

Let's examine the statistical characteristics of a long open half-channel, considering the property of an intelligent system - i.e. responding appropriately to intermittent disturbances to maintain a constant or homeostatic environment.

We have all experienced the intermittency of rainfall, lasting a day or so, and subsequent flooding. We also are familiar with the pleasant and even flow of rivers even though there might be occasional rainfall upstream.

In a long open half-channel we have the capacity to adjust the flow according to the intermittent inputs along its length, and through the storages and controlled outflows, achieve a constant and regulated outflow along its length (see upper image).

Thus, the reliability of water is ensured through intelligent responses to the variability of the environment and this reliability increases with length of the aqueduct (see lower image).

An irrigation system drawn from a low storage flow, such as a river, increases the variability of the system. That is, when the weather is dry, farmers withdraw more water for thirsty crops thus decreasing the flow even more. When the weather is rainy, little water is withdrawn for crops as they also receive water from the rain, and so the flow is enhanced. In this way, the natural variability of flow in the stream is exaggerated.

It is the enhancement of variability of flows that is responsible for the environmental deterioration of our rivers and streams in the Murray-Darling Basin and elsewhere. That is, it is an example of systems being pushed beyond their natural variability, reaching breaking points from which they cannot recover easily. Sustainability, on the other hand, requires maintaining the system within its natural bounds.

The presence of a storage dam or weir increases the availability of water during the dry season, but it does not address the central problem of exaggeration of rainfall variability. Consequently, during a dry spell, the water levels in a local dam fall rapidly as demand increases. During a wet spell when water is not tapped for irrigation, the dam over-tops and the excess spills over the floodway. Thus variation is exaggerated. This is an inefficient usage of water resources.

Thus it seems that a fully established open half-channel aqueduct has the capacity to provide reliable water supplies along its length. Due to the capturing of inflows along its length, it can provide a similar average flow at the end as at the beginning (see image), e.g. 2000GL pa in and 2000GL pa out. By contrast due to losses, the volume of flows diminishes with length. By contrast with a pipeline, a gravitationally driven flow requires no energy for pumping, and delivers water long distances cheaply, reliability and intelligently.