Section Factor and Normal Depth

SPEAKER Rick Huizinga: Once again, we're going to start with the Manning's equation as we've introduced in the first section. Q is equal to 1.49 over N times A, which is the area, times R to the two-thirds, which is the hydraulic radius, times the square root of the friction slope. If we look at just the A times R to the two-thirds, we call that the section factor. And if we rearrange Manning's equation to isolate that section factor, we get the equation that you see in the middle of the screen, A times R to the two-thirds is equal to N times Q over 1.49 times the square root of S sub-f. Well, A sub-r--excuse me, AR to the two-thirds is dependent only upon the channel geometry, and the area is proportional to the hydraulic radius. This is a very useful bit of information because what this tells us for a given Manning's roughness and discharge and friction slope, there is only one depth that will maintain what we call uniform flow, and that depth is called the normal depth. And this is the depth to which water wants to go to when there are no changes in channel geometry, roughness or slope. And this is very useful to us because if the Manning's roughness for a section is known, the discharge is known and the slope are known, then the depth can be found. Or conversely, if the Manning's roughness and the friction slope and the depth are known--such as after a flood--we can then determine the discharge at that cross-section. This is called the "slope conveyance method" and is useful at a given cross-section. It can be used to determine discharge. It's rather rough and dirty, but it's a useful starting point. If we can determine the roughness coefficient and the depth and some assumptions can be made about the friction slope, we can then determine a discharge as a starting point. And this is used by many surface water models as a starting point for computations.

This last slide I'd like to show conceptually once again what normal depth is. If the depth at the upstream end and the depth at the downstream end of this reach of river are equal to each other, the velocity V1 is equal to the velocity V2 and the friction loss is equal to the change in the bed elevation, then this is considered normal uniform flow. And the water surface in this situation at depth D1 or D2 is the normal depth. This will be true for a given roughness and a given discharge. As the discharge changes, the depth will change, but the normal depth is the depth that which water wants to go when there are no changes in discharge or roughness.

And this concludes the lecture on computations for steady uniform flow.