Example Problem 1

SPEAKER Charles Berenbrock: In this section, we're gonna be looking at an example to really reinforce why we should be subsectioning for our cross-section. Let's take our original cross-section that we looked at before in the previous lectures where we had a main channel. It was 50 feet wide, 10 feet deep. It had a Manning's n value of 0.030. And the flood plane was 150 feet wide and 2 feet deep, and it had a Manning's n of 0.050. The first thing you should do is you can use a spreadsheet to do this or a table of some sort, but you should have lines listed in there that have each of your sections in there. So for example, you have--let's say, your channel, you'd say main right for this example. And then the next column in our spreadsheet here, we have depth, and then width is the next section. And then the next two columns is where we calculate--well, should subsectioning occur. Well, we do that for the right channel and we determine that when we see--we have a D over a little "d." We know note that the--the resultant is five, so it's greater than two. So we should subsection this channel out.

Also--let's also do it for the second part of subsectioning, that second equation. So if we have the width, divided by the D, so 150 feet divided by two is equal to 75, and it is also greater than five. So that also shows that we should subsection this cross-section out. The last column in this spreadsheet shows that the--is the area. You just multiply the width times the depth of the channel for this simple example here. So for the main channel, our area is 500 feet squared. For the right flood plane channel or subsection, it is 300 feet squared, and the total is 800 feet squared. We continue on with that spreadsheet, and we also add on where the perimeter is for each section, and let's also do the n-value too. And then the last column in this second part of the spreadsheet is the hydraulic radius. And remember, the hydraulic radius is the area divided by the perimeter. Now when we do the perimeter, it can be a little confusing at times. So the perimeter for the first--for the main channel is your width on--I mean, is your depth on the left-hand side of this section. So it's 10 feet plus 50 feet plus 8 feet. So we get a total of 68 feet for the perimeter for that cross-section. And then for the flood plane section, the perimeter would be 150 feet plus 2 feet, so the perimeter is 152 feet. And then, again, the hydraulic radius is area divided by the perimeter. The perimeter might be a little confusing calculation. You do not add the two feet that's in the middle.

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Okay, then what we do next is we determine the conveyance for each of these sections. And remember that conveyance is equal to 1.49 divided by your N value multiplied by your area for that subsection multiplied by the hydraulic radius for that subsection to the two-thirds power. So you do that for each of the subsections. So for the first--for the main channel subsection, the conveyance would be 93,902 cfs. For the right flood plane subsection, your conveyance would be 14067 cubic feet per second. As you noticed before, I said cfs, that is denoted as cubic feet per second.

Now in this next slide in the middle column, we put what the conveyances that we just calculated into that column, and then we total or summation those out so we get the total summation of conveyances, 107,969 cfs. We add a third column because we want to calculate what the energy coefficient is. And the third column is conveyance to the third power divided by A squared. And we do that for each section and then we sum them up also. And so if you look at the total, that is the summation of each of those columns. Well, you take those values and we put it to the alpha coefficient. So we take the summation number, which is 3.3429 times 10 to the ninth power, that's our numerator, and we'll divide that by what the total conveyance is, which is 107,969, and we'll take that to the third power. And then we'll divide that, the conveyance, by area to squared, and the area was 800. The total area was 800, and we square that. Well, the resultant--after you do all the calculations and everything, the resultant for alpha or the energy coefficient is 1.70. And this can be used in subsequent calculations, let's say for the energy as in the energy equation.

In the next example, we'll look at--which is an example from the book, we'll look at some other variables that we can calculate too.

This concludes this section.