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Rollin' Rollin' Rollin':
Project Boulder for InfraWorks 360

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Learning Objectives

- Discover the value of 2D Flood Modeling
- Discover how model analysis helps drive designs
- Discover insights not possible with standard modeling
- Learn how to be more productive

Description

Autodesk Labs: Project Boulder for InfraWorks 360 software brings together the immersive 3D design environment that is perfectly suited for immersive design and analysis. Project Boulder is a collaboration with Hydronia RiverFlow2D that provides the ability to simulate, visualize, and animate 2D flood events directly in the InfraWorks 360 software model environment while using the Hydronia RiverFlow2D computation model.

Your AU Experts

Reinaldo Garcia, Ph.D.

Reinaldo is the creator of the original RiverFlow2D model and director of Model Development at Hydronia, LLC. He has participated in hundreds of 2D flood hazard assessment projects worldwide. He has more than 30 years of experience developing and applying hydraulic computer models for flooding and riverine applications, including sediment transport dynamics.

Matthew Anderson, PE CFM

Matthew is a register professional engineer (IL, IN, WI, MI, TX) and is a Product Manager in the Autodesk AEC Design Civil group, responsible for civil infrastructure products. Over the past twenty years, and a number of roles, Matthew has worked on projects of all shape and size that to provide, avoid, or manage water & utilities in some shape or form.

Autodesk© //Labs_ Project Boulder for InfraWorks 360 is a free limited technology preview that matches the simplicity of two--dimensional (2D) flood simulations together with the immersive model. As collaborative effort between Autodesk and Hydronia, the Autodesk© InfraWorks 360 user is provided the ability to simulate, visualize, and animate 2D flood events directly in the Autodesk InfraWorks 360 model environment while utilizing the Hydronia RiverFlow2D computation model.

Over the past number of months since Project Boulder was launched on the Labs site, the response and functionality that we have been able to provide hopefully has matched your expectations and requirements. We still have some way to go to leverage the power available with RiverFlow2D to analyze your designs and asses the risk of your projects for flooding conditions.

Installation

Let's cover quickly the requirements to leverage Project Boulder for InfraWorks 360. Firstly, Autodesk© InfraWorks 360 is required. This can be simply a trial version which is active for 30 days, or a fully entitled version of InfraWorks 360. The vertical components – Bridge, Road, or Drainage are not necessary at this time as we don't leverage specific elements from those designs with Project Boulder, however, if you want to see the impact of your bridge, road, or drainage designs, consider the verticals.

You can find the free trial here: http://www.autodesk.com/products/infraworks-360/free-trial

Project Boulder for InfraWorks 360 requires you to be a member of the Autodesk© //Labs_ project. You can join the Labs project from the link below.

https://beta.autodesk.com/callout/?callid={ABADE776-9718-43AD-9C88-47A011D71CBA}

Once inside the Labs project – the download for Project Boulder can be found in **Resources** > **Downloads** portion of the beta site.

The next step would be the need to install the Hydronia software for the RiverFlow2D computation model. This is found here:

http://www.riverflow2d.com/forms/RiverFlow2D_Infraworks_Autodesk_Labs/RiverFlow2D_Infraworks_Autodesk_Labs.php

With all three elements need to be installed to leverage Project Boulder, RiverFlow2D and InfraWorks 360. We've seen too many installations that include only InfraWorks and RiverFlow2D, but without the Boulder plug-in.

Figure 1 When Project Boulder is properly installed - you should see these icons under any Analysis toolbar

New!

Over each of the past three releases, we have followed up each InfraWorks 360 quarterly release with a new set of functionality for Project Boulder. Today, or at least real soon, we are jumping the gun and releasing an intermediate release that contains spatial Manning's functions.

To accomplish this we leverage some Drainage Design functionality that translates render materials used in the model for either roughness or runoff coefficients. We can discuss the format a little later.

As I have learned over the years, the effort needed to take a contour map, conceptualizing it, digitizing cross-sections, translating and ultimately data entering into spaced text editors is rapidly disappearing. Autodesk Labs Project Boulder steps the game up a level by powering the analysis via Hydronia RiverFlow2D.

Let's walk the process step by step starting on the next page.

Model Builder

Using Model Builder in InfraWorks 360, we have the ability to quickly build the contextual environment to begin some analysis.

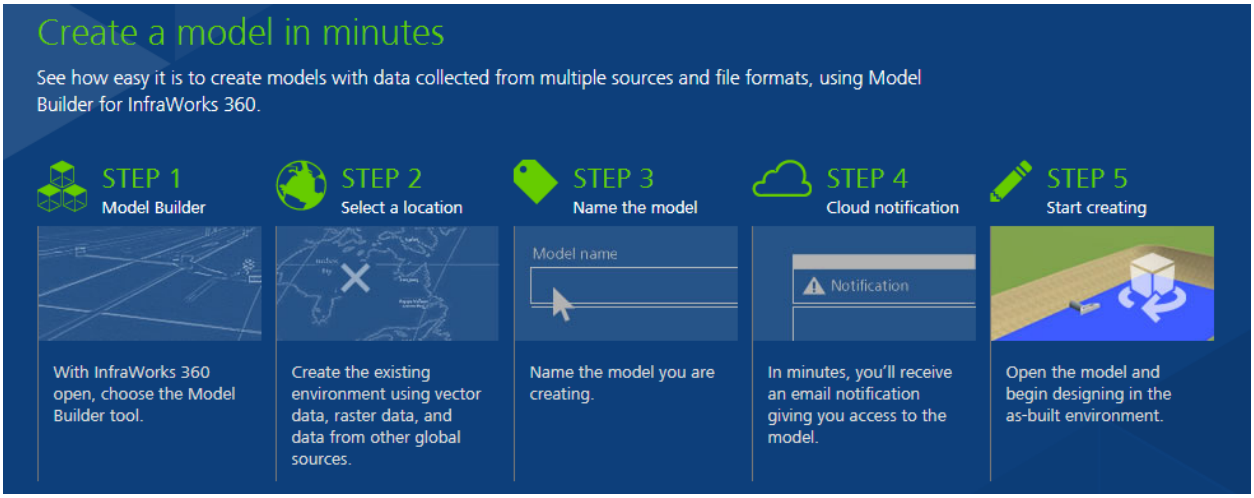

Figure 2 Model Builder

If you leverage the surface capabilities of AutoCAD Civil 3D to build surfaces, simply import the AutoCAD Civil 3D drawing into InfraWorks and connect to the surfaces. Project Boulder utilities the InfraWorks top surface to provide the surface mesh elevations for analysis.

Figure 3 Model Builder Example

Flood Simulation

1. Simply start with the Flood Simulation icon.

2. Read, and agree to the Labs Preview dialog box. Proceed to the Autodesk Labs website, provide feedback so we can graduate this functionality.

3. Define the boundary for the analysis by digitizing the boundary. It's probably easiest to perform in a true top down view.

Figure 4 Define Boundary

4. Double Click to finish digitizing the boundary points. We assume a closed polygon and use this as the limits of the surface to send to RiverFlow2D, so it's best to digitize something where the flow won't touch.

5. Click the boundary twice to define the length of the boundary edge where flow enters the boundary. This is the inflow boundary condition. Horseshoes & Hand grenades are ok at this point as the location is editable later.

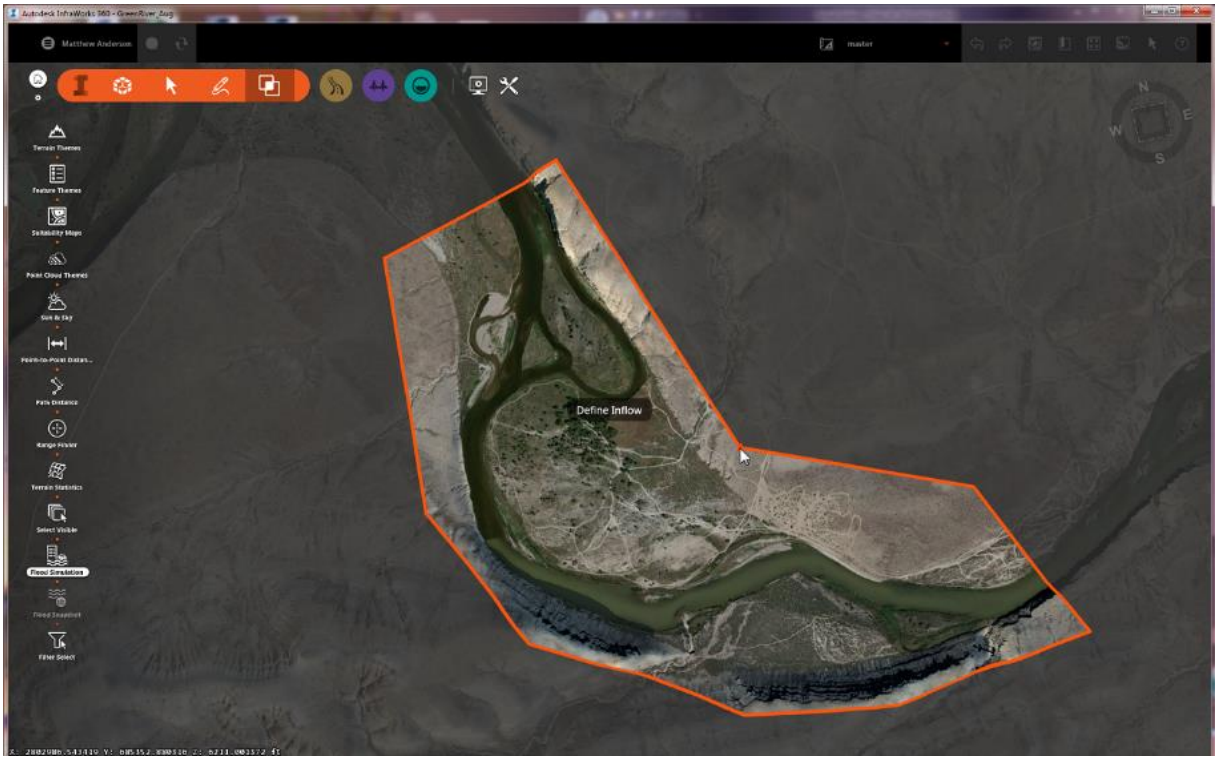

Figure 5 Inflow Boundary

6. Repeat this process by clicking twice on the edge to define the outflow boundary condition location.

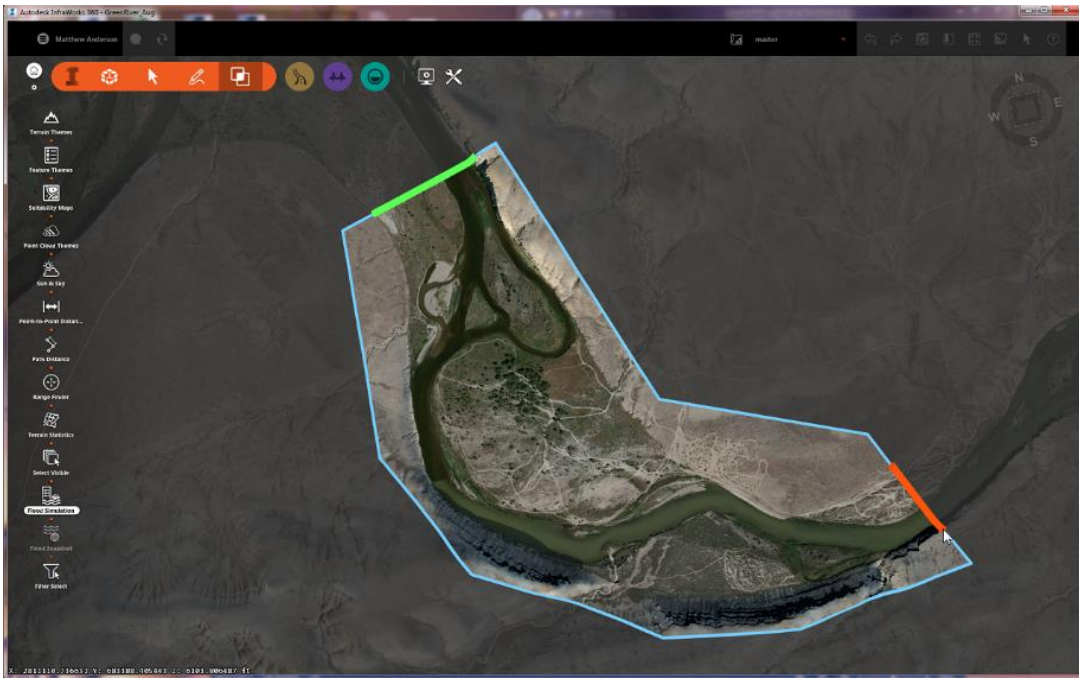

Figure 6 Both Boundary Conditions

7. Once successful – the Flood Simulation dialog box will appear. This provides you the ability to define the boundary conditions for the model.

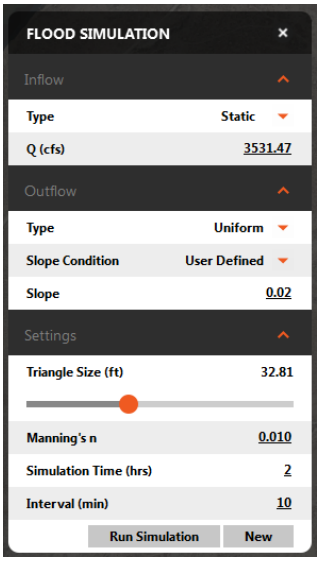

Figure 7 Flood Simulation

8. On the Inflow panel, Type section, click the drop-down selector for Type. Change it from Static to Hydrograph. The panel should now show a unit, and a Data file selector.

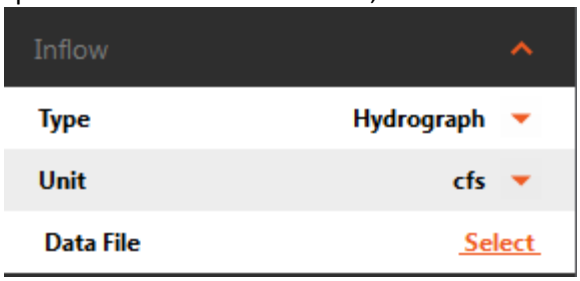

Figure 8 Hydrograph Options

9. Click Select. This launches the operating system file selection dialog box. Project Boulder is looking for a DAT file. This file is a simple text file that contains the flow and time information. The first row indicates the number of flow steps that follow. In the image below, there are 4 values that define the hydrograph. The second through the fifth rows contains a time and flow value pair.

(Note that you are not limited to 4 entries on the hydrograph)

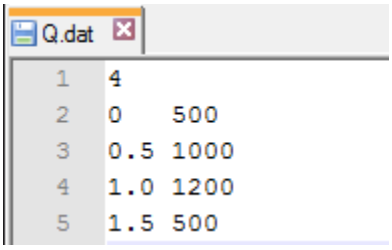

Figure 9 Inflow Condition

10. Click OK to load the file. The hydrograph time series is then shown as rows on the panel.

11. Modify the Outflow boundary condition as the model context determines.

12. For the Settings section, a small triangle size will obviously increase the model simulation time, where a larger size could possibly gloss over the model elements. Adjust the Manning's n value for the default condition of the model.

With this new build we empower users to use coverages to define different materials and the resulting manning's roughness for Flood Simulation. This is the same functions that Drainage Design for InfraWorks uses for pavement drainage.

In the following path, InfraWorks Drainage rule for the material mapping exists:
C:\ProgramData\Autodesk\InfraWorks 360\Resources\Standards\Drainage\Common\Rules

The MaterialMapping2RunoffManningCoeff.clp file contains a simple mapping of the coverage materials and the expected material roughness.

Take a look at Row 106:

(of RunoffManningCoeff (material "Sample Material") (runoff_coefficient 0.0) (manning_coefficient 0.0) (resolved TRUE))

Replace the "Sampler Material" with the path and name of the InfraWorks created style. Leave the ACItem extension off the name. Add a custom runoff_coefficient and manning coefficient to those that line.

Draw any coverage that represents extra surface roughnesses, and create a style and map that style to a roughness.

13. Edit the simulation time to cover the hydrograph and run the simulation.

Each model simulation time varies by size, hydrograph, and simulation time.

Once the simulation has completed, the animation player will appear allowing the user to review the water surface elevation, depth or velocity over the time of the simulation. To change the theme, click stop.

A snapshot can be preserved in the InfraWorks model such that the flood simulation panel can be closed.

Autodesk \\Labs

Project Boulder is an Autodesk & Hydronia collaboration. The success of Project Boulder is predicated on customer feedback. Over the next 6 months, we would like to continue to progress this Labs project to the point that we can graduate this into a full service. With that in mind – please take some time to consider dropping an email to labs.iw.boulder@autodesk.com with your list of requirements ranked by the priority that you wish to see them enabled in Project Boulder.

RiverFLow2D is a full functioning tool to which Project Boulder leverages only a small portion of the capabilities. If there are questions regarding RiverFlow2D's capabilities, Hydronia would appreciate hearing from you as well.

Thanks for attending! Happy Modeling!