CE 5362 Surface Water Modeling
Lesson 10

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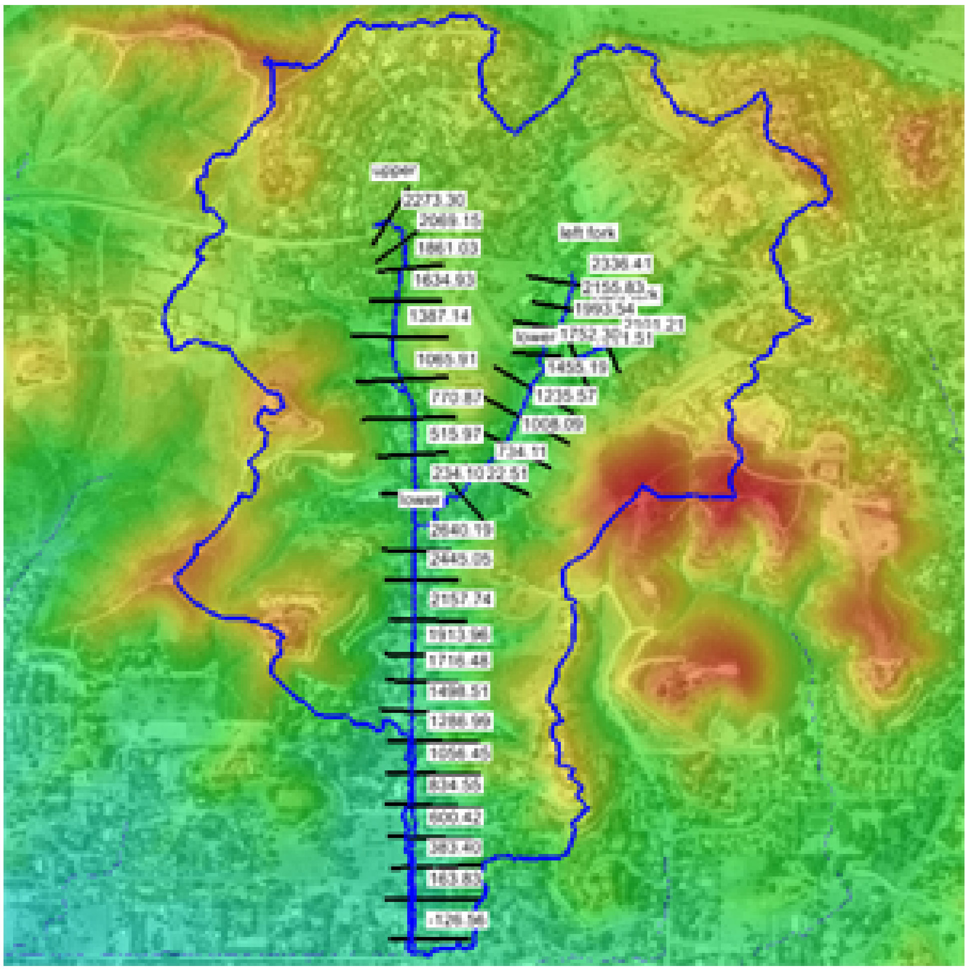

Contents

1 HEC-RAS Unsteady

what is HEC-RAS? what is unsteady?

1.1 Installation Verification

The software install was demonstrated in Lesson 3. Here we just want to check the install. Easiest way is to start the program and run one of the example

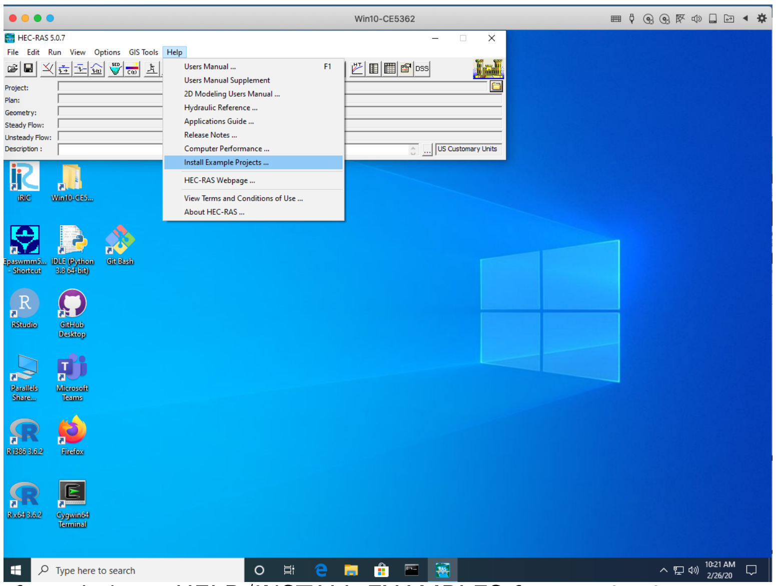

Figure 1. Start from desktop, HELP/INSTALL EXAMPLES from navigation menu..

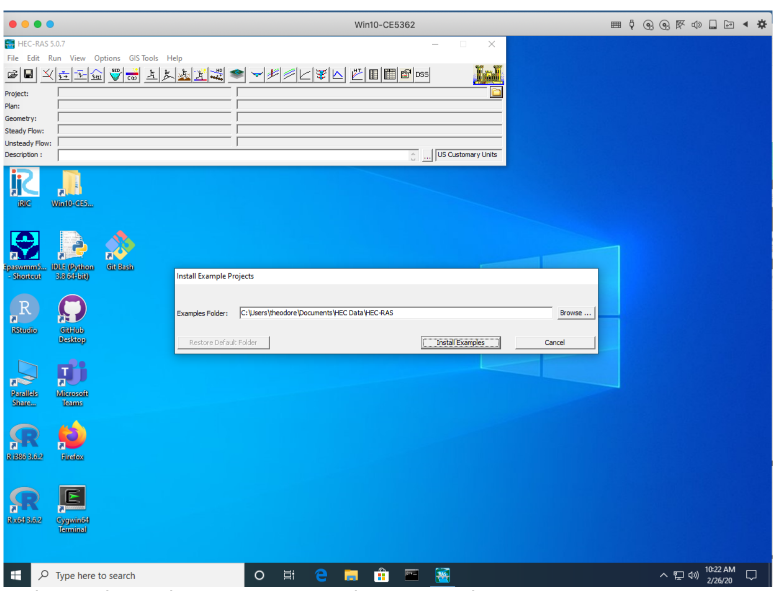

Figure 2. Select the path to the examples, and instruct the program to install its examples.

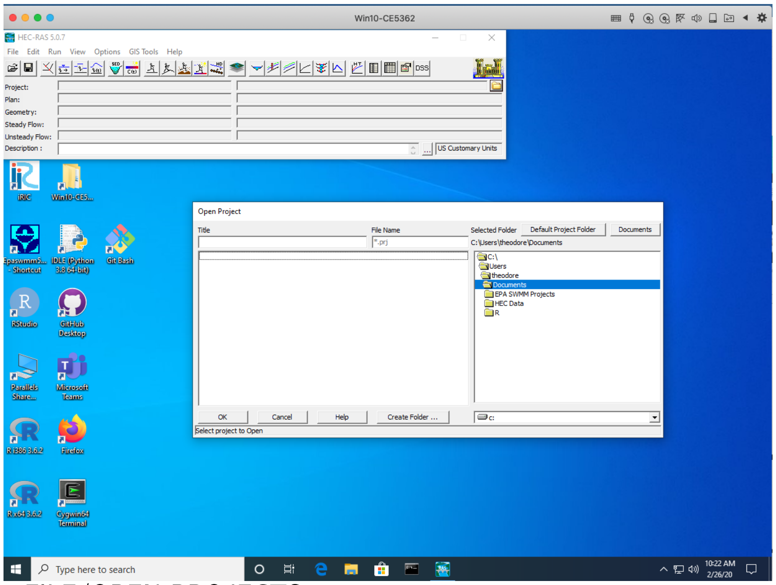

Figure 3. Select FILE/OPEN PROJECTS.

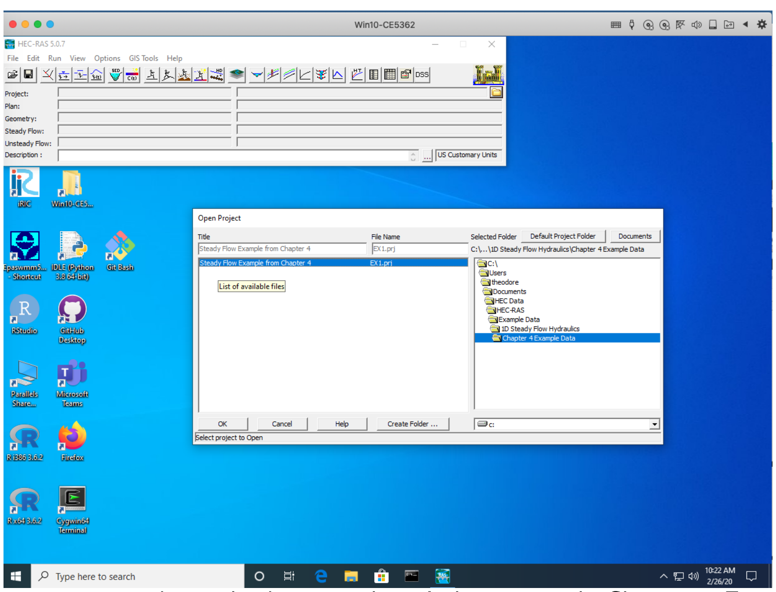

Figure 4. Navigate to examples and select one, here I choose steady Chapter 4 Example.

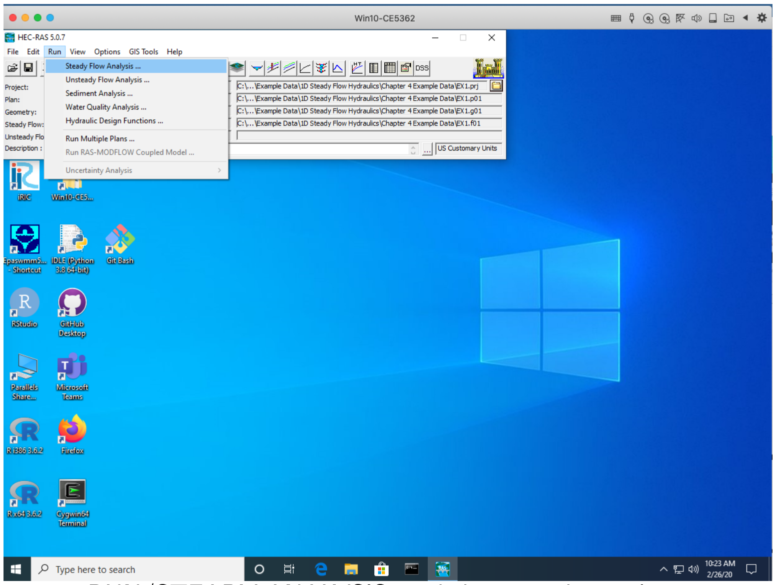

Figure 5. Navigate to RUN/STEADY ANALYSIS; and then run the analysis .

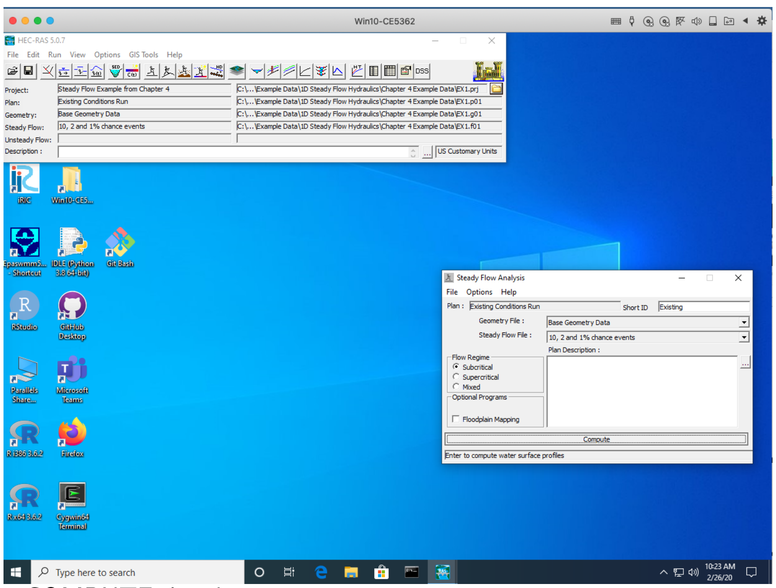

Figure 6. Select COMPUTE, let the program run.

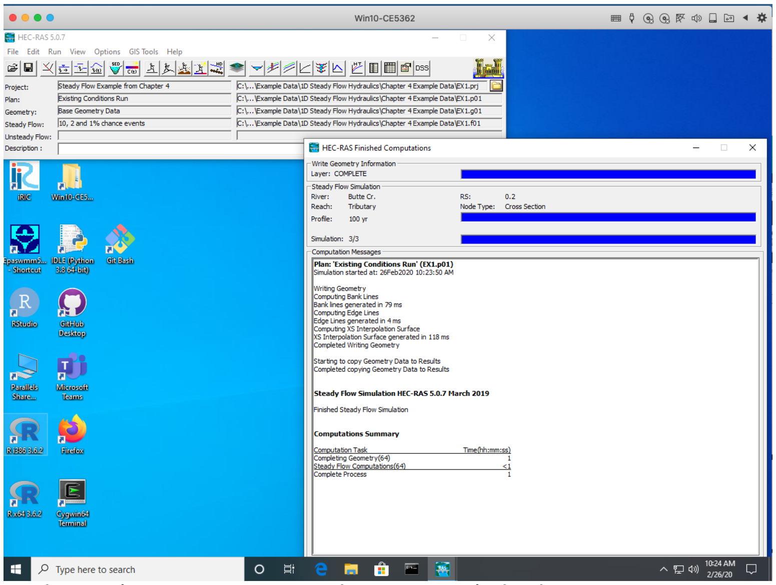

Figure 7. Expected completion appearance; thus we conclude the program is correctly installed and paths are established..

1.2 Interface Tour

1.3 Examples

1.3.1 Example 1.A – Rectangular Channel using HEC-RAS Steady

Figure 8 is a backwater curve[1] for a rectangular channel with discharge over a weir (on the right hand side — not depicted). The channel width is 5 meters, bottom slope 0.001, Manning's $n = 0.02$ and discharge $Q = 55.4\frac{m^3}{sec}$. Use HEC-RAS steady to reproduce the backwater curve on 1000- meter spacing

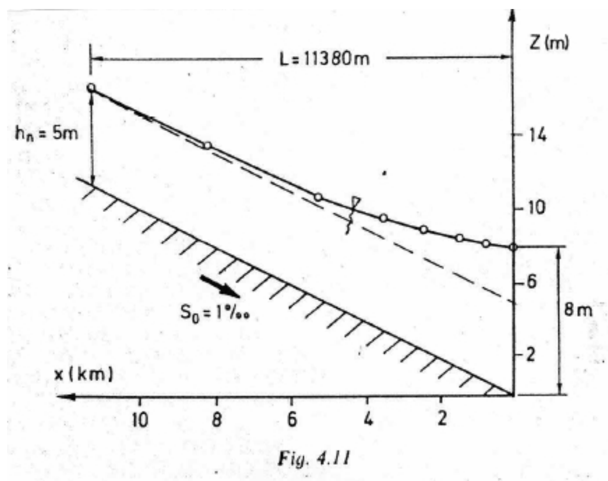

Figure 8. Example backwater curve.

1.3.2 Example 1.B – Rectangular Channel using HEC-RAS Unsteady

The backwater curve situation for a rectangular channel with discharge over a weir is repeated, but an unsteady input is implemented (a couple step changes in flow) to illustrate how to enter transient boundary conditions.

1.3.3 Example 2.A – Non-prisimatic channel using HEC-RAS Steady

A plan view of a channel of variable width as shown in Figure 9.

The channel conveys $Q = 100\ m^3/sec$, with a bottom slope of 0.001 and average Manning's n value of 0.033. A backwater curve is caused by a weir at the downstream end (to the right in the figure) by a 7 meter tall weir. Flow depth over the weir is at critical depth $h_c = 2.17$ meters.

Use HEC-RAS steady to reproduce the backwater curve on 1000- meter spacing

[1] Page 85. Koutitas, C.G. (1983). Elements of Computational Hydraulics. Pentech Press, London 138p. ISBN 0-7273-0503-4

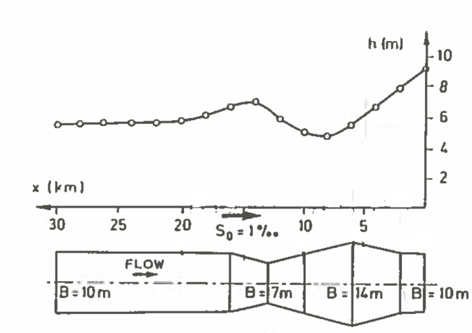

Figure 9. Non-Prismatic Rectangular Channel.

1.3.4 Example 2.B – Non-prisimatic channel using HEC-RAS Unsteady

The backwater curve situation for a non-prisimatic rectangular channel with discharge over a weir is repeated, but an unsteady input is implemented (a couple step changes in flow) to illustrate how to enter transient boundary conditions.

1.3.5 Example 3 – Sudden Gate Closing in an Aqueduct Channel

Flow in a 1000-m long trapezoidal channel with a bottom width of 20-m, side slope of 2H:1V, longitudinal slope S_0=0.0001, and Manning's resistance n=0.013. Initial discharge in the channel is 110 m3/s and initial flow depth is 3.069 m. Simulate the flow and depth at every 100-m station when a downstream gate is closed at t=0. Produce a graph of depth and velocity versus location for t=0, 60, 360 seconds.[2]

1.3.6 Example 4 – Flood Hydrograph in Horizontal Channel

The initial depth in a horizontal channel of rectangular cross section is 1 meter. The channel is 29 kilometers long and ends with a non-reflection boundary condition.

[2]Example 12-1, Page 623. Roberson, J A., Cassidy, J.J., and Chaudhry, M. H. (1988). Hydraulic Engineering. Houghton Mifflin Co., Boston, 662p.

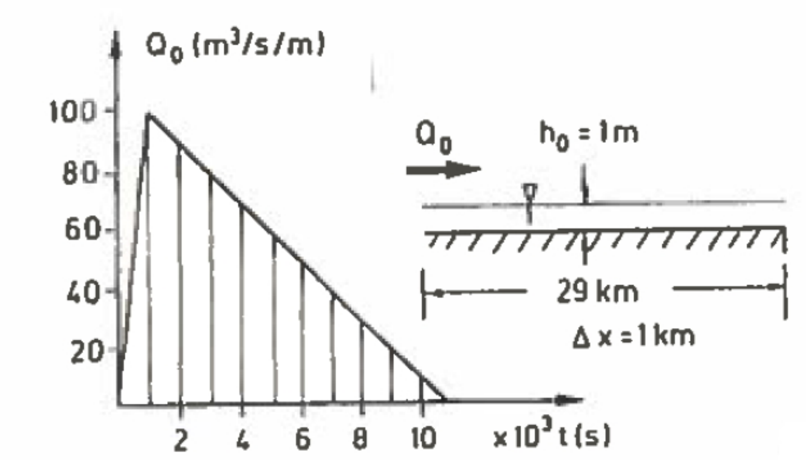

Figure 10. Upstream hydrograph for example.

The initial discharge in the channel is 0 cubic meters per second. The upstream input hydrograph is shown in Figure 10. The manning friction factor is $n = 1/40$. Simulate the water surface elevation over time in the channel.[3]

1.3.7 Example 5 – Long waves in a Tidal-Influenced Channel

1.4 Appendix

[3]Example 4.1, Page 70. Koutitas, C.G. (1983). Elements of Computational Hydraulics. Pentech Press, London 138p. ISBN 0-7273-0503-4

References

Koutitas, C.G. (1983). *Elements of Computational Hydraulics*. Pentech Press, London 138p. ISBN 0-7273-0503-4

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