Flood Modeller Pro

Case Study

Using a SWMM-Flood Modeller 2D model to identify areas at risk of flooding

Jacobs developed a coupled SWMM-Flood Modeller 2D model for the Little Shooks Run drainage basin within the City of Colorado Springs to identify locations at risk of flooding when the subsurface drainage system exceeds capacity. The model was also used to explore different solutions to reduce flood risk which were fed directly back to the client.

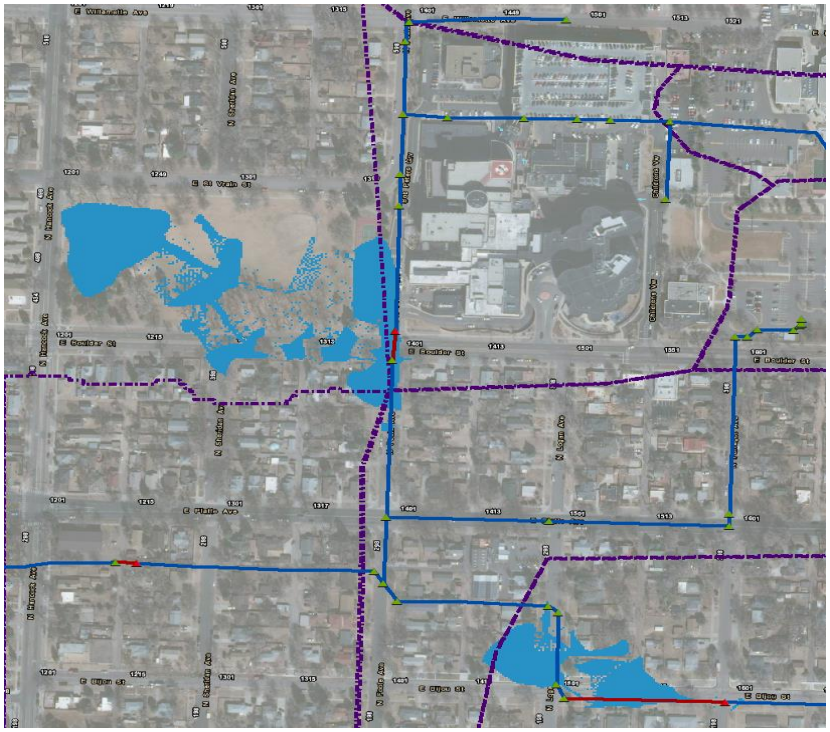
In addition to its built in 1D and 2D solvers, Flood Modeller also has the ability to link with a range of other modelling software to expand its functionality. One of the pieces of software that Flood Modeller can link to is the Storm Water Management Model (SWMM). This allows Flood Modeller to not only model flood water on the surface but also to dynamically link to the subsurface drainage system beneath, meaning that water can dynamically flow between the surface and subsurface during a simulation.

Map of drainage network and locations of flooding

Jacobs were tasked with developing a coupled SWMM-Flood Modeller 2D model for the Little Shooks Run drainage basin within the City of Colorado Springs to identify locations at risk of flooding when the subsurface drainage system exceeds capacity. This is a particular problem in this area due to their susceptibility to intense thunderstorms during the spring and summer which typically last for 2 hours and cause surface water flooding within the city.

This study aimed to develop and run the coupled SWMM-Flood Modeller 2D model to both identify areas at risk of flooding once the subsurface drainage system exceeded capacity and test various options that could be implemented to reduce flood risk in the future while optimizing inlets within the watershed.

Furthermore, the model outputs have the potential to provide guidance to developers and City officials to help them improve the existing drainage system and the street conveyance system throughout the basin.



Subsection of the drainage network showing the junctions within the drainage network where flow escapes (in red), leading to surface flooding

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With a legacy stretching back 40 years, Flood Modeller allows users to model rivers, floodplains and urban areas, using our powerful 1D and 2D solvers.

"The ability to couple Flood Modeller to external modelling software, such as SWMM, is one of the key features that makes Flood Modeller so versatile in its ability to solve a range of modelling problems."

Myles Gardner
(Engineer, Jacobs)

Additional information

To find out more on how to link SWMM to both Flood Modeller 1D and 2D models, please see the links below:

How to link a SWMM model to a Flood Modeller 1D model using the map view

How to create a Flood Modeller 1D-SWMM link within Flood Modeller

How to link a SWMM model to a Flood Modeller 2D model

How to create a Flood Modeller 2D-SWMM link within Flood Modeller

Flood Modeller Pro can be used for a range of applications, including:

- 1D and 2D floodplain modelling
- Floodplain mapping
- Flood forecasting
- Hydrological analysis
- Embankment/levee failure
- Dam breach analysis
- Options' appraisal
- Detailed design
- Structure blockage

Methodology

To undertake this analysis, it was clear that both the subsurface drainage and surface water flows needed to be modelled dynamically. To do this, a Storm Water Management Model (SWMM) was built for the Little Shooks area and linked to a Flood Modeller 2D model. The SWMM model simulates the subsurface drainage system for a range of storm events. As the subsurface drainage system exceeds capacity, flow is routed out of SWMM through manholes and onto the 2D model. As the models are dynamically linked, any flow that has diverted out of the 1D SWMM system into the 2D system is able to flow across the surface and back into the 1D system if there is available capacity within the subsurface drainage network at other locations.

Results and benefits of this modelling approach

Linking SWMM to the Flood Modeller 2D solver allowed the team to better understand the uncertainty of surface flow patterns in the sub-basin once the drainage system capacity is exceeded. It was also possible to compare the existing inlet capacity to the overland street conveyance to understand when different locations became at risk of flooding.

Modellers were able to use the model to understand how blockages in a culvert within the sub-drainage basin reduced the capacity of the local system, leading to water being discharged onto the surface upstream. The model showed how in some locations, water was then able to flow overland and back into the drainage system downstream of the blockage, while in other locations water leaving sub-drainage system ponded and could not re-enter the system. The linked model was therefore vital in understanding how the subsurface drainage basin influenced the surface water conveyance of flood waters.

Following this, the model was then applied to test the impact of a range of potential solutions to reduce flooding on the surface. These include incorporating additional inlets into the drainage system, adding storage facilities and increasing pipe capacity. The end result was a set of possible approaches that could be adopted by city official and planners to reduce flood risk arising from intense thunderstorm events in the Little Shooks Run drainage basin.

Screenshot of a SWMM-Flood Modeller 2D simulation in Flood Modeller

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