**3.1.1.2 The Storm hydrograph**

**Concept Checker:**

* **Runoff variation and the flood hydrograph.**
* **Changes in the water cycle over time to include natural variation (including storm events, seasonal changes) and human impact (including farming practices, land use change and water abstraction).**

**Key terms:**

**Storm Hydrograph**

**Rising limb**

**Receding limb**

**Lag time**

**Peak discharge**

**Base flow**

**The storm hydrograph.**



Watch this clip:

<https://www.youtube.com/watch?v=gb9JvFfo3vc>

Can you label the features?

The storm (flood) hydrograph is a graph showing the of a river leading up to and following a particular . They are important because they can help us predict how a river might respond to a rainstorm, which can help with .

The storm hydrograph starts with the . The river is fed by slow-moving throughflow of and ground water. As storm water enters the drainage basin the river begins to be fed by much water.

The discharge (as shown by the **rising limb**) and eventually reaches , the highest flow in the channel for that event. The maximum amount of water a river can hold before it begins to overflow is called its .

The time taken from to peak discharge is called the . Discharge falls and when all the storm water has passed through, the river returns to its **base flow**.

Lag time Base flow discharge Soil water Rises Bankfull discharge

River management Storm event Peak rainfall Faster-flowing Peak discharge

*TASK: Study the hydrograph below and answer the following questions:*

1. At what time does the rain start?
2. What value does the peak rainfall achieve?
3. At what time does the discharge of the river begin to rise?
4. At what time (and day) does the river reach its peak discharge?
5. What is the peak discharge of the river (in cumecs)?
6. At what time (and day) did the river return to normal flow?
7. How long (in hours) is the lag time of this river?

Although all storm hydrographs have the same common elements, they are not all the same shape.

There are two main models that most hydrographs will fall into: ‘**flashy**’ and low or ‘**subdued**’.

Flashy = steep rising limb, steep falling limb, short lag time and high peak discharge.



Subdued/low = gentle rising limb, gently falling limb, long lag time and low peak discharge.

|  |  |  |
| --- | --- | --- |
|  | **Flashy or subdued?** | **Explain why** |
| **Steep relief**  | Small basins often lead to a rapid water transfer. | Large basins result in relatively slow water transfer. |
| **Low drainage density** |  |  |
| **Permeable** |  |  |

What factors do you think might determine the shape of the hydrograph?

For each factor in the table, decide if it will result in a flashy or subdued hydrograph and explain why.

|  |  |  |
| --- | --- | --- |
| **Basin shape - round** |  |  |
| **Area that has been deforested** |  |  |
| **Saturated ground** |  |  |
| **Presence of a dam** |  |  |
| **Bare soil** |  |  |
| **Light and steady rainfall**  |  |  |
| **Urbanised area** |  |  |

TASKS

1. Use two different colours to colour code your table to identify human and physical factors.
2. Rank the different factors in order of their relative impact on lag time.
3. Explain why there is a lag time between peak rainfall and peak discharge on a storm-hydrograph. (4 marks)

In the winter of 2015/16 there were serious floods in parts of northern UK. In the Lake District, rivers responded very quickly to the heavy rainfall events. The already saturated soil and steep slopes meant water moved rapidly overland and along river channels to devastate villages such as Glenridding.

York was similarly affected, but it took days for the water to work its way down the tributaries and into the main channel of the River Ouse, which flows through the city.

**1) Account for the difference in lag times and hydrograph curve of Glenridding Beck and the River Ouse for the same rainfall event.**

**2) *“Human factors have a greater impact than physical upon the lag time of a drainage basin.”* To what extent do you agree with this view?**





