Physical fieldwork

Enquiry question:- How does infiltration vary on different surfaces?

Aim:- to see how quickly infiltration works on different surfaces.

Expected outcomes:- 1) I expect that water will infiltrate through permeable surfaces like soil and grass.

2) I expect that water won't infiltrate into impermeable surfaces like concrete.

3) I expect that water will infiltrate quickest through sand.

Why I chose this enquiry:- this enquiry links to the Distinctive Landscapes unit which looks at the causes of flooding. By looking at infiltration rates on different types of surfaces, it shows how this is an important factor in understanding the cause of flooding and the role of people.

Theory behind this enquiry:- infiltration allows rainwater to sink into the soil and is then transferred to rivers by the processes of throughflow and groundwater flow.

Infiltration can easily happen on permeable surfaces such as soil, grass and wooded areas and permeable rocks like chalk. This means floods are unlikely as less water will stay on the surface as surface runoff and run straight into rivers.

Infiltration cannot happen on impermeable surfaces like concrete and tarmac or impermeable rocks like granite and clay. Flood risk therefore increases as there is a lot of surface runoff. This highlights the impact of people as building on floodplains adds concrete and tarmac so increasing flood risk.

Risk assessment:- the enquiry was conducted on the school grounds as it was safe, convenient without the need to get parental permission and there were a range of different surfaces to investigate.
Possible risk 1 - members of the public getting on site and approaching students. **Solution** - making sure work was done in groups.

Possible risk 2– falling over on hard surfaces. **Solution** – not running around school site.

Possible risk 3 – getting infection from touching soil, sand in pit. **Solution** – washing hands afterwards and wearing plaster if cut on hand.

How data was collected

Equipment cut-off bottles with 200ml marked on; timer / stopwatch and water.

Primary data method:- in groups of 4, one person held the cut-off bottle tightly to the ground with neck nearest ground; 2nd person poured water slowly into cut-off part of bottle until water reached the 200ml line; 3rd person started timer as soon as water started to be poured into bottle and pressed stop once all water had gone from bottle and 4th person recorded time taken. This method was repeated around the school on 6 sites each with a different surface including permeable and impermeable surface:-

- Piazza – concrete
- Astroturf – plastic
- Picnic bench area – thick grass
- Shrub area – soil
- Under oak trees on field – thin grass / soil
- Sand pit – sand

Sampling of sites:-

Stratified and random sampling – Teacher had selected 6 areas on the school grounds that had different surfaces from which each group would collect their data giving equal number of data sets from each area – **stratified sampling**. Within each site, each group would randomly select where specifically they would do the infiltration test – **random sampling**.

Stratified was used by teacher as it ensured all different surface types were equally tested for giving representative results. Random sampling was used by students to spread the groups around each different area and limit impacts of water used affecting other groups' results.

Secondary data method:- our teacher had collected **weather data** from the **Met Office** website for a week leading up to the fieldwork including **rain and temperature** data. This meant we could see if the weather had an impact on infiltration. If it had rained a lot a day or two before, this would create **antecedent conditions** where the soil may be saturated which would reduce infiltration rates. If the weather had been hot, the soil may dry out and act like a solid impermeable surface and reduce infiltration. This data would help analyse our results.

Presentation of data:-

The whole class collated the results for each area and we **calculated the average infiltration time** for each area. I drew a bar graph to show the different average infiltration times. A **bar graph** was appropriate as the data was discrete, i.e. each bar shows infiltration time for a different surface. It does not cover change over time or data collected along a transect so a histogram was not suitable. I **coloured each bar** a different colour to emphasise that they were different surfaces and this made the graph **clear and easy to read**.

A **different presentation method** I could have used was to use **GIS mapping** and map the infiltration times for each group at each location by **adding the time**. Each group could say where they exactly collected the data to pinpoint the placing of the time. The **average time** could then be added to that area in a **different colour**. **Labels** could be added to **describe the different surfaces**. This method would be **good visually** and show a **clear pattern** to infiltration rates.

Analysis of findings:-

- **Quickest** infiltration rate was on the **piazza** with an average time of **19 seconds.** This was due to water leaking out from the cap because there was not a tight seal between cap and surface. It was not due to infiltration but surface runoff.
- **Slowest** infiltration was in sand pit with time of 206 seconds. This was because the sand was quite wet due to antecedent rain and because of sand compaction as the sand pit is used during PE lessons.
- Weather data showed that there had been rain the previous 2 days which had dampened the ground. Temperatures averaged 16◦C for the week leading up to and concluding fieldwork.

Conclusion:-

- Expected outcome 1 proved correct – permeable surfaces did allow infiltration to happen. This is because the soil and sand have pores that give space for water to infiltrate into slowly.
- Expected outcome 2 proved correct – impermeable surfaces didn't allow infiltration to happen as the concrete on the piazza and plastic on Astroturf are solid and instead allow surface runoff. This is despite an **anomaly** of the piazza having the quickest time but this was due to a fault with the method.

- Expected outcome 3 proved incorrect – sand didn't have quickest infiltration despite being the loosest substance due to antecedent weather conditions which slowed infiltration due to partial saturation and compaction by students.

These results confirmed my **geographical understanding** of the process of **infiltration** and **factors that affect it** such as permeability of surface and weather conditions. I know that **human action** of laying down impermeable surfaces can **increase the flood risk** and now understand why planners need to carefully consider whether to build on **floodplains** or not as the flood risk is greatly increased.

Evaluation:-

- **Data collection problem 1** – anomaly at piazza as water leaked from bottle top as surface was bumpy and there was a gap allowing water to seep out quickly. **Improvement** - put Blu Tack round the top sealing it to the ground before adding water in and stopping leaks.
- **Data collection problem 2** – bottles did not have the same cap size. This limits the reliability of the data as a larger cap means infiltration could happen quicker which has nothing to do with type of surface. **Improvement** - make sure all bottles were the same make and size so that it is only the permeability of the surface being tested.
- **Data collection problem 3** – there was a 200ml line marked on the bottle but some students may have added more than 200ml especially if the water infiltrated quickly before the line was reached. This affects reliability as not all data will be accurate as false time readings may be given for more water. **Improvement** - water needs to be poured in quickly with 2 people observing flow of water to improve accuracy.
- **Antecedent weather** with rain 2 days before affects reliability of data, especially with the sand pit. This factor needs to be taken into account when analysing the data as there is no solution.