FORM ANALYSIS

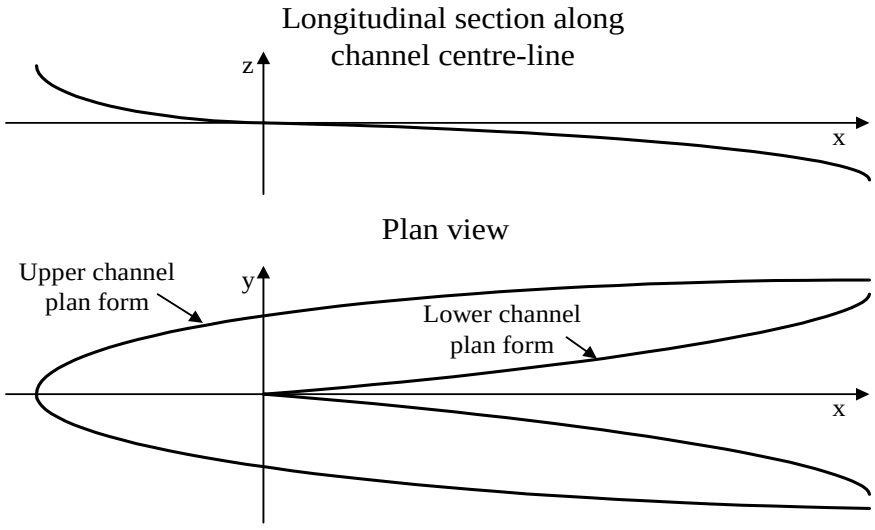
In developing an analytical solution for tidal wave propagation in estuaries Prandle & Rahman made use of power law representations to describe the longitudinal variation in width and depth (Prandle & Rahman, 1980). This was found to be a particularly flexible formulation allowing most estuary forms to be accommodated. The description is for width at mean tide level and the hydraulic depth at any given section, as follows:-

$$B = B_L.\left(\frac{x}{L}\right)^n \quad \text{and} \quad H = H_L.\left(\frac{x}{L}\right)^m$$

The values of the shape parameters, n and m, determine whether the form is a funnel (convex to centre-line) or bell shaped (concave to centre-line). These two equations have been used as the basis of generating a 3-D form that can be fitted to the wide variety of forms exhibited by both creeks and estuaries. The model is based on a longitudinal thalweg (total depth and not hydraulic depth) defined about a zero datum in x and z (which will later be referred to as the shoulder). As x becomes negative so the profile inverts, to give the longitudinal section shown below. In the model, the ability to define scaling lengths and shape factor (H_L, L and m) for the descriptions above and below the zero datum, provides great flexibility. To define the plan form, the origin at any given level, z, is moved to be coincident with the position (x chainage) of the thalweg at that level (the plan form is set to zero for negative values relative to the transformed origin). Depths can then be calculated from the following relationship:

$$z(x,y) = D.\left(\frac{x}{L} - \left(\frac{y}{B}\right)^{1/n}\right)^m \quad \text{s}$$

where D and B are the depth and width at length L respectively. For real world systems, it is necessary to provide a setting for the creek/estuary form and this requires an approximate description of the surrounding catchment. This can, in addition, be used to prescribe the form of any river channel, which can also modify the overall form of the creek/estuary. Both of these aspects have been added to the model using a similar approach, defining 3-D forms that correspond to the key dimensions of the catchment/river system using either power or exponential descriptions.



This approach forms the basis of the *E*st*F*orm model and is useful for exploring the magnitude of estuary transgression (see Estuary translation), and for the design of intertidal creek systems. It also provides a useful representation for the exploration of analytical and numerical tools. Further details of its application can be found in Wells and Townend (in press).

References

Prandle D, Rahman M, 1980, Tidal response in estuaries, Journal of Physical Oceanography, 10(10), 1552-1573.