (Q).

Table 1 Table of Measurements and Calculations for the Cross-Section

	Col.1	**Col.2**	**Col.3**	**Col.4**	**Col.5**	**Col.6**	**Col.7**	**Col.8**	**Cols 1-8**	
Area 1	0.00	0.07	0.12	0.22	0.23	0.19	0.13	0.00	0.96	
Area 2	0.07	0.06	0.03	0.00	0.00	0.02	0.02	0.11	0.31	
Area 1+2	0.07	0.13	0.15	0.22	0.23	0.21	0.15	0.11	**1.27**	Cross-Section area (m^2)
V	0.05	0.60	0.90	1.10	1.00	0.50	0.40	0.10	**0.58**	Mean Velocity (m/s)
Q	0.00	0.08	0.14	0.24	0.23	0.10	0.06	0.01	**0.86**	Discharge (m^3/s)

In the Table, Area 1 refers to rectangles and Area 2 to triangles

From the table:

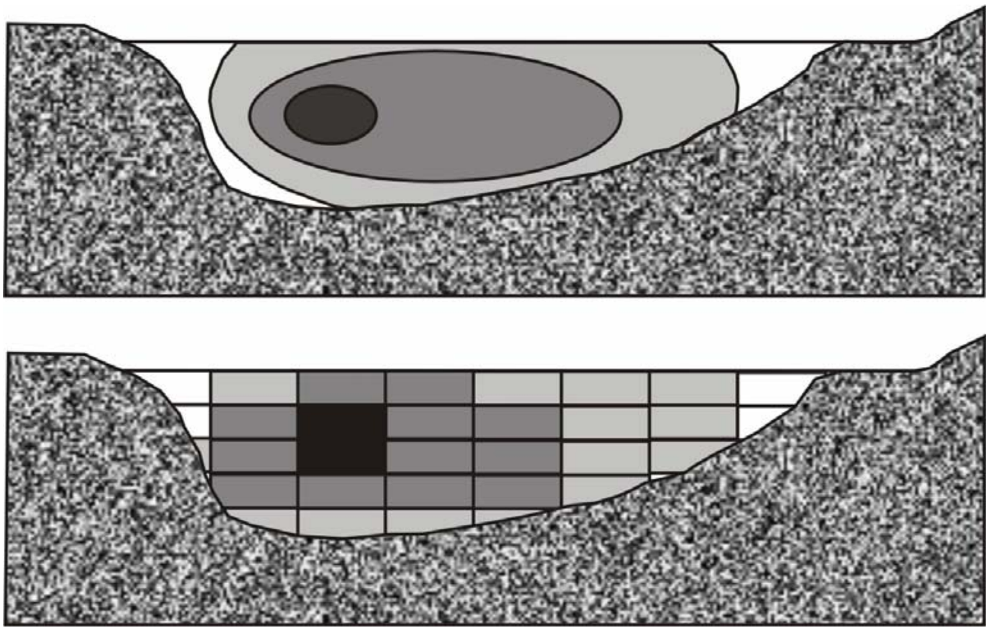
The total cross-sectional area has been calculated as	1.27 m^2
The mean flow velocity through the section is	0.58 m/s
The total discharge (Q) through the section is	0.86 m^3/s

These procedures ensure that the best possible results are obtained from fieldwork. Once the hard work of surveying the channel section has been done, the profile can be used repeatedly under varying circumstances (e.g. before and after heavy rain) though adjustments for changes in depth and in-channel geometry due to erosion and deposition must be made. The exact position of the cross-section(s) must be fixed by inserting discrete stakes into the river banks.

4.4 Plotting Flow Patterns within a Stream

Using the cross-section channel profile(s) constructed for discharge measurements (or survey some new sections), it is possible to collect data to illustrate the internal flow characteristics of channelled flow. There are a number of techniques, most common being the construction of **ISOVELS** or **CHOROPLETHS**. Isovels are lines joining points of equal velocity and Choropleths involve shaded areas of like and unlike velocity.

Figure 13 Showing internal flow patterns – Isovels (above) & Choropleths

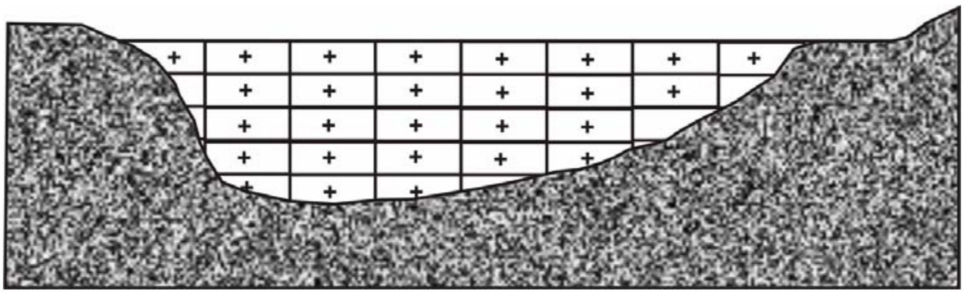


Key: dark shades = high velocity; light shades = low velocity

The isovels and choropleths represent lines and areas of equal velocity respectively. The highest velocity occurs usually in the centre of the channel near to the surface, while it is often lower nearer the bed and banks (Figure 13). However, the pattern displayed by the isovels and choropleths also reflects the shape of the channel i.e. its width, depth and symmetry (Figure 13). The spacing of the isovels and choropleths represents the velocity gradient.

Both methods can be effective in showing internal flow patterns. The degree of refinement depends on the number of readings which are taken – the more the better. Three values must be collected at each point – distance out from one or other bank; depth; and velocity at that point. The stream cross-section must be surveyed as meticulously as possible for the calculation of discharge and readings are collected systematically in a transect across the stream channel. Instead of taking just one velocity reading 0.6 of the depth, a number of readings are taken at regular points within the water column.

Figure 14 Data collection grid for Isovel and Choropleth Construction



In Figure 14, the "+" signs indicate the midpoint of each "cell" in the grid. Typically a grid would consist of cells 0.25 m wide and 0.125 m deep. The size is determined by the size and scale of the channel and degree of accuracy required.

Table 2 Stream Velocity Data collected in Cells

			Stream	Velocity	In m/s			
Depth	Col.1	Col.2	Col.3	Col.4	Col.5	Col.6	Col.7	Col.8
to 0.125	0.00	0.06	0.12	0.11	0.07	0.05	0.05	0.00
to 0.25	0.00	0.09	0.17	0.10	0.10	0.05	0.06	
to 0.375	0.05	0.11	0.16	0.10	0.10	0.10	0.04	
to 0.5	0.00	0.09	0.12	0.09	0.08	0.04		
to 0.625		0.06	0.07	0.06	0.06			
		Cells are 0.25 wide and 0.125m deep						

The data shown in this grid are ideally suited to constructing choropleths. For a representative and refined Isovel construction, at least twice as many velocity readings would be required (typically in a grid with 0.1 by 0.1 m cells).

Geopacks publishes a computer software package called "Channel Analysis" which not only plots choropleths from fieldwork data but also draws channel cross-sections and calculates discharge among a wide range of other functions. For details see Appendix V.

5.0 Calibration

The impeller stick has been carefully calibrated under laboratory conditions. The formula and graph from what we call the Calibration Data are essential for users of the Basic Flowmeter with impeller stick. The Advanced Flowmeter has the relevant calibration data built into the electronics so that direct velocity data is generated in m/s or mph as selected.

5.1 Impeller Stick Calibration

The impeller sticks have been calibrated in a flume where the velocity of water flow can be strictly controlled by combined variations in discharge, gradient and weir height adjustments. Flow rate was monitored by a miniature Nixon electronic flowmeter and an Ott flowmeter. The formula required to convert counts per minute (C) recorded by the Basic Flowmeter to water velocity (V) in m/s is:

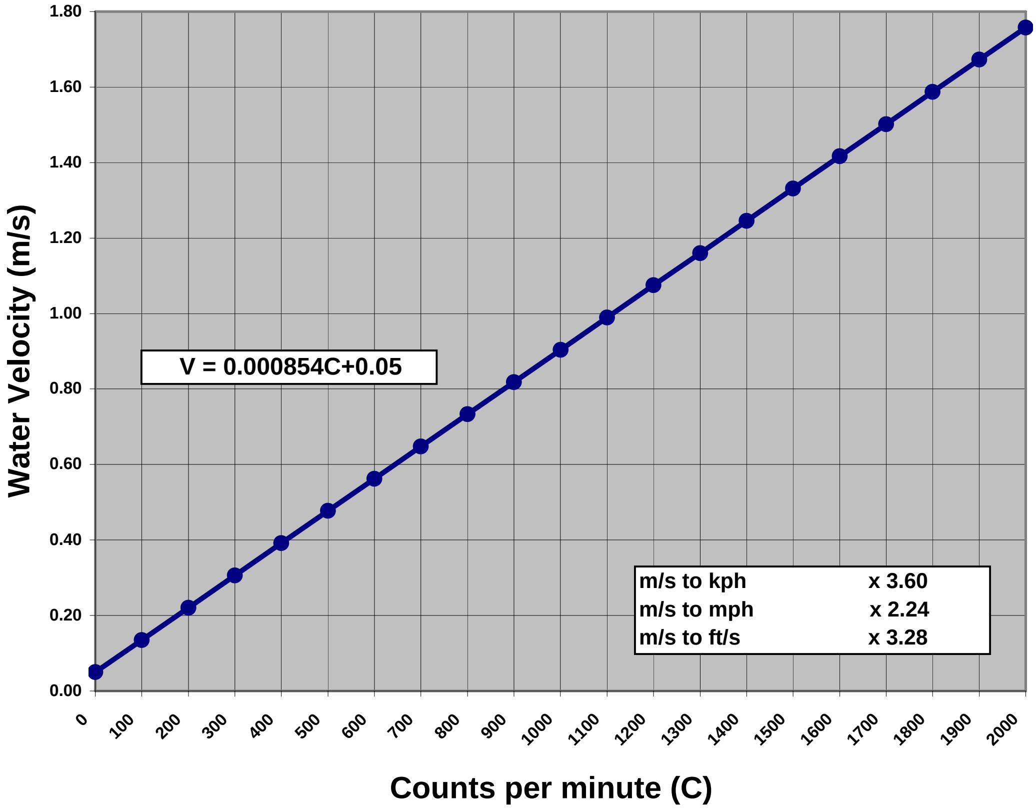
Water Velocity (V) m/s = 0.000854C + 0.05

Alternative units can be calculated using the following conversion factors:

m/s to kph	**x**	**3.60**
m/s to mph	**x**	**2.24**
m/s to ft/s	**x**	**3.28**

Values in this manual are given in metres per second (m/s). The formula can be entered into a spreadsheet or other computer program and used to convert counts per minute into the desired unit of velocity. Alternatively, a Calibration Chart can be used. The chart (Figure 15) is reproduced in laminated format with this manual for use in the field.

Figure 15 Calibration Chart for Water Velocity



Appendix I

CARE OF YOUR FLOWMETER

Check your equipment before you start work.

BEFORE leaving for fieldwork check your equipment as follows:

> Switch on the meter by plugging the impeller into the socket (use the ON-OFF switch on the Advanced flowmeter)
>
> If nothing is displayed, check the batteries are correctly fitted. Batteries are accessed in the Basic flowmeter by undoing the small cross-headed screws on the back of the unit (try not to lose the screws!). On the Advanced flowmeter, un-clip the battery cover on the back of the instrument (take care not to lose the cover). Fit new batteries if necessary: always carry spares ("AAA" for the Basic – average life several months: PP3 (9 volt) for the Advanced – average life 80 hours continuous use).

Although your flowmeter has been designed for use by fieldwork parties under a wide range of conditions and is reasonably robust, it can be damaged by rough treatment or immersion in water. Should either meter be immersed in water, REMOVE the batteries IMMEDIATELY; the basic meter can be left open to dry in a warm room, do not attempt to open the Advanced meter but leave it to dry slowly.

Should the flowmeter (impeller stick and/or meter) be damaged or otherwise malfunction we can repair/replace damaged parts at a very reasonable cost and will also provide repairs under guarantee.

Please telephone Geopacks on 08432 160 456 and ask for Technical Product Manager prior to returning the meter.

GEOPACKS
Unit 4A, Hatherleigh Industrial Estate
Holsworthy Road
Hatherleigh
Devon
EX20 3LP

We can also customise your Flowmeter for any special requirements.

We recommend that the moving parts be lubricated with WD 40, or similar, after each field session. Also, the battery should be removed if the equipment is not being used for any length of time

YOUR FLOWMETER IS GUARANTEED AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP FOR 12 MONTHS FROM THE DATE OF PURCHASE.

Appendix II

Safety Considerations

BE AWARE – BE SAFE

When undertaking fieldwork in and around streams, please heed the following safety first points:

1. Never work alone. Let someone responsible know where and when you will be working; and don’t go elsewhere.

2. Always work with others – 3 is a sensible minimum.

3. Never work in fast flowing or deep water - as a general guide FAST means greater than 0.5 m/s and DEEP means where the water level comes above the knee.

4. Always survey the stream for: unstable banks, dangerous obstacles on the bed, overhanging trees and other “common-sense” dangers.

5. Never risk HYPOTHERMIA – wear warm, waterproof clothes and even in summer, have these to hand – stream water can be very cold, almost all year round. If you don’t know what the term HYPOTHERMIA means, please seek advice, it is a life threatening, though avoidable, medical condition caused by loss of body heat due to cold and wet and or exhausting conditions.

6. Always take the utmost precaution when attempting to cross streams – if in doubt, don’t.

7. Never attempt to cross or work in streams prone to flash floods.

BE AWARE – BE SAFE

Appendix III

Calibration Chart

The large chart enclosed have been laminated for your convenience. Please make photocopies for your records in case the original become mislaid or damaged in use.

Enclosed – water calibration chart - laminated

Appendix IV

Data Collection Sheets

Insert units of measurement as appropriate (e.g. m and m/s)

V.1 For use with Geopacks Basic Flowmeter – stream velocity

V.2 For use with Geopacks Advanced Flowmeter – stream velocity

Enclosed – 1 each of the above sheets, laminated

Appendix V

Resources

Geopacks manufactures and distributes a wide range of products associated with the flowmeter discussed in this manual. We have measuring tapes, stop watches, ranging poles, a wide range of other survey equipment, as well as the more specialized items described below.

Of particular interest are the following products – but be sure to ask for our full Geopacks catalogue if you don't already have a copy; our address and telephone number given in Appendix 1.

Videos:

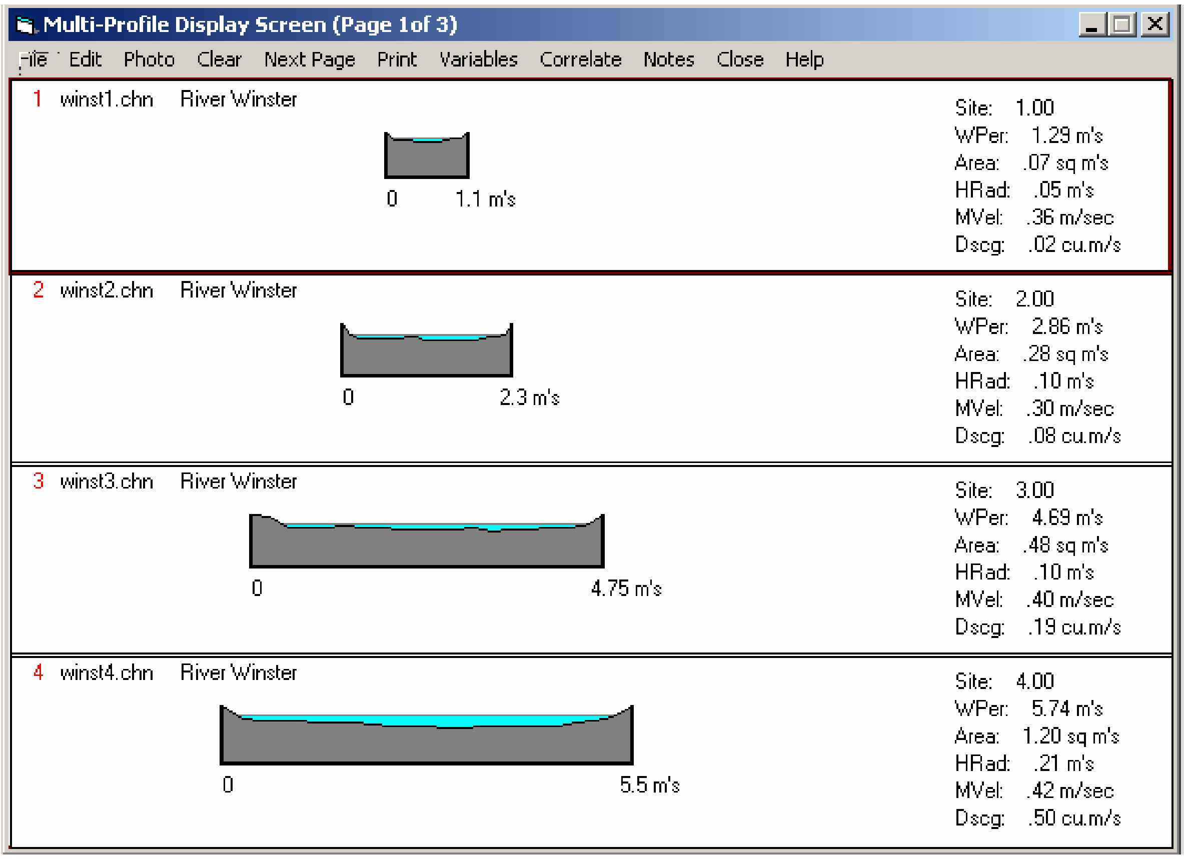
"Studying Rivers, a Practical Approach" – a 60 minute compilation for teachers and students. Practical guidance in using the flowmeter to test simple hypotheses moving on to develop skills in plotting internal flow characteristics and undertake full scale discharge measurements. Based on fieldwork in South Wales but incorporating background material from other locations especially the Colorado Plateau area of the American South West. PAL for VHS; GPV2 - £19.99 (plus VAT where appropriate).

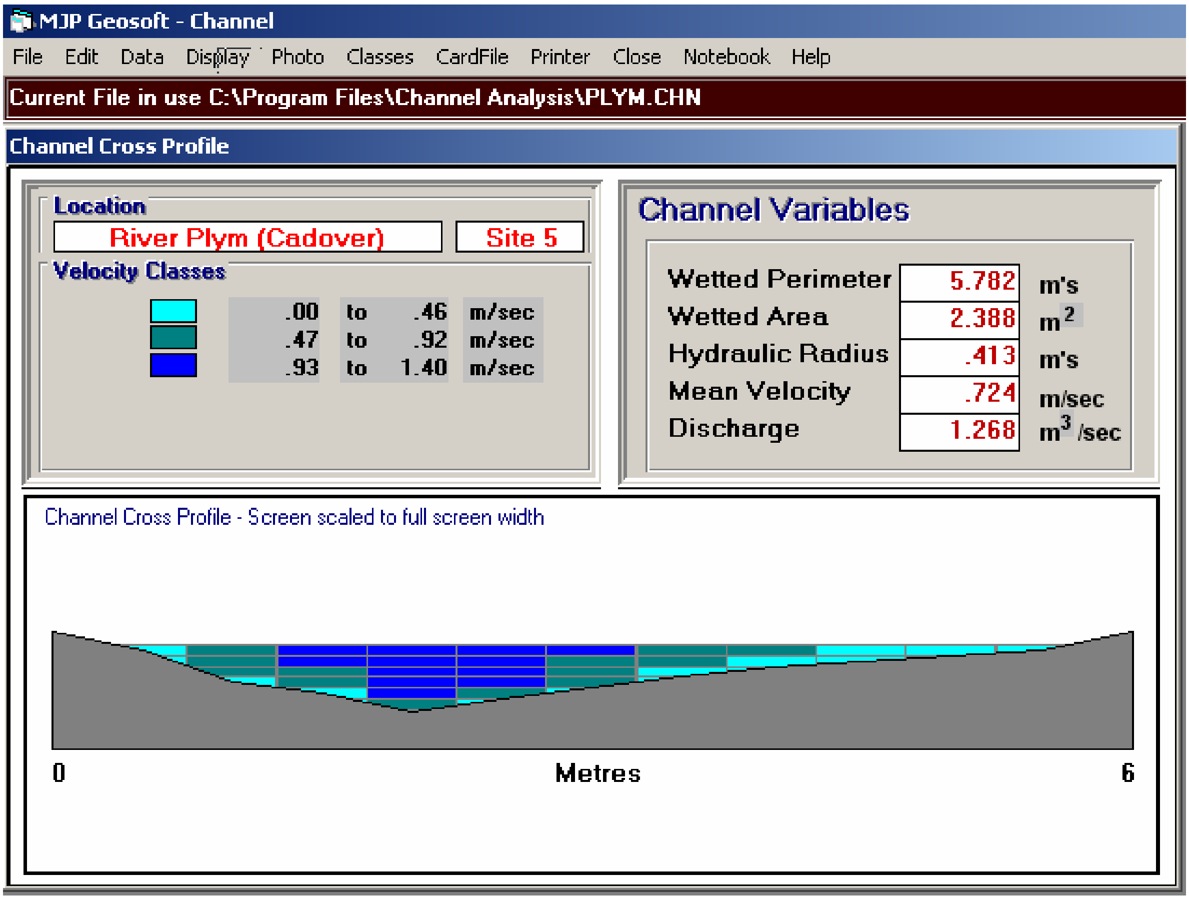
"Studying Sediment in Motion, a Practical Approach" – 45 minutes of instruction and demonstration on how to measure sediment transportation in streams and in moving air using flowmeter/anemometers. Filmed on location in South Wales, the video aims at students in the 13 to 18-age range of the UK education system (KS3 through GCSE to A level) through a series of staged experiments. Laboratory follow-up to fieldwork is especially emphasised in this compilation. PAL for VHS; GPV1 - £19.99 (plus VAT where appropriate).

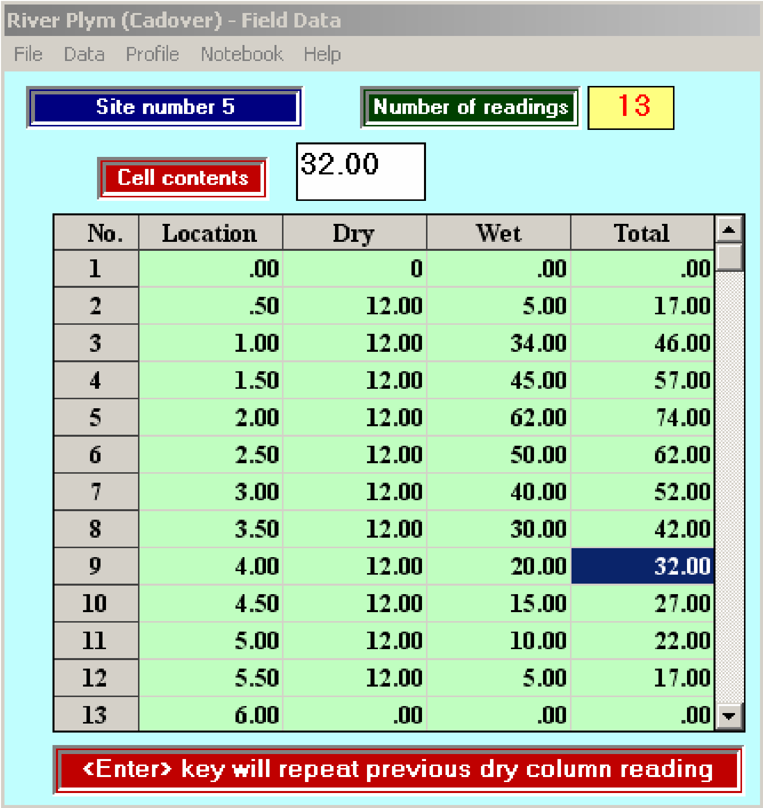
Computer Software:

"Channel Analysis for WINDOWS" by Rick Cope. The Essential software tool for guiding, processing, presenting the fruits of your river based field studies. "Channel Analysis" has been written for Windows by Rick Cope, a geography teacher well known for his expertise in field studies. This is available in single user, 2 – 10 users, or 11+ users. Please contact Geopacks for more information and Costs.

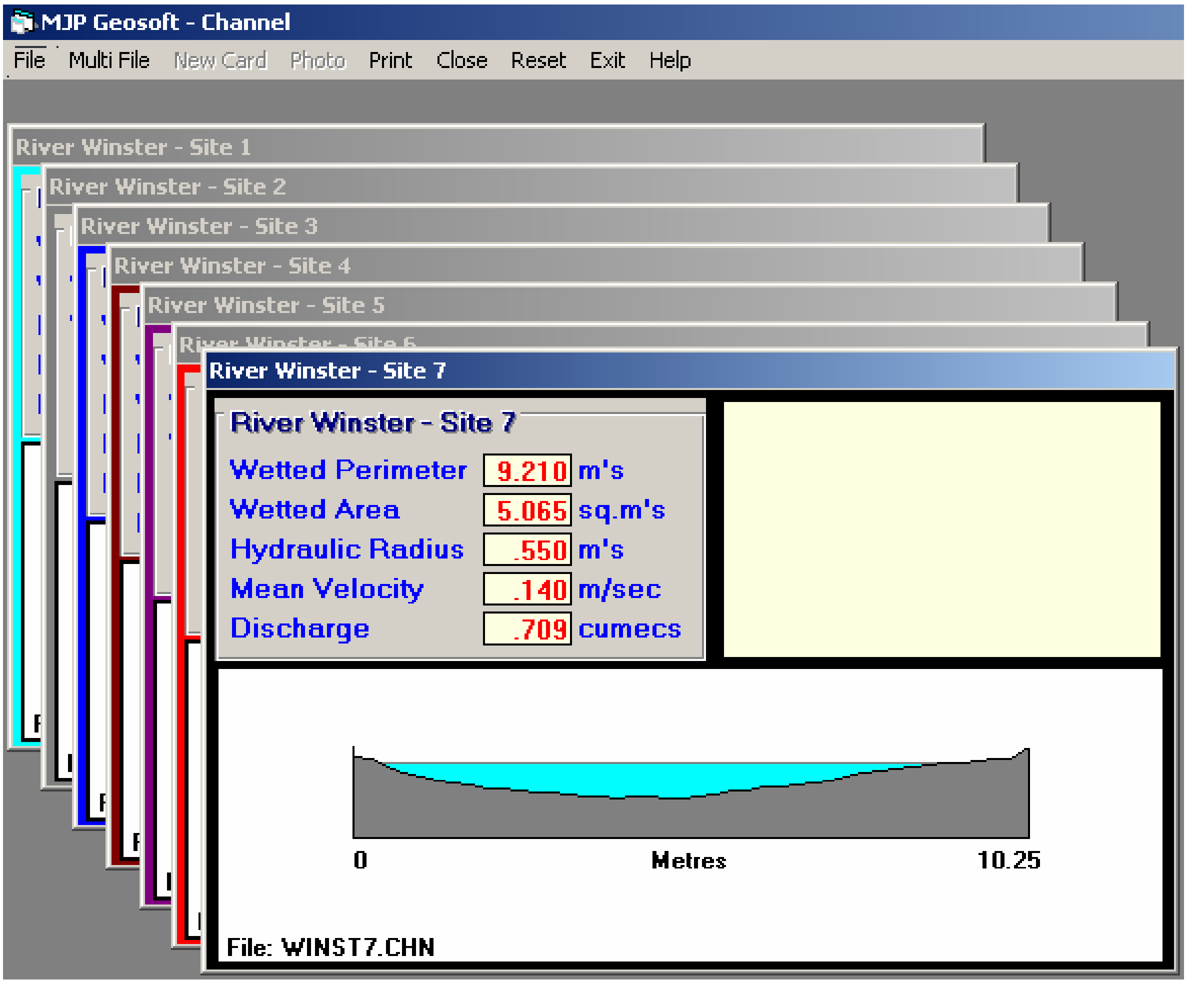
Some illustrations from "Channel Analysis "appear on the following pages. Please note the last illustration which highlights the unique facility in this program for storing "card file" data clips on a whole range of river features.


Multi-Profile Display Screen (Page 1of 3)
File Edit Photo Clear Next Page Print Variables Correlate Notes Close Help
1 winst1.chn River Winster
0 1.1 m's
Site: 1.00
WPer: 1.29 m's
Area: .07 sq m's
HRad: .05 m's
MVel: .36 m/sec
Dscg: .02 cu.m/s
2 winst2.chn River Winster
0 2.3 m's
Site: 2.00
WPer: 2.86 m's
Area: .28 sq m's
HRad: .10 m's
MVel: .30 m/sec
Dscg: .08 cu.m/s
3 winst3.chn River Winster
0 4.75 m's
Site: 3.00
WPer: 4.69 m's
Area: .48 sq m's
HRad: .10 m's
MVel: .40 m/sec
Dscg: .19 cu.m/s
4 winst4.chn River Winster
0 5.5 m's
Site: 4.00
WPer: 5.74 m's
Area: 1.20 sq m's
HRad: .21 m's
MVel: .42 m/sec
Dscg: .50 cu.m/s

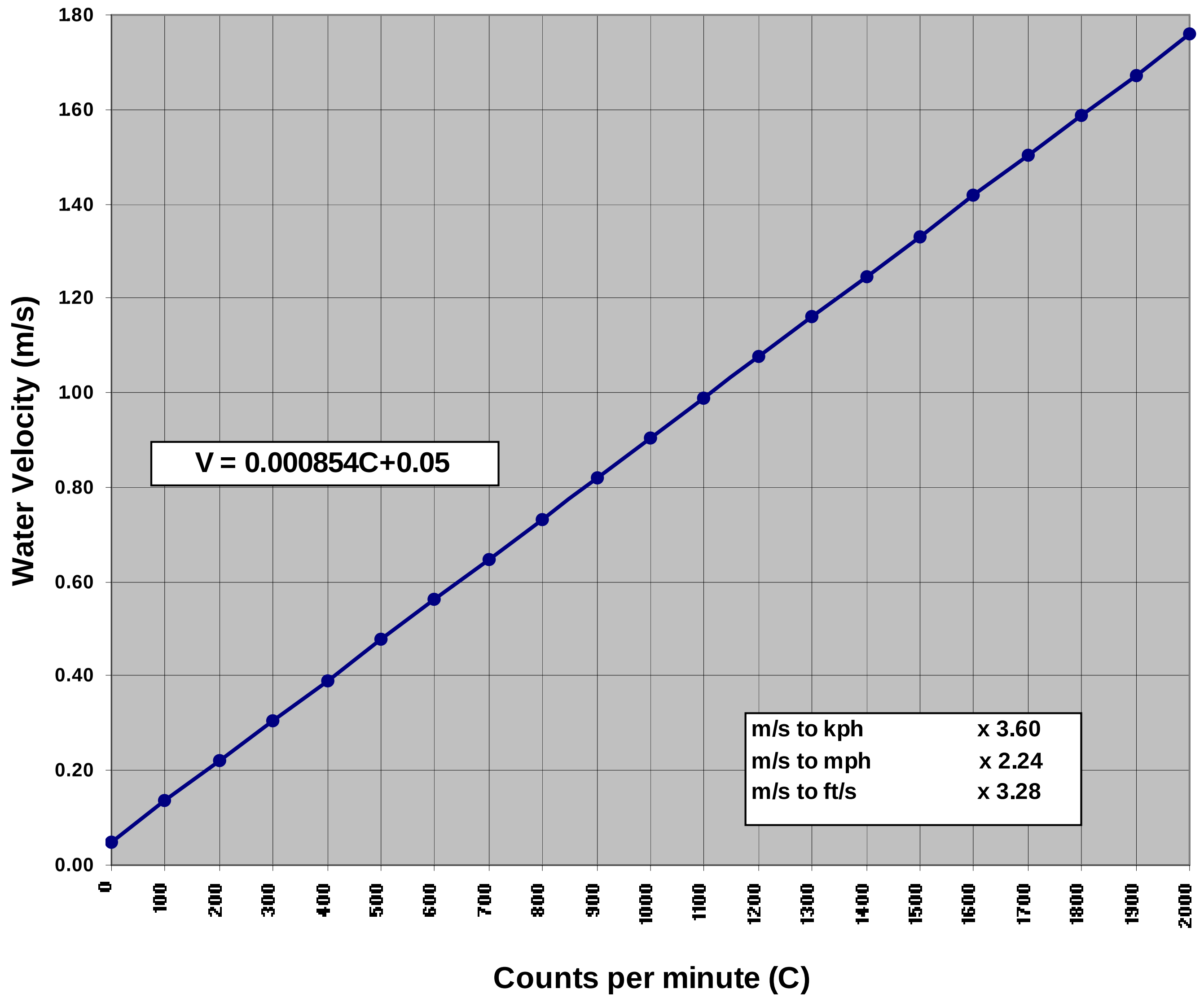

MJP Geosoft - Channel
File Edit Data Display Photo Classes CardFile Printer Close Notebook Help
Current File in use C:\Program Files\Channel Analysis\PLYM.CHN
Channel Cross Profile
Location
River Plym (Cadover)
Site 5
Velocity Classes
.00 to .46 m/sec
.47 to .92 m/sec
.93 to 1.40 m/sec
Channel Variables
Wetted Perimeter 5.782 m's
Wetted Area 2.388 m2
Hydraulic Radius .413 m's
Mean Velocity .724 m/sec
Discharge 1.268 m3 /sec
Channel Cross Profile - Screen scaled to full screen width
0
Metres
6



No.	Location	Dry	Wet	Total
1	.00	0	.00	.00
2	.50	12.00	5.00	17.00
3	1.00	12.00	34.00	46.00
4	1.50	12.00	45.00	57.00
5	2.00	12.00	62.00	74.00
6	2.50	12.00	50.00	62.00
7	3.00	12.00	40.00	52.00
8	3.50	12.00	30.00	42.00
9	4.00	12.00	20.00	32.00
10	4.50	12.00	15.00	27.00
11	5.00	12.00	10.00	22.00
12	5.50	12.00	5.00	17.00
13	6.00	.00	.00	.00



Water Velocity Calibration Chart



Obs #	Distance Out	Depth	Counts/ Minute (C)	Velocity (V)	Obs #	Distance Out	Depth	Counts/ Minute (C)	Velocity (V)
1					51				
2					52				
3					53				
4					54				
5					55				
6					56				
7					57				
8					58				
9					59				
10					60				
11					61				
12					62				
13					63				
14					64				
15					65				
16					66				
17					67				
18					68				
19					69				
20					70				
21					71				
22					72				
23					73				
24					74				
25					75				
26					76				
27					77				
28					78				
29					79				
30					80				
31					81				
32					82				
33					83				
34					84				
35					85				
36					86				
37					87				
38					88				
39					89				
40					90				
41					91				
42					92				
43					93				
44					94				
45					95				
46					96				
47					97				
48					98				
49					99				
50					100				

V.1 For use with the Geopacks Flowmeter for Stream Velocity

(users may copy this sheet)

Obs #	Distance Out	Depth	Velocity (V)	Obs #	Distance Out	Depth	Velocity (V)	Obs #	Distance Out	Depth	Velocity (V)
1				51				101			
2				52				102			
3				53				103			
4				54				104			
5				55				105			
6				56				106			
7				57				107			
8				58				108			
9				59				109			
10				60				110			
11				61				111			
12				62				112			
13				63				113			
14				64				114			
15				65				115			
16				66				116			
17				67				117			
18				68				118			
19				69				119			
20				70				120			
21				71				121			
22				72				122			
23				73				123			
24				74				124			
25				75				125			
26				76				126			
27				77				127			
28				78				128			
29				79				129			
30				80				130			
31				81				131			
32				82				132			
33				83				133			
34				84				134			
35				85				135			
36				86				136			
37				87				137			
38				88				138			
39				89				139			
40				90				140			
41				91				141			
42				92				142			
43				93				143			
44				94				144			
45				95				145			
46				96				146			
47				97				147			
48				98				148			
49				99				149			
50				100				150			