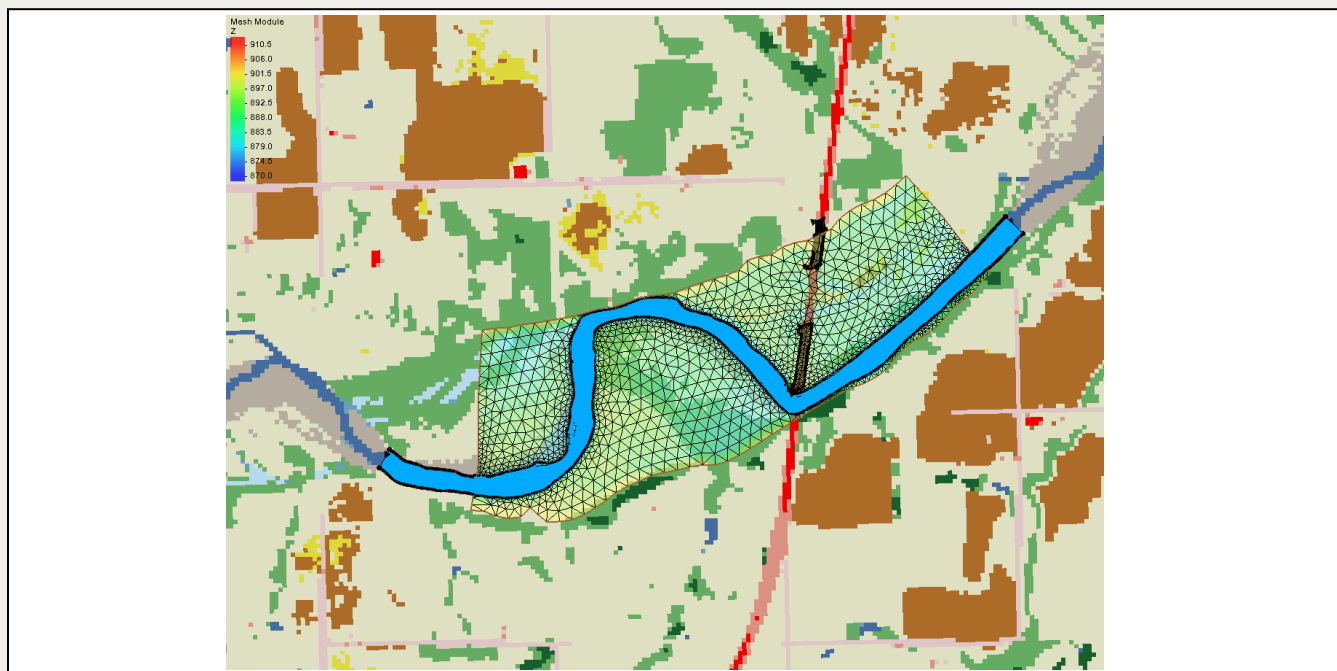




SMS 14.0 Tutorial

SRH-2D Using NLCD

Using National Land Cover Data for Roughness in SRH-2D



Objectives

This lesson demonstrates how to use National Land Cover Database (NLCD) data to define roughness in an SRH-2D simulation in the Surface-water Modeling System (SMS).

Prerequisite Tutorials

- Overview

Required Components

- SMS Core

Time

- 10–20 minutes

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1 Introduction

The National Land Cover Database (NLCD)

(<https://www.usgs.gov/centers/eros/science/national-land-cover-database>) is a comprehensive land cover dataset, developed by the U.S. Geological Survey (USGS) in collaboration with the Multi-Resolution Land Characteristics (MRLC) Consortium.

It covers the United States and is created from satellite imagery to provide detailed information on land cover types and changes over time. NLCD data has been used historically to provide spatially varying roughness (based on the land cover) for hydraulic models such as SRH-2D, HEC-RAS 2D, and ADCIRC.

It should be noted that the resolution of the NLCD data is approximately 30 meters (or 100 ft), which is too coarse to capture smaller features, such as channels and roadways. This limitation should be kept in mind when applying NLCD data to high resolution hydraulic simulations.

The legacy NLCD has been replaced with the “Annual NLCD” which is available with a graphical viewer (MRLC Viewer) at <https://www.mrlc.gov/viewer/>. SMS includes a connection to the legacy NLCD through the “Import from Web” command. This feature will be deprecated soon, and we recommend that the annual NLCD be used.

This tutorial describes some of the information that is available in the annual NLCD and how to use it in conjunction with an SRH-2D simulation in the SMS interface.

All files for this tutorial are in the *data_files* folder for this tutorial. This includes data files that you would typically download through the MRLC Viewer website.

2 Import the Initial Project

An initial SMS project is provided for this tutorial. It includes an SRH-2D simulation for the Cimarron River at the I-35 crossing in Oklahoma.

To import the project files:

1. If necessary, launch SMS.
2. If SMS is already running, select the *File* | **New** menu command to ensure that the program settings are restored to their default state.
3. Select the *File* | **Open...** menu command to bring up the *Open* dialog.
4. Browse to the *data_files* folder for this tutorial and select the file “NLCD_initial.sms”.
5. Click the **Open** button to import the project and close the *Open* dialog.
6. Click the *File* | **Save As...** menu command to bring up the *Save As* dialog.

7. Enter the name “NLCD”.
8. Click the **Save** button to save the file under the new name and close the Save As dialog.

The Main Graphics Window should look similar to Figure 1.

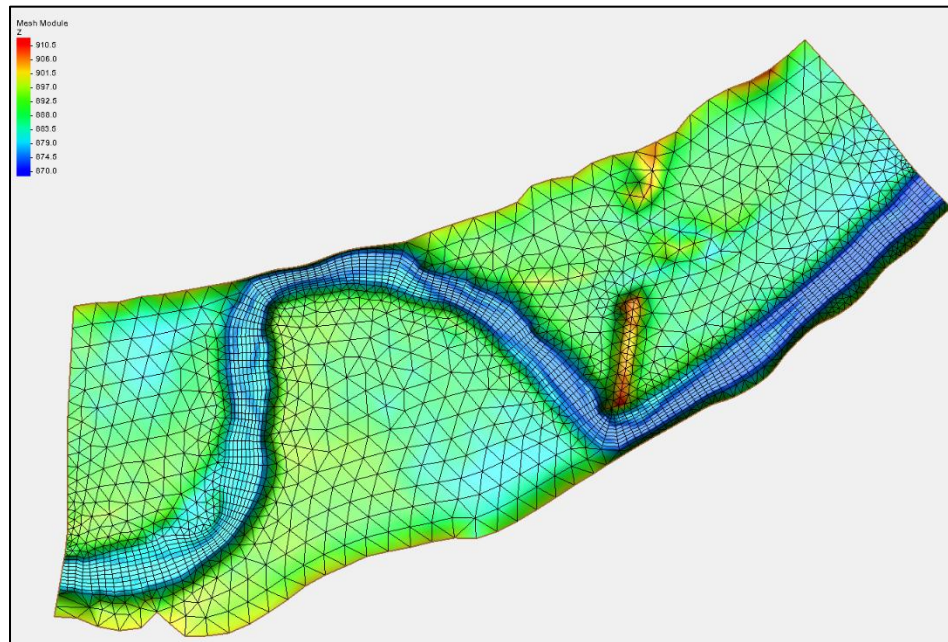


Figure 1 Graphics Window after opening the project.

3 The NLCD Raster

This tutorial illustrates the interface and workflow for using an NLCD raster in an SRH-2D simulation. This requires that you have such a raster image.

This section describes the steps to obtain a raster image for this section of the Cimarron River from the MRLC Viewer. The data is also provided in case an internet connection is not available or there are issues with the web site.

3.1 Downloading an NLCD Raster

Download NLCD data from the MRLC website. For convenience, the data for this tutorial is included in the “From MRLC” folder in the *data_files* folder.

Web sites and services are constantly changing, so the specific steps included in this section may not be precise, however, they should provide guidance to download an NLCD raster image.

1. Open a web browser and navigate to the MRLC Viewer website (<https://www.mrlc.gov/viewer/>).
2. Zoom to area of the United States where the Cimarron River crosses I-35 in Oklahoma. For reference, the crossing is near (97.353 W, 35.985 N).
3. Use the “Data Download” () tool and click twice to define a rectangular region that contains the SRH-2D domain.

The entire SRH-2D domain can be defined in the *Data Download* tool window by entering *Longitude (dd)*: “-97.38” to “-97.32” and *Latitude (dd)*: “35.975” to “36.00”).

4. In the *Data Download* tool window, for the category, select “Land Cover”.
5. For the *Select Years* option, specify “2024-2024”.
6. Enter your email address.
7. Click the **Download** button.

This enters the data request, and a message will appear indicating that the request will be processed “within 24 hours”. Typically, the email will be sent within a few minutes containing a link to the requested data.

Note: the download request can span multiple years, in which case, the data provided will include an NLCD raster image for each year requested along with a GIF file containing a summary of the raster images.

3.2 Loading the NLCD Raster

Once the NLCD raster (TIFF) image is available, it can be loaded into SMS. To do this:

1. In the Project Explorer, turn on the *Google Hybrid* GIS data image checkbox to provide a frame of reference.
2. Select the *File* | **Open** menu command and navigate to the downloaded data folder. For convenience, a file is included in the *data_files\From MRLC* folder.
3. Select the *TIFF* file and click the **Open** button to load the file and close the *Open* dialog. The file appears in the *GIS Data* folder of the Project Explorer.
4. Right-click on the *TIFF* file and select the **Transparency** context menu command to open the *Layer Transparency* dialog.
5. For the *Transparency*, enter “80” (%).
6. Click the **OK** button to close the *Layer Transparency* dialog.
7. The Graphics Window should appear similar to Figure 2.

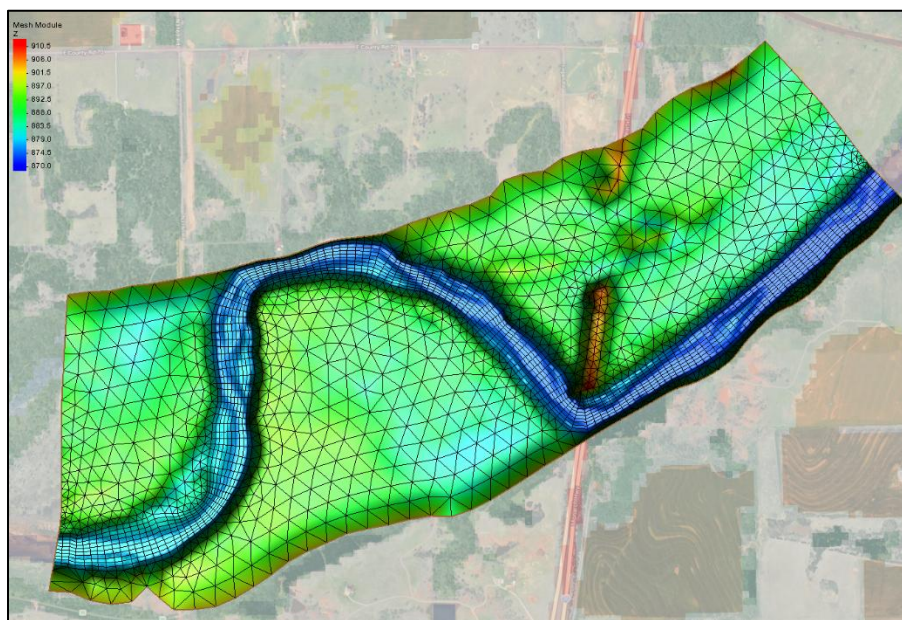


Figure 2 Mesh and NLCD raster of the background data

4 Run the Existing SRH-2D Simulation

As a baseline we have provided a simulation with a constant Manning's N.

1. In the Project Explorer, right-click on the  "MatCov" simulation, and select the **Save Project, Simulation and Run** context menu command.
2. When the simulation is completed, click the **Load Solution** button to load the results into the project.

5 Setting up New SRH-2D Simulation

Create a new simulation from the existing simulation.

1. Right-click on the  "MatCov" simulation and select the **Duplicate** context menu command.
2. Right click on the  "MatCov (2)" simulation and select the **Rename** context menu command.
3. Enter "NLCD" and press the *Enter* key to set the name.
4. In the  "NLCD" simulation, right-click the  "Default Material" map data coverage and select the **Remove** context menu command.
5. Right-click on the  "Specific Material" map data coverage and select the **Apply to | SRH-2D Simulations → NLCD** context menu command.

This coverage only contains polygons that cover the channel and roadway.

Note: if a material coverage is provided for an SRH-2D simulation, that material specification takes precedent over an NLCD raster. This means that any cell in the mesh that is located in a material polygon will be assigned roughness based on the specified material for that polygon.

6. Right-click on the  "NLCD" simulation and select the **Model Control** context menu item to open the *SRH2D Model Control* dialog.
7. Select the *Advanced* tab.
8. In the *Materials from NLCD* section, turn on the *Specify materials using NLCD raster* checkbox.
9. Click the **Select NLCD raster...** button to open the *Select NLCD Raster* dialog.
10. Turn on the *NLCD raster* checkbox.
11. For the *Background Manning's N* value, enter "0.03".
12. Click the **OK** button to close the *SRH2D Model Control* dialog.

6 Run the NLCD Simulation

The NLCD simulation can now be run.

1. In the Project Explorer, right-click on the  "NLCD" simulation, and select the **Save Project, Simulation and Run** context menu command.
2. When the simulation is completed, click the **Load Solution** button to load the results into the project. Roughness value data is saved to disk.

7 Visualizing the Resulting Roughness

Roughness values were added to the simulation data and saved to disk. To view the roughness values that were passed to the SRH-2D engine:

1. Select the *File* | **Open** menu command to bring up the *Open* dialog.
2. In the data files folder, browse to the *data_files\NLCD_models\SRH-2D\NLCD* folder.
3. Select the “NLCD.srhhydro” file.
4. Click the **Open** button to load the results file and close the *Open* dialog. If necessary, choose the projection for the coverage.
5. Right-click on the “ Materials” map data coverage and select the **Material List and Properties** command to bring up the *Material List and Properties* dialog.
6. Review the *Manning’s N* assigned to each *NLCD* value.
7. Click the **OK** button to close the *Material List and Properties* dialog.

The values for Manning’s n associated with each land use in the NLCD are applied by SMS. These values are documented in the wiki under the *SRH-2D Model Control/Advanced tab* section (https://www.xmswiki.com/wiki/SMS:SRH-2D_Model_Control#Advanced_Tab).

8 Conclusion

You may wish to set up another simulation that uses the NLCD exclusively for roughness. This can be done by removing the SRH-2D materials coverage completely from the desired simulation.