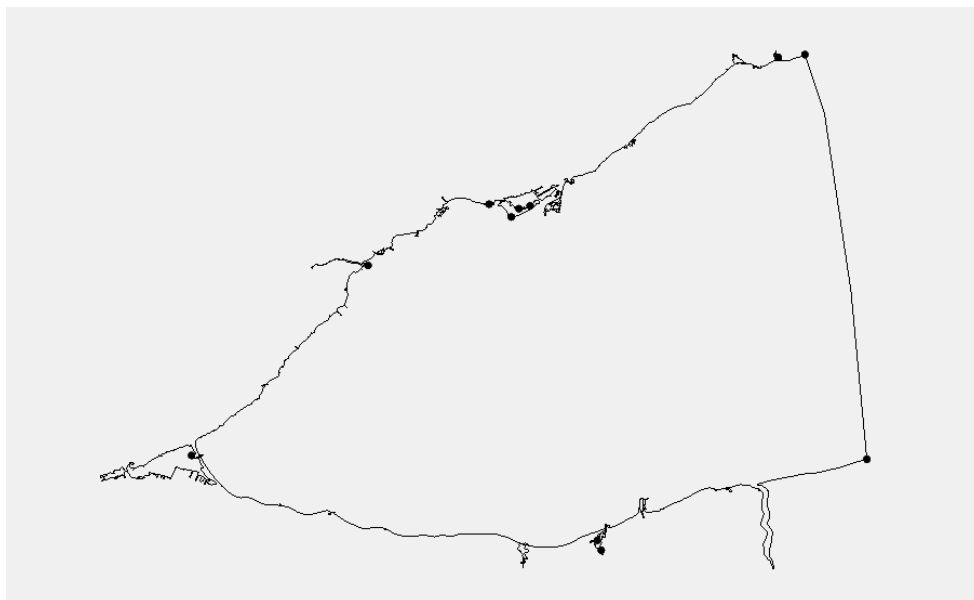*SMS 13.4 Tutorial*

Clean Shapes – Merge Polygons

Combining Nearby Polygons

Objectives

This tutorial demonstrates how to prepare geographical information system (GIS) data for use in the process of constructing numerical hydrodynamic models.

Prerequisite Tutorials

- Overview
- Clean Shapes – Delete Polygons

Required Components

- SMS Core

Time

- 10–15 minutes

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1   Introduction

This tutorial is the third in a series that illustrates workflows for cleaning and conditioning GIS data for numerical applications. If not already completed, review the "Clean Shapes – Data Preparation" and "Clean Shapes – Delete Polygons" tutorials which precede this tutorial in this series.

This tutorial will illustrate operations in the *Clean Shapes* tool in SMS which allows the user to quickly review and process many entities. This tutorial specifically focuses on merging polygons with their approximate neighbors. These neighbors could be a bounding polygon, such as an island inside a body of water, or a sibling, such as two adjacent islands. When two islands are very close to each other, they may be too small individually to be included in a mesh, however, hydraulicly they could act as a single, larger island.

2   Getting Started

Start by loading the SMS project representing Lake Ontario.

1.   Launch the SMS application*.*

2.   Select *File* | **Open…** to bring up the *Open* dialog.

3.   Browse to this tutorial's *data files* folder and select "LakeOntario_west end.sms".

4.   Click **Open** to exit the *Open* dialog and import the data.

The imported project should appear similar to Figure 1. This project is a single section of the lake trimmed from the project saved from "Clean Shapes – Delete Polygons".
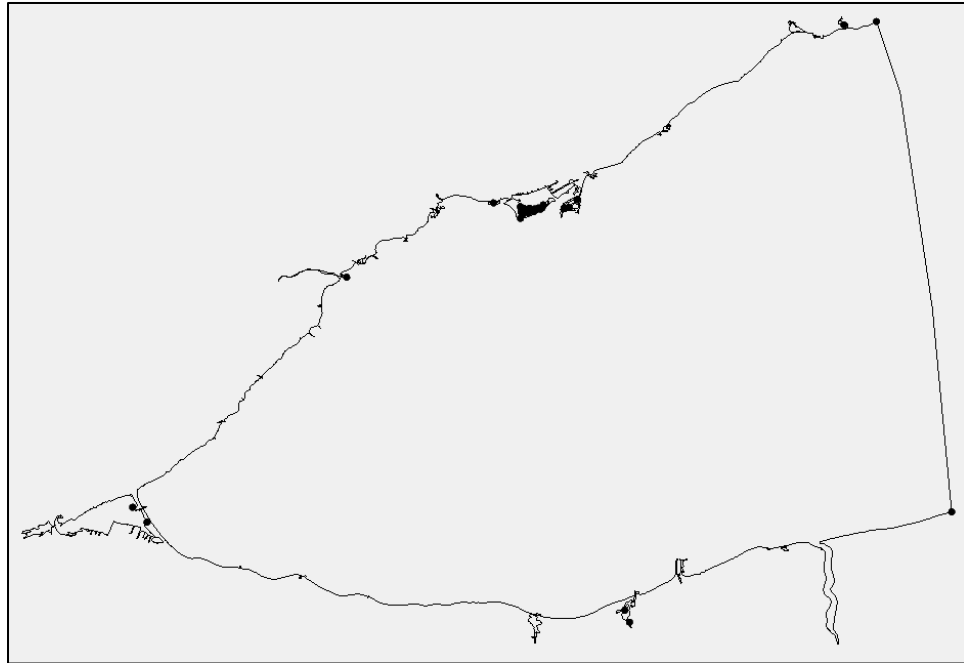
Figure 1   Initial project

3   The Clean Shapes Tool

The *Clean Shapes* tool is accessed in the SMS toolbox. To invoke the tool:

1. Select the "▤ Toolbox" macro from the toolbar to open the *Toolbox (beta)* dialog.

2. Expand the "🗀 Coverages" folder.

3. Select "🔧 Clean Shapes" and click **Run Tool…** to open the *Clean Shapes* dialog.

4. For the *Input coverage* parameter, select "Map Data/West End".

5. Set the *Geometry type* to "Polygons".

6. Enter "Polygons Merged" as the *Output coverage* name.

7. Click **OK** to exit the *Clean Shapes* dialog.

As the tool is running, two windows will appear. If desired resize the windows as shown in Figure 2.
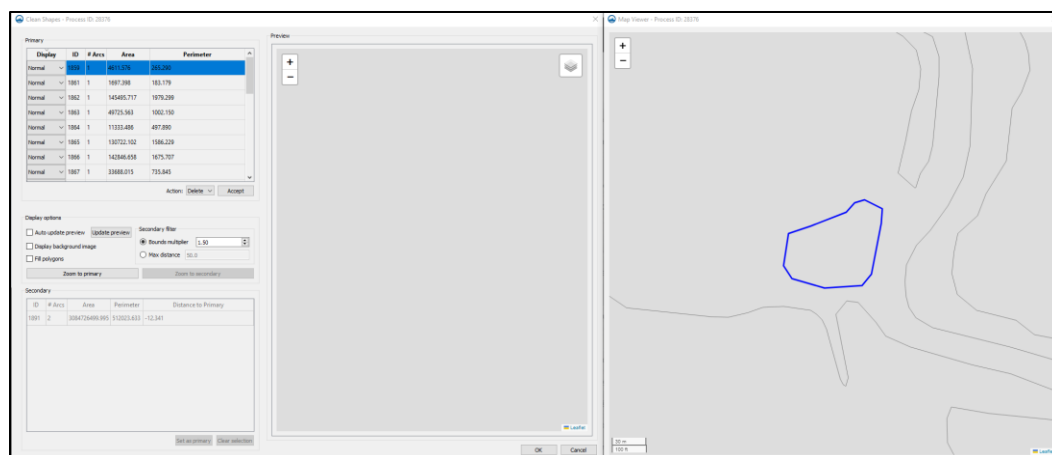
Figure 2   The Clean Shapes tool dialogs.

4   Deleting Ponds

When a polygon is outside of the desired domain boundary, it generally represents a pond that is near the lake. These features would not impact circulation in the lake, so they can be deleted.

The *Clean Shapes* tool allows these situations to be identified and the pond to be deleted.

To illustrate this process:

1.   Click on the *Area* column header two times to sort in descending order.

2.   Set the *Action* to "Merge".

This action can have several effects as will be illustrated in the following sections.

3.   In the *Options* section, set the *Distance* value to "60" m to be two times the minimum element edge length.

4.   In the *Primary* table, select the largest polygon with the *ID* of "1891" with an *Area* of "3.085" billion square meters. This is the shoreline of this section of the lake.

This polygon represents the lake shore on the west end. The *Secondary* list includes 24 polygons. The distances displayed in the *Secondary* list will be negative for polygons that are either inside or completely contain the primary polygon. It will be 0.0 for polygons that share at least one point with the primary polygon. It will be positive if the two polygons do not overlap at all.

The secondary list is sorted by default based on the distance. Reviewing the values for this polygon indicates there are 20 islands in this portion of the lake and 4 polygons outside of the lake (ponds).

5.   In the *Secondary* table, click on the *Distance to Primary* column header two times to sort in descending order.

6.   In the *Secondary* table, select the first polygon with an *ID* of "1863" which is the pond furthest away from the lake (46 meters)

The tool automatically zooms the *Map Viewer* to the smaller of the two active entities, which is the secondary polygon in this case

7. In the *Display options* section, turn on the *Fill polygons* option to clearly show the two polygons.

The primary polygon is filled with blue, while the secondary is filled with green as seen in Figure 3.
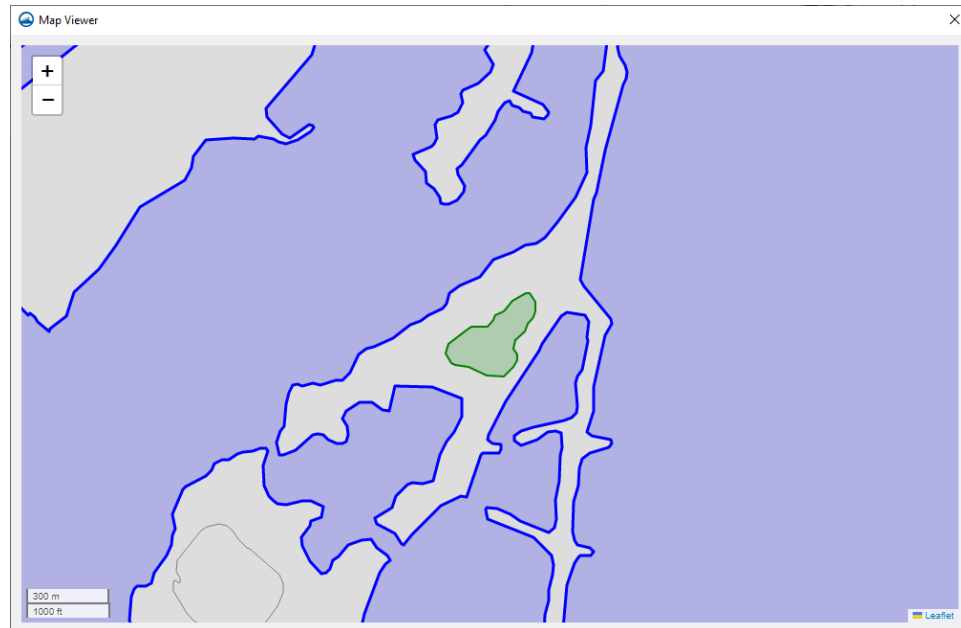

Figure 3   The Map Viewer showing selected primary and secondary polygons

8. Move the mouse cursor into the *Map Viewer* and scroll out a little bit to get a different perspective.

This shows that the secondary polygon is not in the lake.

9. Click the **Delete secondary** button to remove the pond.

10. Repeat steps 6 and 9 for the three other ponds to delete the polygons with IDs of "1865", "1864", and "1889".

If the project needs to include these ponds in the hydraulic simulation, use the tool to expand the lake boundary to include these regions. This is similar to merging two islands which will be illustrated below.

5   Attaching Islands to the Shore

When an island is too close to the shore to allow multiple elements between the island and the shore, the flow between the island and the shoreline is negligible. In this case, good practice dictates that the island be merged into the shoreline.

The *Clean shapes* tool allows these situations to be identified and an action to merge the island into the shore, changing the effective shape of the lake.

To illustrate this process:

1. Select *Max distance* as the secondary filter option and enter a distance of "300.0".

This will trim the secondary list to polygons that are bounding, inside of, or within 300 meters of the primary polygon. Reducing the number of polygons in the secondary list speeds up the display.

The distance of 300 meters was chosen arbitrarily to capture any polygons reasonably close to the primary.

The secondary polygon should now be polygon 1887. The distance to primary is -7.095 indicating that this polygon is inside the primary polygon, but only 7 meters away.

2. Move the mouse cursor into the *Map Viewer* and scroll out a little bit to get a different perspective. This shows that the secondary polygon is almost an extension of a breakwater built on the shore of the lake.

3. Click the **Update preview** button to see what the merge action would produce.

4. Click the **Accept** button to accept the merger action.

5. Repeat steps 1–4 for the other small islands with the polygon IDs of "1886", "1859", and "1862" that are within the lake but closer than 60 meters to the shoreline to allow for flow between the island and the shore.

6   Combining Neighboring Islands

When multiple islands are close to each other, they may act as a single island from a hydraulic point of view. The *Clean shapes* tool allows these situations to be identified and an action to merge the two polygons.

To illustrate this process:

1. In the *Primary* table, select the polygon with an ID of "1885" with an area of "2,530,664" square meters. This is the largest island in this section of the lake.

2. In the *Secondary* table, click on the *Distance to Primary* column header to sort in ascending order.

3. In the *Secondary* table, select the polygon with the ID of "1867".

4. Turn on the *Auto update preview* option.

This option is off by default to make the update process in the tool faster. In this case, the update is fast enough that turning the auto update on is more efficient.

5. Click the **Accept** button to perform the merge action.

The secondary object will update to the next closet island.

6. Click the **Accept** button again to perform the merge action again.

The **Accept** button can be clicked repeatedly to merge all the islands in this region into a single island.

Some situations will require increasing the distance to eliminate small water ways that access areas where the circulation is negligible or not of interest.

7   Reviewing Remaining Islands

Continuing with this project, all islands should be processed. To do this:

1. Click on each island in the primary list in turn. Make sure that the only neighbor for the island is the lake polygon.

2. Click **OK** to close both the *Clean Shapes* tool and the *Map Viewer* dialog.

3. Click **OK** again to close the *Clean Shapes* tool dialog.

A new "⬤ Polygon Merged" coverage will be created.

4. Right-click on the new "⬤ Polygons Merged" coverage and select Properties to open the *Coverage Properties* dialog*.*

The properties show that there are now 11 nodes and 11 polygons for this portion of the lake. This indicates that all the polygons are cleanly defined.

5. Click **OK** to close the *Coverage Properties* dialog.

8   Conclusion

To save the project:

1. Issue the *File* | **Save Project** command.

This saves all the work completed in this tutorial, over-writing the original project loaded at the start of this tutorial. SMS does not modify the data files associated with a project until this command is issued.

This concludes the "Clean Shapes – Merge Polygons" tutorial. Several features have been demonstrated including:

- Deleting ponds.

- Merging islands near the domain boundary into the boundary.

- Merging multiple islands into a single effective island

This tutorial continues in the "Clean Shapes – Prune Arcs" tutorial.