Enquiry approach for rivers fieldwork

Enquiry Approach for Rivers Fieldwork Planning The issue that I will be investigating is whether there is any link between the different areas of a river and its discharge at these areas. My hypothesis that I will investigate is whether, “ Discharge of a river increases with the distance from the source of the river. " I have created three different sub-questions that I will answer once I collected some data. These are: * Does velocity increase downstream? * Does width increase downstream? * Does depth increase downstream? The location of my survey is the River Alderbrook. I have also conducted a pilot survey where I will undertake a few measurements in a small area of the river. I have done this to test the equipment and to make sure the location is suitable to carry out the survey and conclude that my hypothesis can be proven and sub questions can be answered. I have also done this to check that the area is accessible. I have also conducted a risk assessment. I have visited the location to assess the hazards and their severity. We also considered health and safety issues in terms of appropriate clothing and prevention of contact with dirty water. I have then filled forms to comply with legislation. The equipment we used was a meter rule, tape and a flow meter which measures the velocity of the river at a certain point. We planned the data that we collected including depth, width, velocity, wetted perimeter, wetted width, bank-full width and sediment size. The table we used was clear to read and can be used in the field. It also contains the calculations we have to calculate after recording the data from the field. We chose to use a sampling strategy because we were unable to measure the whole river from source to mouth, (whole population). The sample we chose to do was a SYTEMATIC SAMPLE. This sample is the best one to use because it chooses sampling points at regular intervals along the whole river. We chose to use

10 metres as the interval. This is the best sampling strategy to use because it gives a representation of the whole population. This type of sample is better than a random sample because the sample taken may be biased towards one side. Also random sampling can be vulnerable to sampling error because the randomness of the selection may result in a sample that doesn't reflect the makeup of the population. We checked the weather to make sure that it would not affect the data that we were going to collect. For example, if it was really hot then it would affect the depth of the river as evaporation would be greater. This would affect one of my sub questions. Data Collection Hypothesis: “ Discharge of a river increases with the distance from the source of the river. " Sub Questions: * Does velocity increase downstream? * Does width increase downstream? * Does depth increase downstream? The reasons for choosing the River Alderbrook as our location for our survey was because it was nearby to where we obtained the equipment and planned the investigation. Also the river easily accessible as the land either side of the area is not owned. On the one side is a park and on the other is the college. Also the river is the right size and scale to carry out the investigation. The river is not too big so it becomes too risky. On the other hand it is not too small so that no changes are visible. The discharge of a river is the volume of water which flows through it in a given time. It is usually measured in cubic meters per second (Cumecs). The velocity is the speed of the river. It is measured in metres per second (m/s). The cross sectional area is the depth of the river multiplied by the width of the river at the same point. It is area is measured in metres (m2). The cross sectional and the velocity are used to calculate the discharge of the river. (Cross sectional area x velocity) Data was collected from 20 sites along a 1. 5km stretch of river ending at the

confluence of the River Alderbrook with the River Blythe. The data we collected in the river was primary data — we physically measured data ourselves and obtained original results in order to have first-hand evidence for our fieldwork. We collected the data in groups of 4 with each of the 5 groups doing a site along the river. Each group then measures 4 parts of their given site each 10 metres apart. Systematic sampling was implemented, as this is the best form of sampling to measure change along downstream. This sample is the best one to use because it chooses sampling points at regular intervals along the whole river. We chose to use 10 metres as the interval. This is the best sampling strategy to use because it gives a representation of the whole population. This type of sample is better than a random sample because the sample taken may be biased towards one side. Also random sampling can be vulnerable to sampling error because the randomness of the selection may result in a sample that doesn't reflect the makeup of the population. In addition, the repetition of the systematic sampling technique improves the reliability. A huge disadvantage is that some groups could distort the data, causing bias and therefore affecting the results. Difficulties that we had were with the one of the apparatus that we had to use. The propeller started moving and then stopped suddenly because it got stuck on a pebble from the river bed. This meant we had to so it again which took longer. Also sometimes the propeller took longer than we thought it would so we waited till it went halfway and doubled the time to save time. At times the accuracy of the sampling strategy was questioned as it was not always possible measure the intended point of the river due to the safety of accessing water too deep to work in. Data Refinement and Display We created a table which was separated into two sections; Calculations in the Field and Calculations using field data. In the field we collected the: * Wetted Width — the length of the river from bank to bank in metres * Depth — the deepness of the river at 5 different points. * Parkside (1) * In between middle and parkside (2) * Middle (3) * In between middle and college side (4) * College side(5) * Velocity — the speed of the river at 3 different points, in seconds. * Parkside (1) * Middle (2) * College side (3) Then, afterward we calculated the average depth of the river using the 5 points by: Depth 1 + Depth 2 + Depth 3 + Depth 4 + Depth 5 5 Also we calculated the velocity in metres per second. To do this we used this chart below: We did this for each of the velocities. We then calculated the average velocity by: Velocity 1 + Velocity 2 +Velocity 3 3 Then we calculated the cross sectional area by: Wetted Width x Depth Finally we calculated the Discharge in cumecs by: Cross sectional area x velocity (velocity) I then plotted a scatter graph with Distance Downstream (m) on the x axis and Discharge (Q) on the y axis. I plotted the points and then drew a line of best fit. I used this to compare one variable against the other. I could tell from the graph that it was a good positive correlation but I wanted to find a figure to represent this so I used Spearmen’s Rank Correlation Coefficient. To calculate this I used the formula: r= 1- 6âˆ‘ d2n3-n d = difference between two ranks n = number of values âˆ‘ = sum of … Firstly I ranked the distances with 1 being the largest number I then ranked the Discharge with 1 again being the highest number. If the numbers were the same I took the average of how many there were. I then found the difference between the two ranks. I then found d2. I then calculated âˆ‘ d2 by adding all the d2 values. Distance | Rank | Discharge | Rank | d | d2 | 0 | 20 | 0. 06 | 18 | 2 | 4 | 40 | 19 | 0. 06 | 18 | 1 | 1 | 80 | 18 | 0. 05 | 20 | -2 | 4 | 120 | 17 | 0. 06 | 18 | -1 | 1 | 160 | 16 | 0. 09 | 13. 5 | 2. 5 |

6. 25 | 200 | 15 | 0. 10 | 9. 5 | 5. 5 | 30. 25 | 240 | 14 | 0. 07 | 16 | -2 | 4 | 280 | 13 | 0. 11 | 6 | 7 | 49 | 320 | 12 | 0. 10 | 9. 5 | 2. 5 | 6. 25 | 360 | 11 | 0. 10 | 9. 5 | 1. 5 | 2. 25 | 400 | 10 | 0. 09 | 13. 5 | -3. 5 | 12. 25 | 440 | 9 | 0. 08 | 15 | -6 | 36 | 520 | 8 | 0. 10 | 9. 5 | -1. 5 | 2. 25 | 560 | 7 | 0. 12 | 5 | 2 | 4 | 600 | 6 | 0. 13 | 3 | 3 | 9 | 640 | 5 | 0. 10 | 905 | -4. 5 | 20. 25 | 720 | 4 | 0. 10 | 905 | -5. 5 | 30. 25 | 760 | 3 | 0. 13 | 3 | 0 | 0 | 800 | 2 | 0. 13 | 3 | -1 | 1 | 840 | 1 | 0. 18 | 1 | 0 | 0 | | | | | Total | 223 | I then used these values to calculate Spearmen’s Rank Correlation Coefficient. r = 0. 832 (3s. f) 0. 832 0. 832 1 Perfect Positive Correlation 0 No Correlation -1 Perfect Negative Correlation Good Negative Correlation -0. 5 Good Positive Correlation 0. 5 1 Perfect Positive Correlation 0 No Correlation -1 Perfect Negative Correlation Good Negative Correlation -0. 5 Good Positive Correlation 0. 5 To find out what this number represents we used this scale from -1 to 1; Using this scale, the number 0. 832 sits between a Good Perfect Positive Correlation and a Perfect Positive Correlation. This shows that generally, as the distance downstream increases the discharge increases as well. I have then created a scatter graph for the velocity of the river with distance downstream. As you can see there is no relationship between distance downstream and the velocity of the river at each point. I have then done the exact same thing for the wetted width of the river, to see whether there is a relationship between distance downstream and the wetted width of the river. As you can see there is a general trend between the two variables. As the distance downstream increases the width of the rive increases. This shows a positive correlation. I have then again created a scatter graph for the depth of the river along with the distance downstream. As you can see there is a very slight negative correlation between the two variables. This shows that depth doesn’t

increase with distance downstream. Description, Analysis and Interpretation I to describe and analyse the data I have calculated the mean, median and mode of the discharge. The mean discharge was 0. 098. This is a single number to represent the whole group. The mean of the numbers can be misleading. The median and the mean together give a better idea of the spread of the numbers. The median discharge was 0. 10. This is also a single number to represent the whole group. The median is very similar to the mean, which suggests that the spread is probably evenly balanced. The mode discharge was also 0. 10. This is also a single number to represent the whole group. I then decided to calculate the Standard Deviation and of the discharge values. The Standard Deviation is a measure of how ‘ spread out the values are.’ To calculate the standard deviation I used the formula: Ïƒ= x-x2n-1 I have found that the standard deviation is 0. 102567. This number is very similar to the mean which shows that every value is approximately 0. 002 away from the mean. This shows a small deviation from the mean, which suggests that, the spread of data is minimal. Using these findings I have answered each of the sub questions. * Does velocity increase downstream? Velocity doesn’t generally increase with distance downstream. I have come to this conclusion because by looking at the graph I created with the velocity and distance downstream, it shows that there is no relationship between the two variables. This might be because the river is very controlled by concrete banks in some places so the velocity is not natural so therefore there are very rapid changes as you go downstream. * Does width increase downstream? Width does increase as you downstream as you can see from the bar chart. The trend line shows that it does increase. I think the wetted width of the river increased because at the confluence of the river with the

River Blythe (800m) it was very wide because it is where the two rive meet. On the other end of the river it was the end of the river (0m) where it wasn't as wide. However, in some places the river does get wider and then narrower. This may be because there is concrete embankments on the river banks which restrict the river getting wider. * Does depth increase downstream? Depth decreases slightly as you go down stream. This may be because we already know it is very deep at the confluence and at the end of the river. However there are areas along the river that are even deeper, and some places that are actually very shallow. This uneven pattern suggests that the negative correlation is untrue. This uneven pattern is because in some places the river a lower river bed so the more water accumulates there. Also in some places the water in the river cannot infiltrate in the soil because of concrete banks and impermeable rocks on the river bed and banks. Conclusion and Evaluation The conclusions I have come to about id discharge increases with distance downstream is that it definitely does as the two factors which affect the river discharge, (cross-sectional area and velocity) do influence the discharge. The cross sectional area of the river does increase because the wetted width does have a positive correlation which means the cross sectional area will increase as well. Also even though the velocity of the river does not have a correlation the overall trend shows that it must contribute to the positive correlation of the discharge. The results may not be accurate because the Alderbrook River has previously been partly channelized (during the 1930s to prevent flooding in the gardens of the housing adjoining Brueton Park), and so, the data cannot be fully reliable. We feel we have answered all the initial questions. For example, one of our original aims was to find out how river discharge varied and from our results we are able to state that as the river approached the confluence the discharge (Q) increased. There was much strength in our investigation including a good sample size, good weather and clean water and limited health and safety issues that the task was made available to everyone. Yet these factors do not make it reliable. It was felt that the investigation was somewhat unreliable as the data collection was different for each group, the planning and consistency were poor, the river had been partly channelized and the vegetation obstructed the equipment. Also some groups found erroneous data on their database due to a confusion between centimetres and metres, this needed to be addressed as velocity, and discharge and stream efficiency calculations could go wrong. These factors all outweigh the positive factors that included the 20 sites we investigated. If we were to repeat the investigation, we should have fewer people investigating a longer stretch of river (hopefully finding the source) over a longer period of time. Also there was no measure of the environmental parameters of the river including water temperature, fish populations and the presence of plant life (flora) and aquatic invertebrates (insects). The lack of this type of data also needs to be addressed. Also we could have increased the sample size or chosen a more suitable sample strategy. We could have even done the whole river if we had the time. In addition, we could have broadened our investigation by doing the same investigation at different times of the year. This would make the results more applicable to anything we asked and the data we would collect would be more usable. Also if we used accurate calibrated equipment, such as an electronic flow meter would give a more accurate reading which would enhance the reliability of the investigation.