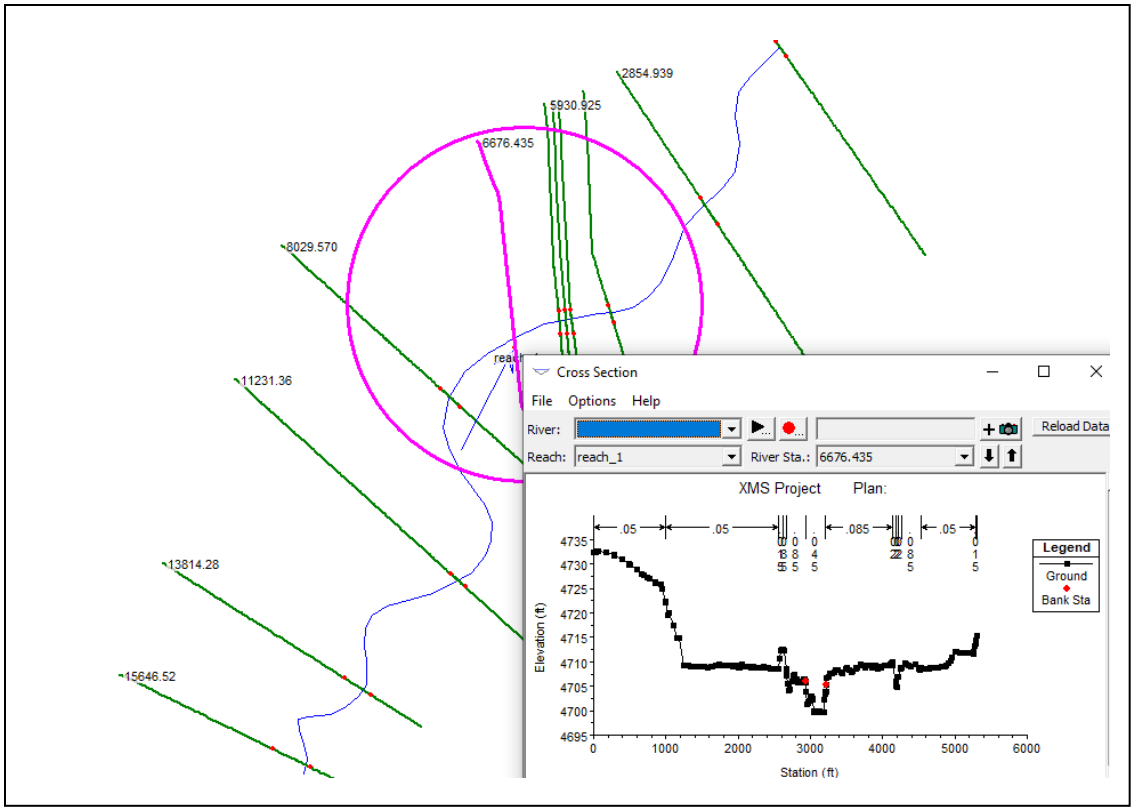
v. 13.1

SMS 13.1 Tutorial

HEC-RAS 1D



Objectives

This tutorial describes how to set up and export a 1D project for HEC-RAS using the 1D Module.

Prerequisites

- SMS Overview
- SMS Map Module

Requirements

- Map Module
- 1D Module
- HEC-RAS

Time

- 10–15 minutes

1 Introduction

HEC-RAS supports both 1-dimensional and 2-dimensional modeling. This tutorial describes the process of setting up a HEC-RAS 1D project within SMS.

2 Getting Started

To get started, do the following:

1. Launch SMS.
2. If SMS is already running, select *File* | **New** to ensure that the program settings are restored to the default state.
3. Click **Open** to bring up the *Open* dialog.
4. Browse to the *data files* directory for this tutorial and select “start.sms”.
5. Click **Open** to import the project and close the *Open* dialog.

The project should appear similar to Figure 1.

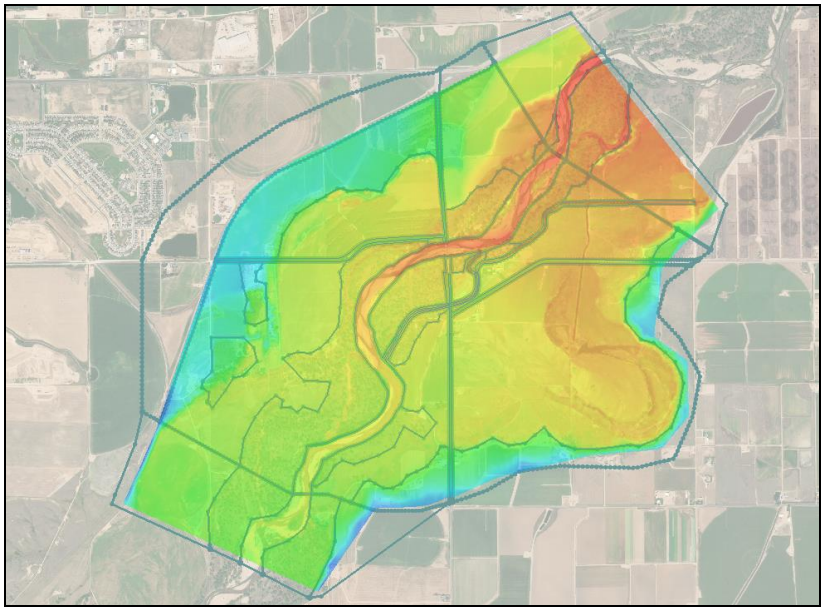


Figure 1 Initial project

The projection for the project has also already been set to Colorado State Plane, North, and the project contains:

- An aerial map of the project location. This is not necessary for HEC-RAS 1D but has been included to give context to the project.
- A scatter set representing the surface, the river channel, and the flood plain. This would normally be the meshed used for a 2D hydraulic simulation of the region.
- Map coverages including:
  - SRH-2D Materials: This coverage contains a set of polygons covering the model area and a list of material types. Each material type has an associated Manning's *n* value and each polygon has an associated material type. (This would normally be the part of a 2D hydraulic simulation.)
  - 1D-Hyd Centerline: This coverage defines the reach to be modeled in HEC-RAS 1D.
  - 1D-Hyd Cross Section: This coverage contains the locations of the cross sections that will be extracted from the scatter set and passed to the HEC-RAS 1D project.

3 The 1D Coverages

A HEC-RAS 1D project requires a centerline and a set of cross sections. In the SMS, these come from a 1D-Hyd Centerline coverage and a 1D-Hyd Cross Section coverage. These have been supplied for this project.

The 1D-Hyd Centerline coverage contains a centerline arc which follows the channel and bank arcs delineating the edges of the channel. The bank arcs are optional. Review the arcs by doing the following.

1. Turn off "SRH-2D Materials" in the Project Explorer.
2. Turn on and select "1D-Hyd Centerline".

Note the direction arrows near the center of the centerline and bank arcs. These arcs should point in the direction of flow (from upstream to downstream).

3. Using the **Select Feature Arcs** tool, double-click the blue arc in the center of the river to open the *River Reach Attributes* dialog.

Note the *Arc Type* is set to "Centerline".

4. Click **Cancel** to close the *River Reach Attributes* dialog.
5. Double click either of the green arcs at the edges of the river banks. Note the *Arc Type* is set to "Bank".
6. Click **Cancel** to close the *River Reach Attributes* dialog.

The other component of the 1D project is a set of cross sections. These are defined as arcs in a 1D Hyd Cross Section coverage. Normally this coverage is created after the centerline is defined so that default stationing can be defined by the intersection of the cross section arc with the centerline arc.

If the cross sections are created first, the coverage should be associated with a centerline coverage after it is loaded or created using the "Assign centerline coverage…" command in the right-click menu of the cross section coverage.

In this example the cross sections have been provided. Review the cross sections by doing the following:

7. Turn on and select "1D-Hyd Cross Section" to make it visible and active.
8. Using the **Select Feature Arcs** tool, double-click on any of the arcs to bring up the *River Cross Section Attributes* dialog.
9. Note that the cross sections don't have elevation data yet. The arcs define the location where the cross sections will be extracted.
10. When done, click **Cancel** to close the *River Cross Section Attributes* dialog.

4 Materials

In the SMS interface for HEC-RS 1D, roughness values can be defined using one of three methods. These include:

- Specifying a constant Manning's *n* value. This applies the same Manning's *n* value over the entire project. (This is recommended for very simplistic models only.)
- Using an area property coverage and the global material list.
- Using a polygon shapefile with roughness attributes. This approach will be used in this tutorial.

For both of the spatially varied approaches, polygons represent regions of consistent roughness (the material zones). Each polygon is assigned a "material type" selected from a list of defined materials. Each material type has an associated roughness value.

4.1 Reviewing the SRH-2D Materials coverage

This tutorial illustrates how to convert an SRH-2D material coverage to a shapefile or global material list. The "SRH-2D Materials" coverage in the project includes a list of polygons and an associated list of materials. To review what this consists of:

1. Turn off "1D-Hyd Cross Section" in the Project Explorer.
2. Turn off the "Terrain+Stamp" object in the Project Explorer.
3. Turn on and select "SRH-2D Materials" in the Project Explorer.

Note the following:

- The list of material types in the legend in the upper left corner.
- The polygons each filled with their associated material pattern and color.

4. Right-click on "SRH-2D Materials" and select **Material List and Properties** to bring up the *Material List and Properties* dialog. The table includes the material name and the Manning's *n* value specified for each.
5. Click **Cancel** to close the *Material List and Properties* dialog

4.2 Creating a shapefile from the SRH-2D Materials coverage

SMS includes a function to convert an SRH-2D materials coverage into a shapefile representation of roughness values.

To do this:

1. With "SRH-2D Materials" active, select *File* | **Save As...** to bring up the *Save As* dialog.
2. Select "Shape Files (*.shp)" from the *Save as type* drop-down.
3. Enter "materials.shp" as the *File name*.
4. Click **Save** to exit the *Save As* dialog and bring up the *Export Shapefile* dialog.
5. In the *Export* section, select *Feature Polygons* → *Polygon Shapefile* and click **OK** to close the *Export Shapefile* dialog.

Now import the shapefile to view in SMS

6. Select *File* | **Open…** to bring up the *Open* dialog.
7. Select "materials.shp" and click **Open** to exit the *Open* dialog.

This file appears in the "GIS Data" section of the Project Explorer. With this file loaded, SMS now can reference it when extracting cross sections for HEC-RAS 1D.

5 Creating 1D Cross Sections

The next step in creating a HEC-RAS 1D simulation is to assign elevation and roughness values to the cross sections defined in the "1D-Hyd Cross Section" coverage. The coverage included in this project includes only the plan view definition of the cross sections. The cross section shape and roughness are extracted.

To do this:

1. In the Project Explorer, right-click on "1D-Hyd Cross Section" and select **Extract cross sections** to open the *Extract Cross Sections* dialog.

This command will extract elevation values for points along the cross section from the active scatter set. (If you want to use a raster or DEM for elevation data on the cross sections, you must first convert the DEM to a scatter set.)

2. In the *Generate line properties* section, select *Shapefile material zones*.
3. Select "materials.shp" from the *Material zone shapefile name* drop-down.
4. Select "MATNAME" from the *Material name field* drop-down.
5. Select "MANNINGS" from the *Manning's n value field* drop-down.
6. Click **OK** to close the *Extract Cross Sections* dialog.

In this example the cross sections have been provided. Review the cross sections by doing the following:

7. Turn on and select "1D-Hyd Cross Section" to make it visible and active.
8. Using the **Select Feature Arcs** tool, double-click on any of the arcs to bring up the *River Cross Section Attributes* dialog.

Notice that the cross sections now have elevation data.

9. Click on the **Assign Cross Sections** button open the *Assign Cross Section* dialog.

This shows all the cross sections that were extracted for the coverage. The current cross section is the data extracted for the selected arc.

10. Click on the **Edit** button to open the *Cross Section Attributes* dialog for this cross section.
11. Select the *Line Props* tab to see the different regions of Manning's roughness on this cross section. The Manning's roughness was extracted from the shapefile.
12. Click **Cancel** to close the *Cross Section Attributes* dialog.
13. Click **Cancel** to close the *Assign Cross Section* dialog.
14. Click **Cancel** to close the *River Cross Section Attributes* dialog.

6 Setting Up HEC-RAS

With the centerline, cross sections, and materials defined, the HEC-RAS 1D model can be defined. This is done in the 1D Module by doing the following:

1. Switch to the **1D Module**.

Review the model to make certain it has been correctly set up.

2. Select *HEC-RAS* | **Material Properties…** to open the *HEC-RAS Material Properties* dialog.

All of the needed materials, with assigned roughness, should be visible in the dialog.

3. When done, click **OK** to close the *HEC-RAS Material Properties* dialog.
4. Select *HEC-RAS* | **Model Control…** to open the *HEC-RAS Model Control* dialog.

The dialog should state that the cross section database is being used and the "Materials" shapefile is being used for the roughness.

5. When done, click **OK** to close the *HEC-RAS Model Control* dialog.

7 Export to HEC-RAS

With all of the components defined, the project can now be exported.

1. Select *HEC-RAS* | **Export HEC-RAS Project File** to bring up the *Enter a filename to save an HEC-RAS project file* dialog.
2. Enter "hecras1d" as the *File name*.
3. Click **Save** to export the file and close the *Enter a filename to save an HEC-RAS project file* dialog.

A project file has now been saved and is ready to be view in HEC-RAS.

8 Viewing the Results

Open the exported project in HEC-RAS be doing the following:

1. Outside of SMS, open the HEC-RAS program.
2. Click **Open** to bring up the *Open Project* dialog.
3. Browse to the location where the project was saved.
4. Select the file "hecras1d" and click **OK** to import the project.
5. Click **View/Edit geometric data** to open the *Geometric Data* dialog.

The project should appear similar to Figure 2.

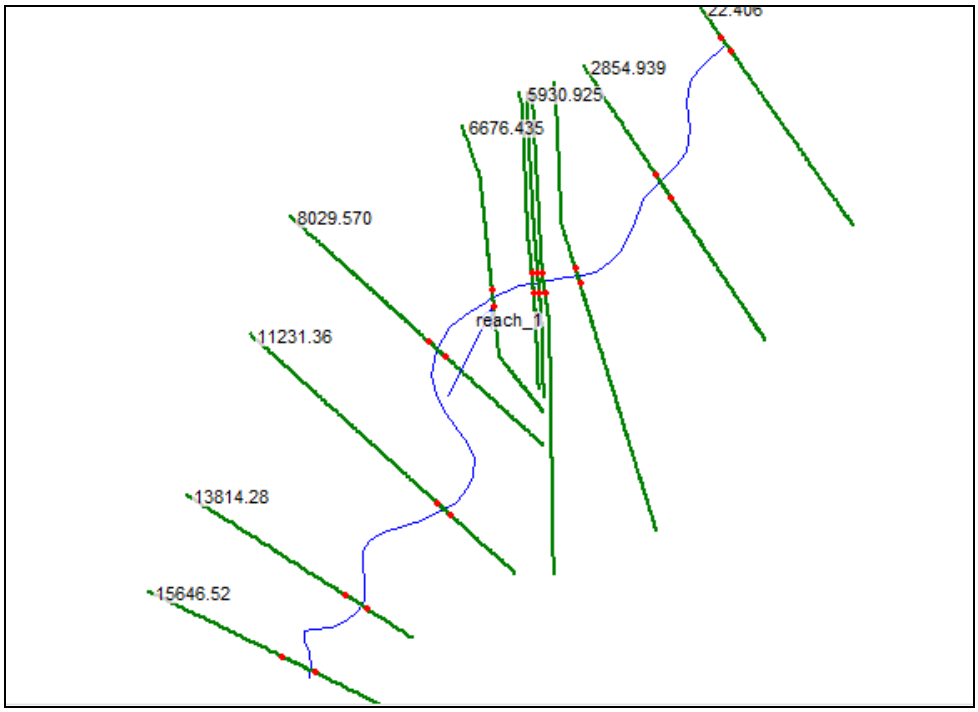


Figure 2 Project imported into HEC-RAS

9 Conclusion

This concludes the "HEC-RAS 1D" tutorial. Topics covered include reviewing the HEC-RAS 1D components, setting the project materials from a shapefile, using the 1D Module, and exporting a HEC-RAS 1D project.

Continue to explore the HEC-RAS 1D features in SMS or exit the program.

