Gravity Irrigation- sizing canals

Submission date   07/10/2024 at 23:00

Exercise 1- Channel sizing

1. Consider a straight rectangular channel (Manning-Strickler roughness coefficient $K = 65\,\mathrm{m}^{1/3}/\mathrm{s}$) with a slope of $1\,\text{‰}$ and a flow rate of 100 l/s.

   Calculate the water head under normal flow conditions for the following base widths:

   (a) 0.1 m,
   (b) 0.2 m,
   (c) 0.4 m,
   (d) 0.6 m,
   (e) 1.0 m.

2. Compare the corresponding values of water depth as a function of:

   (a) wetted cross-section S,
   (b) wetted perimeter P,
   (c) hydraulic radius R,
   (d) mean water velocity v.

3. Use the information obtained from the previous point in order to determine the most appropriate base width value.

Exercise 2- Enlarging or splitting a channel

1. A channel, with dimensions shown in the figure below, carries a flow rate of $Q = 8\,\mathrm{m}^3/\mathrm{s}$.

   To double this flow rate, which option is more economical in terms of landworks:

   (a) excavating a second channel with identical characteristics, or
   (b) enlarging the cross-section of the existing channel while maintaining the same flow depth?
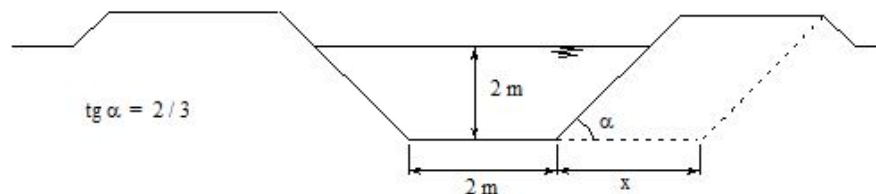
   Provide a detailed explanation supported by the necessary calculations.

Figure 1: Dimensions of the existing channel

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