ReSWMM

USER'S MANUAL

SWMM 5.1 Plugin

Version 0.1

August 2019

1. GENERAL INFO

This application was developed by the Federal University of Santa Maria (Grupo de Pesquisa em Modelagem Hidroambiental e Ecotecnologias) and Auburn University (Department of Civil Engineering) with the objective of introducing artificial spatial discretization in SWMM 5.1 models. This is a first version of the plugin, we count on users' collaboration to improve the software and correct possible errors.

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Code

https://github.com/ecotecnologias/ReSWMM.git

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2. INTRODUCTION

ReSWMM is an application for SWMM that introduces artificial spatial discretization in SWMM models. The routing algorithm used by SWMM does not employ intermediate calculation points between two adjacent nodes. In some highly dynamic situations, such as pressurization of conduits, entrapment of air pockets within the pipes, pressure surges, pipe filling bores and even waterhammers, artificial spatial discretization along with the full form of the Saint Venant equations brings significant improvements in SWMM results.

This software (Figure 1) is able to read and edit the SWMM input file, recommend the routing time-step based on Roesner et al. (1988) and Vasconcelos et al. (2018), and create artificial spatial discretization by placing intermediate calculation points (dummy nodes) between actual nodes. Furthermore, the software analyses the input file to verify if discretization is required. This analysis is also based on the EXTRAN recommendation that the longest conduit in the system should not exceed four or five times the length of the shortest conduit.

Three types of discretization are available in its current version:

• Regular Interval Discretization: places a regular number of dummy nodes between actual nodes.

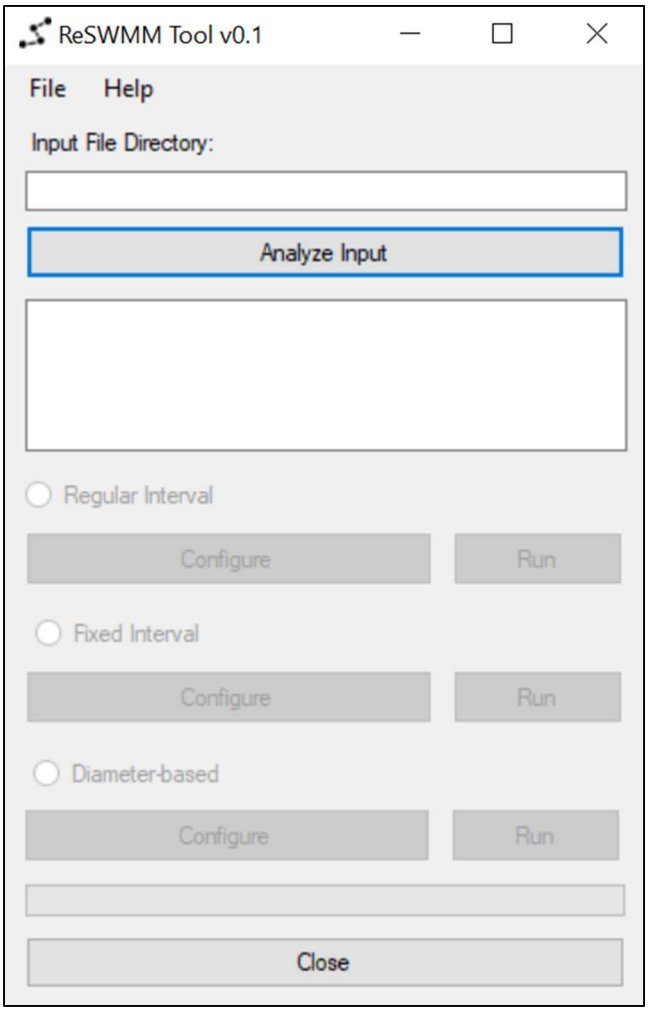
• Fixed Interval Discretization: limits the maximum and minimum space between dummy nodes by a maximum and minimum threshold.

• Diameter Based discretization: sets the number of dummy nodes in each link based on a ratio between the conduit length and diameter/max depth.

This application can be coupled within SWMM as an add-on or executed as a standalone application. The following sections will describe how to add this tool within SWMM and how to execute it as a standalone application. Also, an example showing the

results of this tool is provided.

Figure 1 - ReSWMM interface.

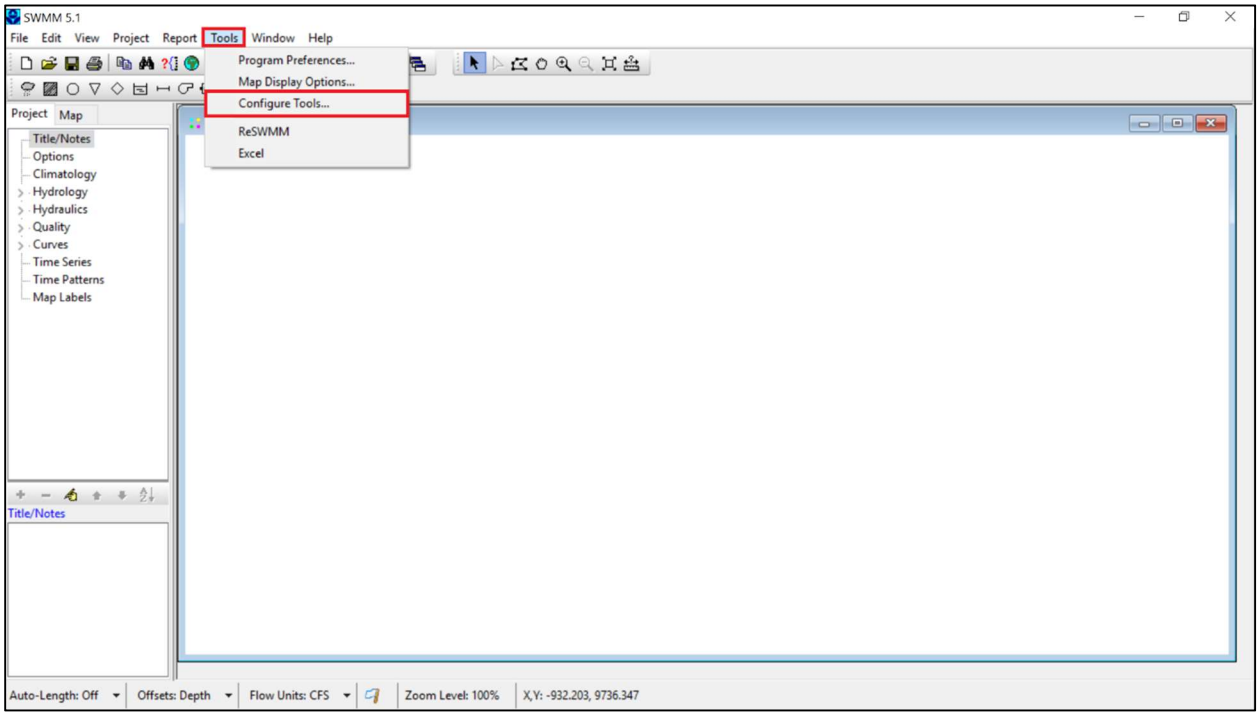


Source: The Author.

3. SWMM ADD-ON

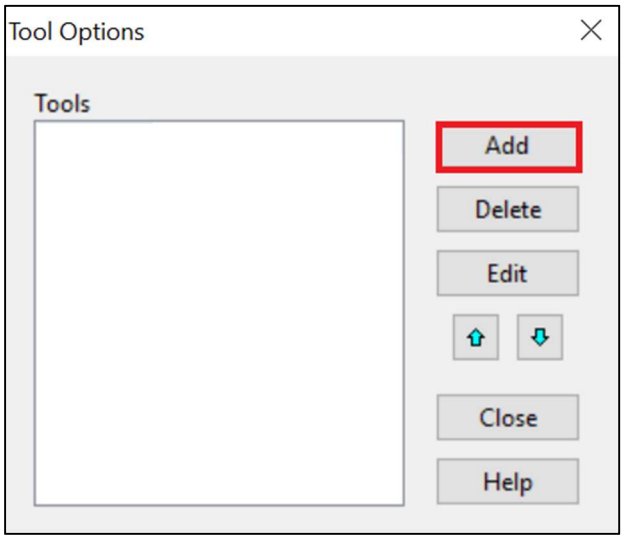
In order to use ReSWMM as an SWMM Add-on, the user must select Tool > Configure Tools (Figure 2) in the SWMM interface and then click on Add (Figure 3).

Figure 2 - SWMM interface.



Source: USEPA (2018)

Figure 3 - SWMM tool options.

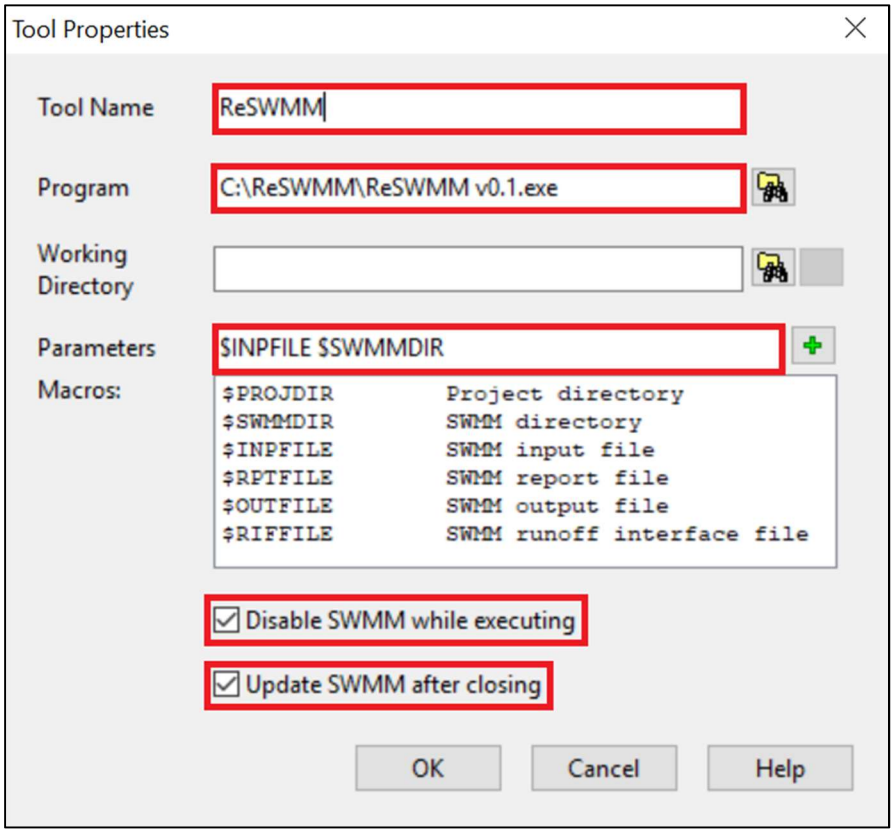


Source: USEPA (2018)

After, the user must fill the blank spaces marked in red (Figure 4). Tool Name

should be filled with ReSWMM. In Program, the ReSWMM executable directory should be selected. In parameters, $INPFILE and $SWMMDIR should be selected. Finally, the two options in the bottom should be checked.

Figure 4 - SWMM add-on configuration.



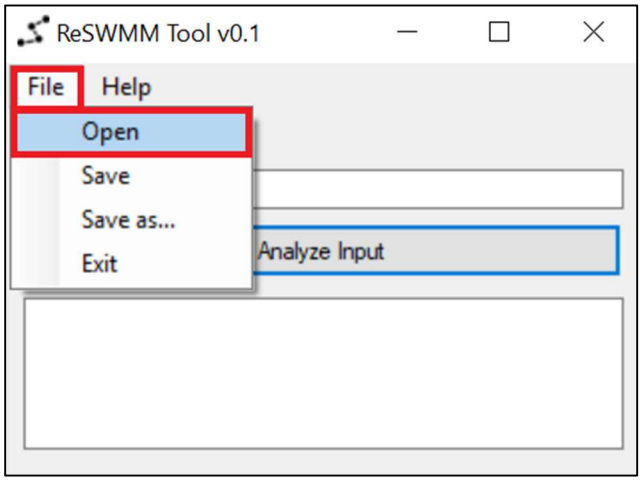
Source: USEPA (2018)

After this, the ReSWMM will appear at the Tool menu strip as shown in Figure 2.

4. STANDALONE APPLICATION

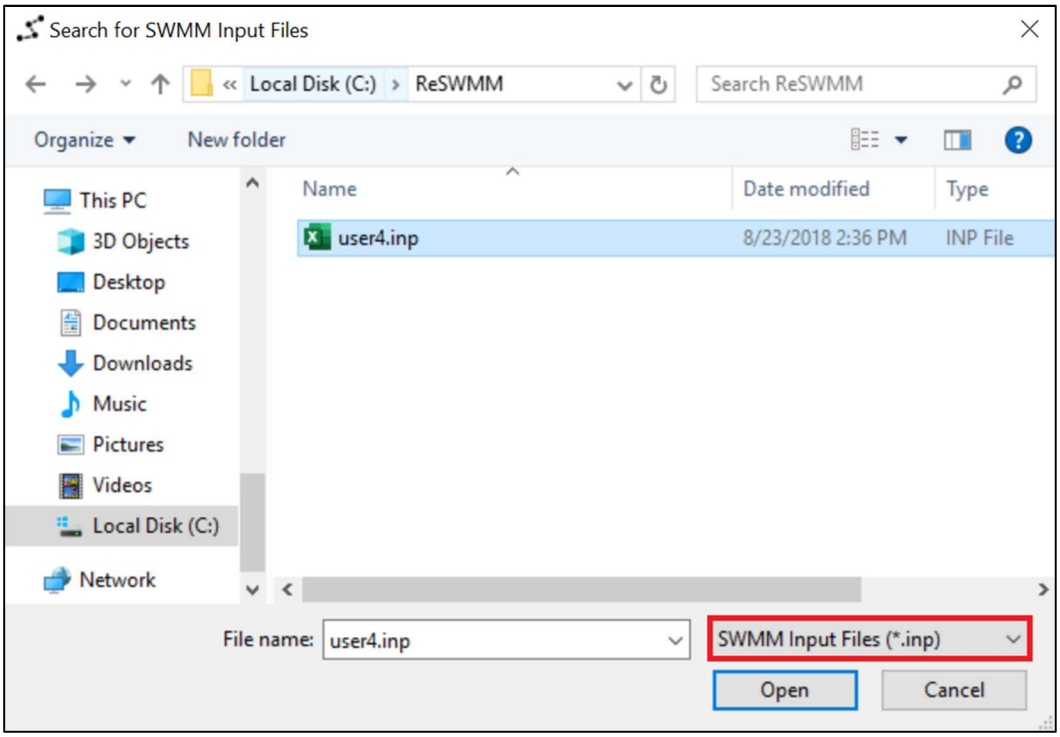
In order to work as a standalone application, the user only has to click on the ReSWMM executable (.exe) and select an SWMM input file (.inp) as shown in Figure 5 and Figure 6.

Figure 5 - ReSWMM open input file.



Source: The Author.

Figure 6 - ReSWMM select input file.



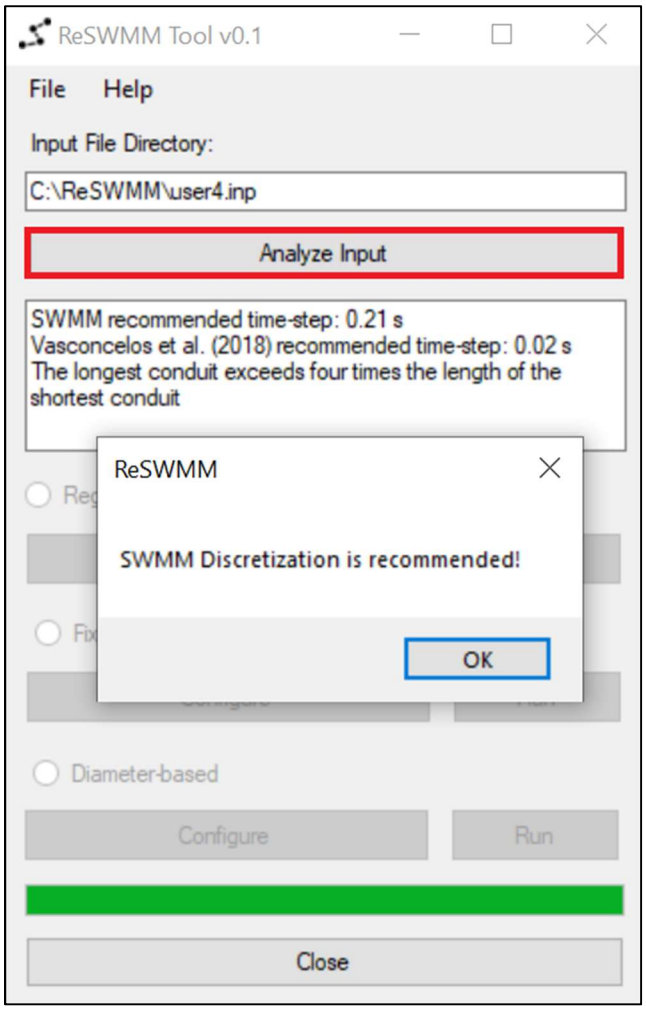
Source: The Author.

After this point, there is no difference in using ReSWMM as an add-on or as a

standalone application.

With the SWMM input file selected, the user must analyze the input file clicking on Analyze Input as shown in Figure 7. If the longest conduit in the system exceeds four times the length of the shortest conduit, ReSWMM will recommend to discretize the input file. If there is no need for discretization based on the Roesner et al. (1988) recommendation, the user can still discretize the model.

Figure 7 - ReSWMM analyze input file.

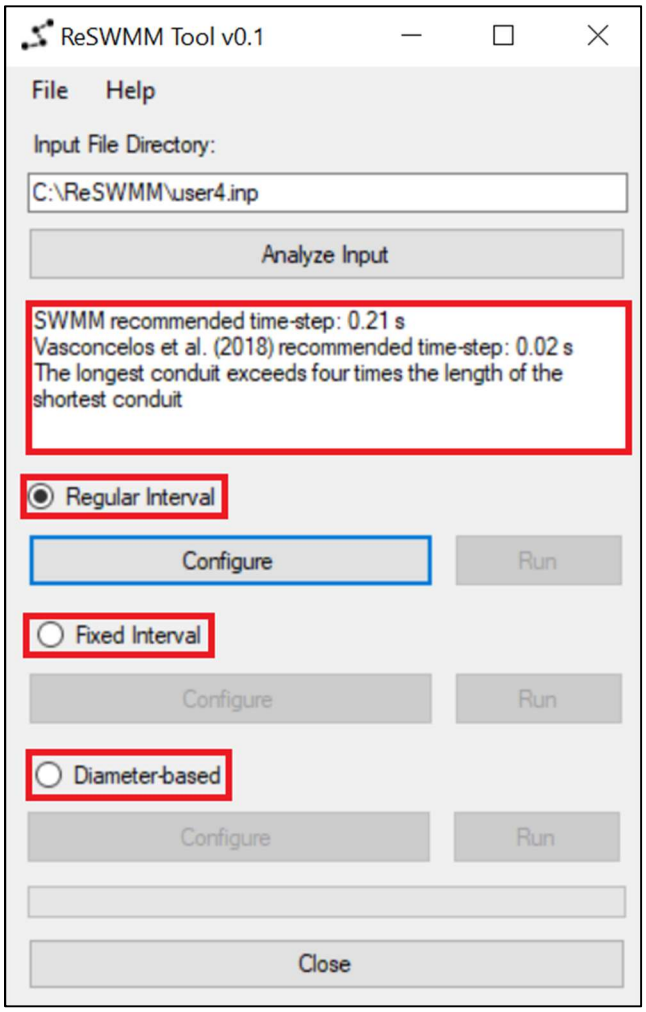


Source: The Author.

The two routing time-steps estimated by ReSWMM will appear at the text box as

shown in Figure 8. At this point, the user will be able to select which type of spatial discretization technique he will adopt to add the dummy nodes.

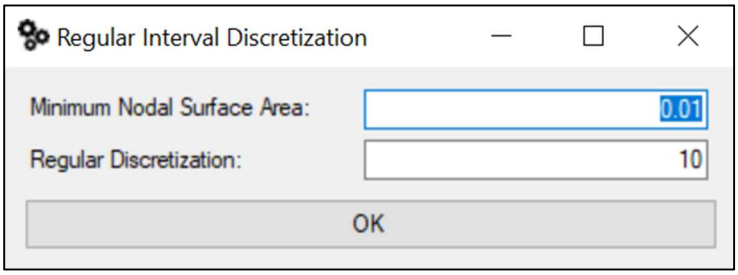
Figure 8 - ReSWMM select discretization technique.



Source: The Author.

If the user selects the Regular Interval discretization, a window as shown in Figure 9 will appear. The user will be able to select a new value for the Minimum Nodal Surface Area (0.01 or less is recommended) and the quantity of dummy nodes that will be placed in-between the actual nodes.

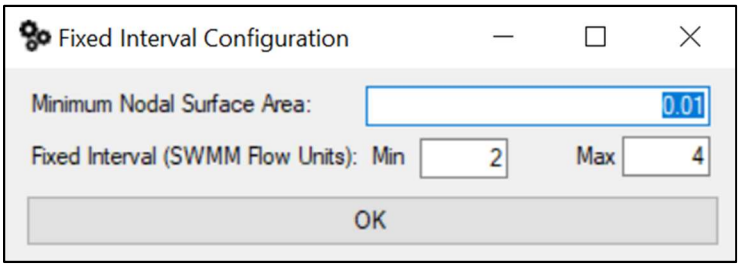
Figure 9 - ReSWMM regular interval.



Source: The Author.

If the user selects the Fixed Interval discretization, a window as shown in Figure 10 will appear. The user will be able to select a new value for the Minimum Nodal Surface Area (0.01 or less is recommended) and the minimum and maximum threshold (in SWMM flow units) that will limit the minimum and maximum space between the dummy nodes.

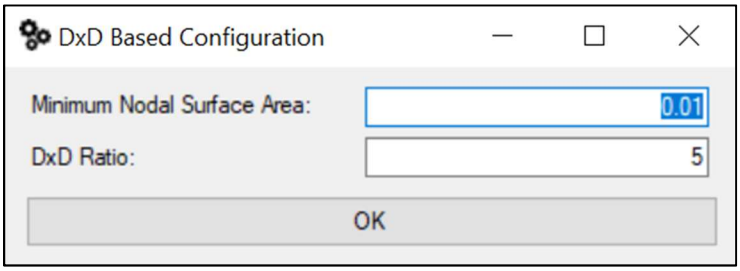
Figure 10 - ReSWMM fixed interval.



Source: The Author.

If the user selects the Diameter Based discretization, a window as shown in Figure 11 will appear. The user will be able to select a new value for the Minimum Nodal Surface Area (0.01 or less is recommended) and the ratio that will define the number of dummy nodes placed in each link.

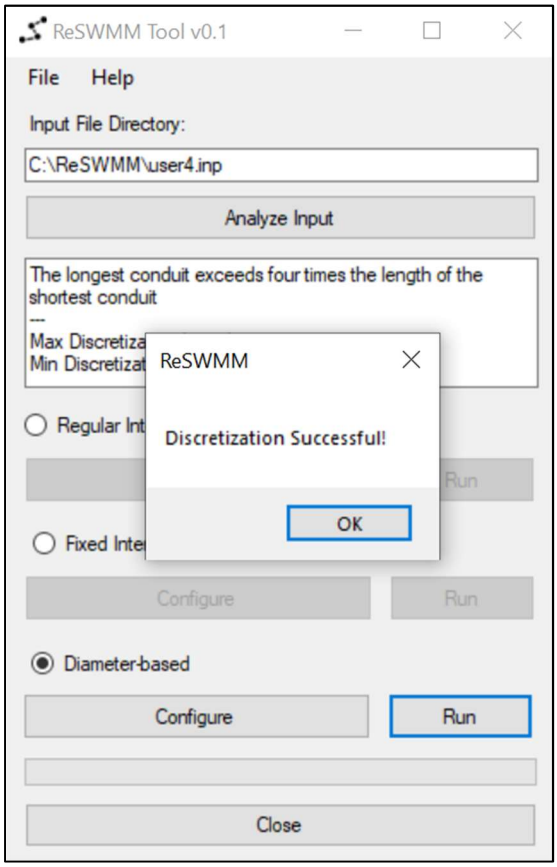
Figure 11 - ReSWMM diameter-based.



Source: The Author.

If the discretization runs successfully a message as shown in Figure 12 should appear. Clicking OK will update the SWMM project if used as Add-on or will save a new file if used as standalone application.

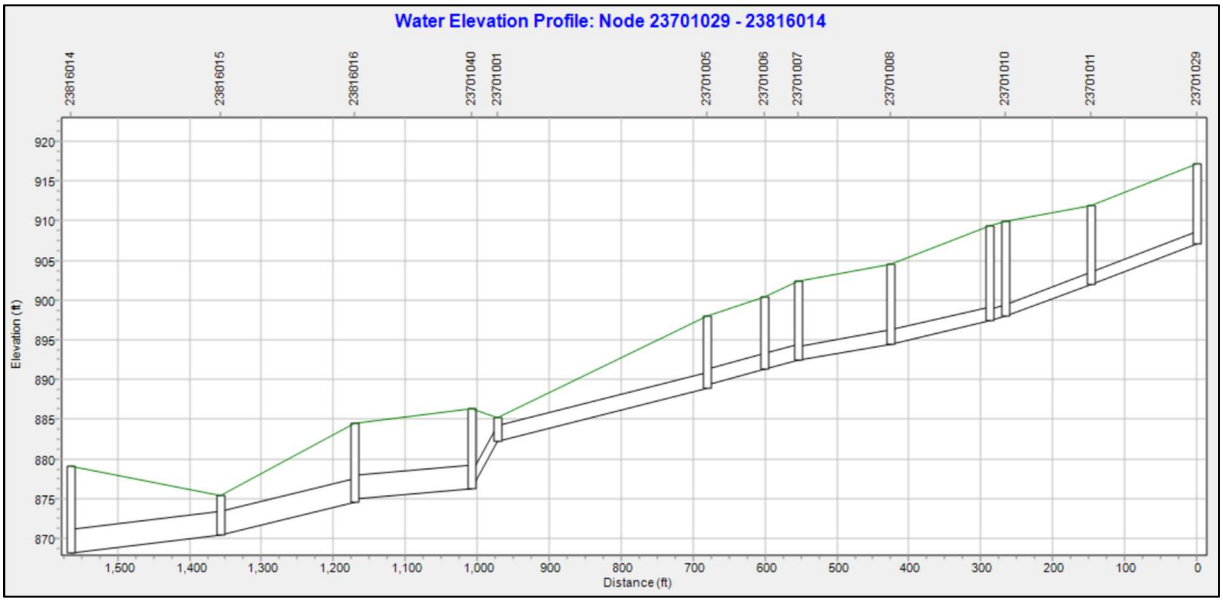
Figure 12 - ReSWMM discretization successful.



Source: The Author.

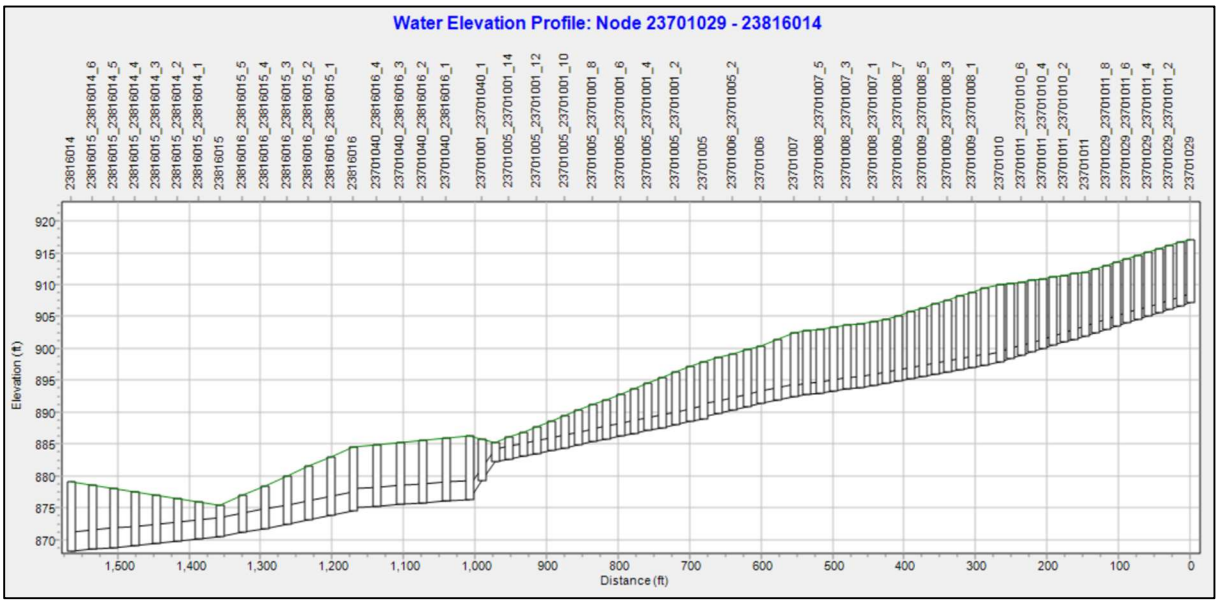
Figure 13 shows an original link-node SWMM model and Figure 14 shows the same model spatially discretized based on a DxD ratio of 10.

Figure 13 - Link-node approach.



Source: The Author.

Figure 14 - Diameter-based discretization.



Source: The Author.