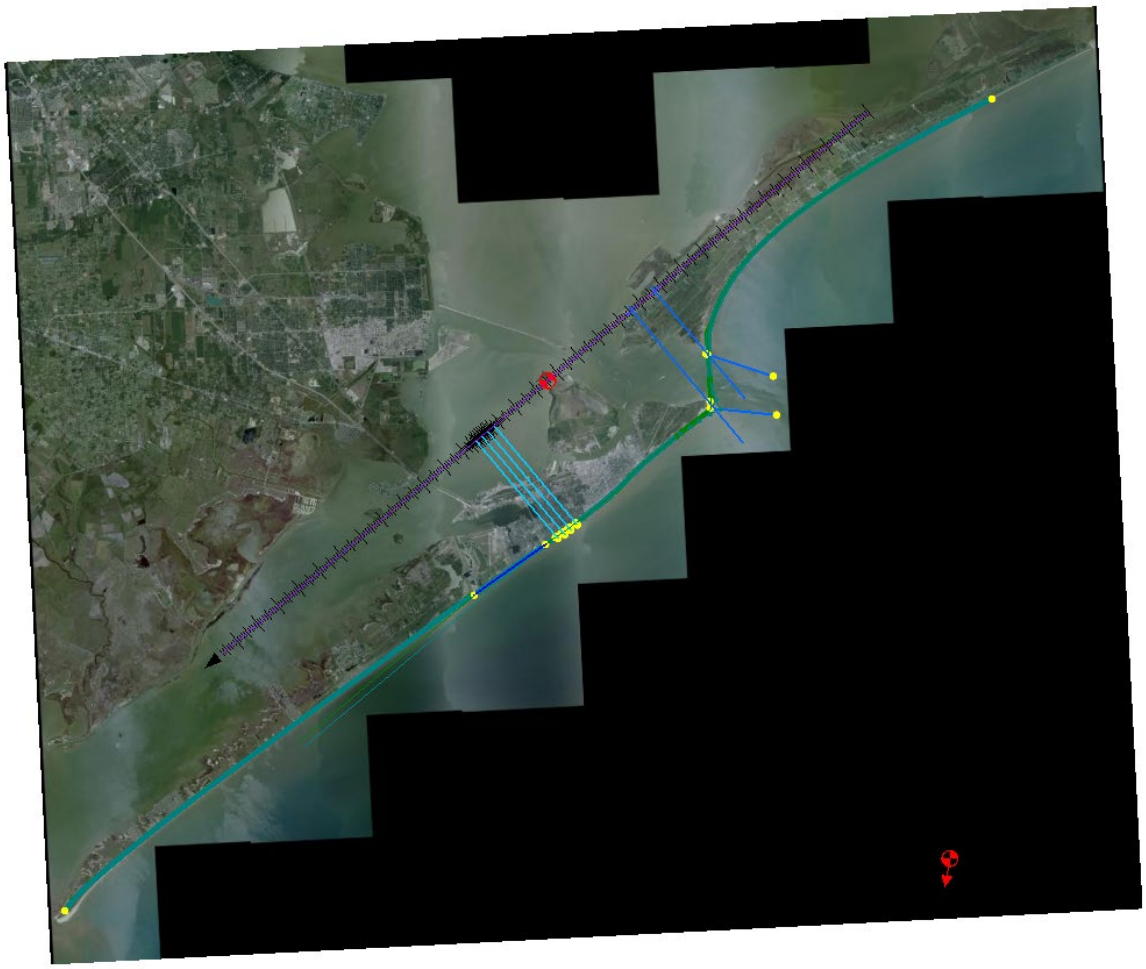
GenCade Step-by-Step Tutorial for New Users
Idealized Test Case: Galveston Island, TX



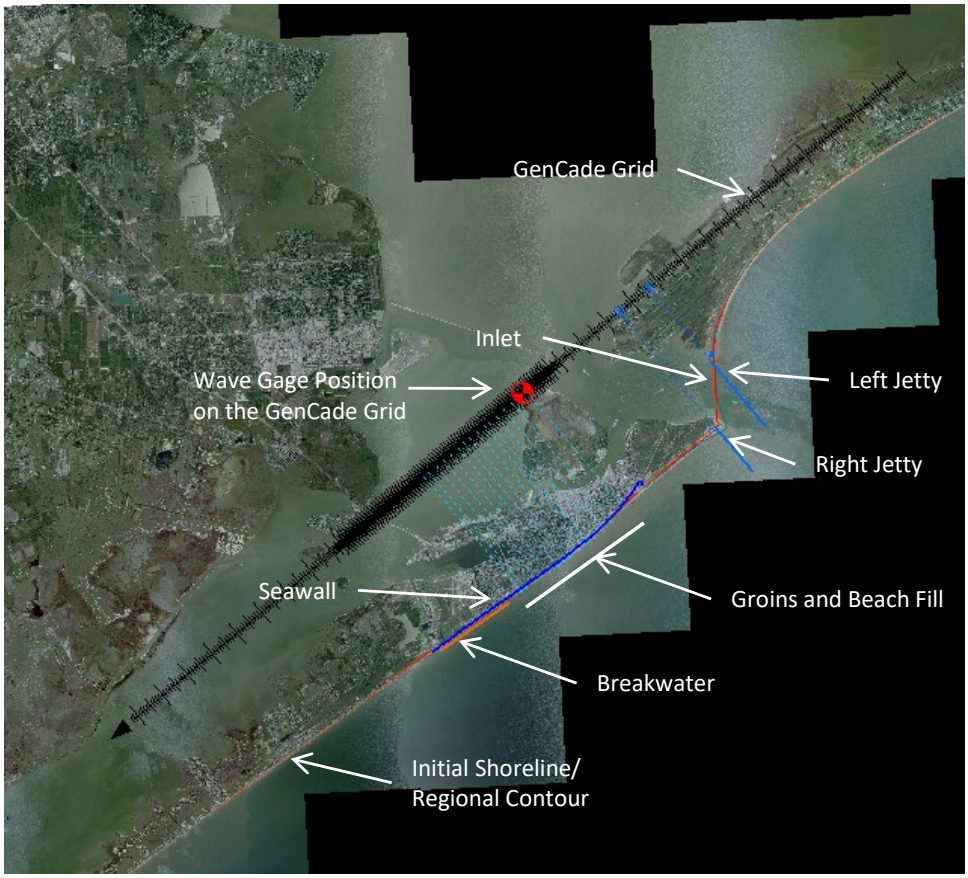
Coastal Inlets Research Program (CIRP)
Technology Transfer Workshop

http://cirp.usace.army.mil/

Table of Contents

1. Introduction

This tutorial is designed for new users unfamiliar with GenCade. The tutorial demonstrates model setup for an idealized case along Galveston Island, an area that includes many of the structures and features included within a GenCade model. This model is not verified and many of the parameter settings are chosen to exaggerate results or to clarify model limitations. The image below shows the modeled area and major features. The overall goal of this guided example is to allow the user to work with real and simulated datasets at a realistic location to demonstrate model capabilities.



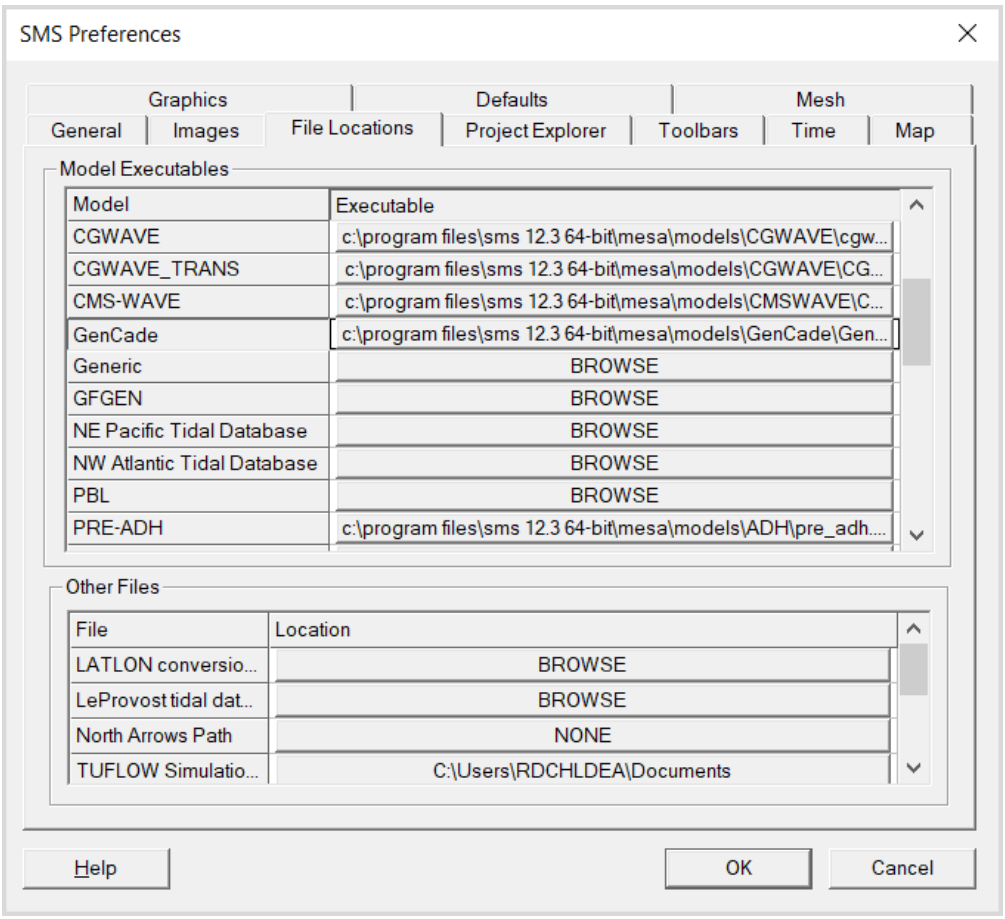
Each section has step-by-step instructions to setup or run different model parameters. Following the steps, a beginning user can visualize everything in SMS. While this document shows one path, many of the steps can be completed in more than one way or in a different order. This document allows experienced users to skip certain steps and open a GenCade project that is already setup to that point. By navigating to ***\\GenCade\Hands_On_Example\Checkpoints***, and selecting the Surface-Water Modeling System (SMS) file named after the section in the documentation, the user can immediately begin work in the following section. Additional help is available for users at the GenCade Wiki, located at ***http://cirpwiki.info/wiki/GenCade_Users_Guide***.

2. Conceptual Model Setup

Much of this example is set up in conceptual model space of the SMS map module. Using this method, as opposed to making changes in the 1D grid module enables modification without duplication of effort.

2.1 Setting up SMS

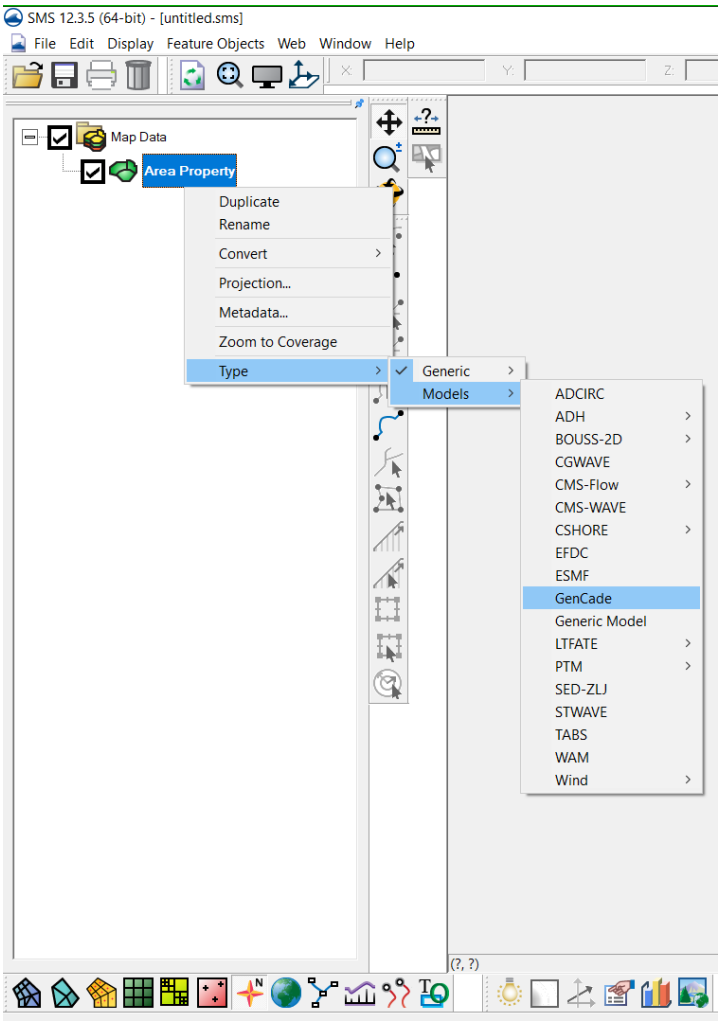
A licensed copy of the SMS software must be used to run GenCade in SMS. Follow these steps to complete the process.

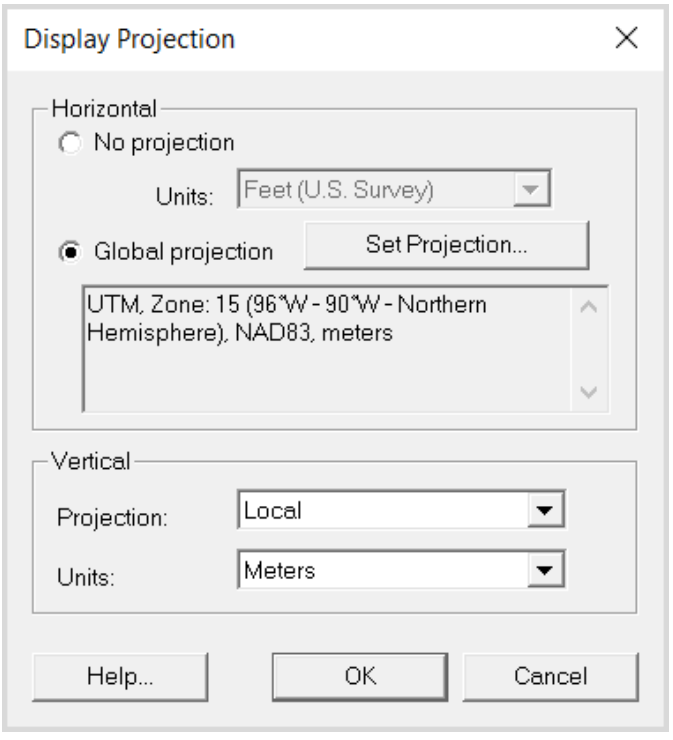


1) Open the SMS application and select ***Edit*** and then ***Preferences*** from the drop down menu to open the SMS Preferences window.

2) Select the ***File Locations*** tab and scroll down to ***GenCade*** under the model executables area.

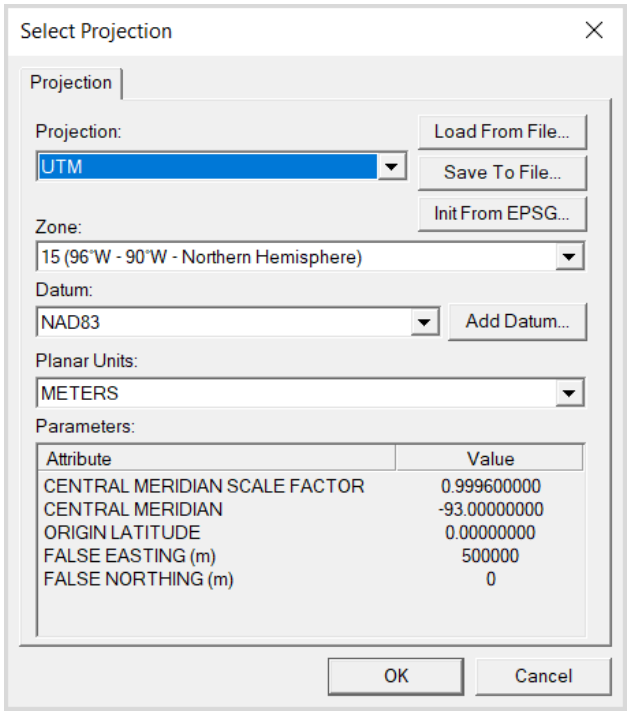
3) Press the link to open the Select Model Executable window and browse to ***GenCade\Hands_On_Example\Models\GenCade_v1r7.exe***, or to a newer version, if instructed.
4) Press ***OK*** to close the Model Executable Window, and then ***OK*** again to close the SMS Preferences window.





5) Change the coverage type to GenCade by pressing on the plus sign at the top of the table of contents. Right click on ***Area Property***, select ***Type*** from the drop down, then select ***Models*** and ***GenCade***.

6) On the SMS toolbar select ***Display*** and then ***Projection*** from the drop down menu. In the Display Projection window, choose ***Global Projection***.



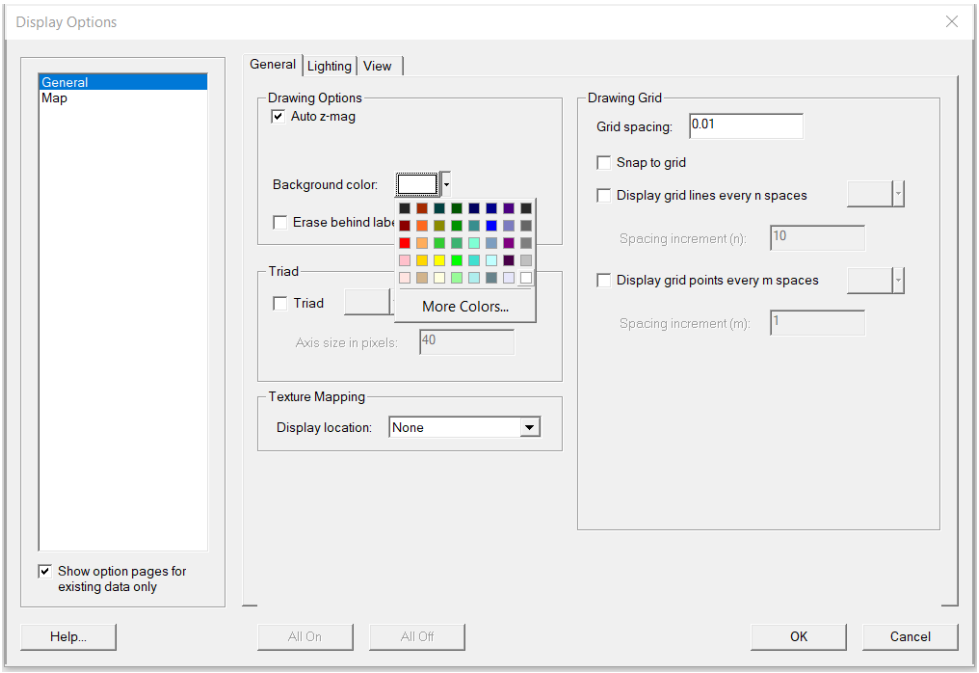
7) In the Select Projection window set these properties.
   - **Projection:** UTM
   - **Zone:** 15 (96°W–90°W–Northern Hemisphere)
   - **Datum:** NAD83
   - **Planar Units:** Meters

   Press ***OK*** to close the Select Projection window.

8) Back in the Display Projection window set:
   - **Projection:** Local
   - **Units:** Meters

   Press OK to close the Display Projection window.

The sign convention for the conceptual model grid is in degrees counterclockwise from the X-axis but after converting to the GenCade grid, the sign convention will change.



9) On the SMS toolbar select ***Display*** and then ***Display Options*** from the drop down menu. In the Display Options window, change the SMS map area's background color to white by selecting ***Background Color*** and choosing white from the drop down menu. Make sure ***General*** is highlighted in the white area on the left side of the window. Press ***OK*** to close the window.

10) Select ***File*** and ***Save Settings*** to make the changes in this section permanent.

As you become familiar with the SMS application, the Display Options window is used to make additional choices (e.g., background color, line styles, line color, etc.) to suit your personal preference.

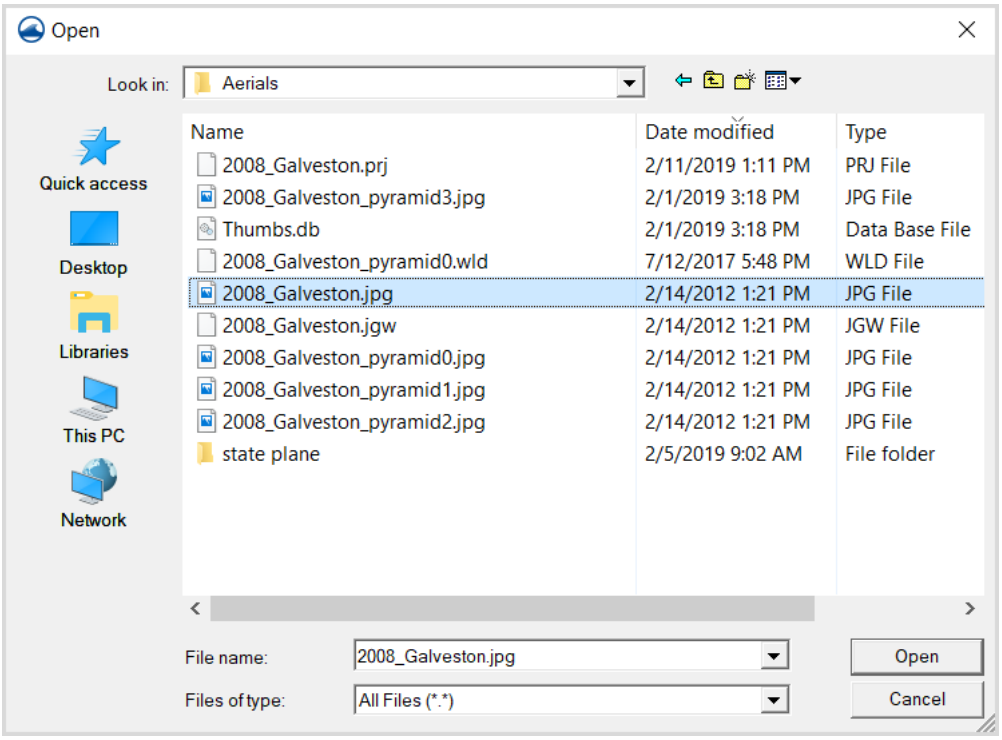
2.2 Importing Aerial Imagery

Much of the GenCade model setup is formed by identifying features found on georeferenced aerial imagery, which is available from both commercial and governmental entities. Free sources include:

- National Oceanographic and Atmospheric Administration (NOAA) Data Viewer found at: https://coast.noaa.gov/dataviewer/?#/imagery/search/
- Natural Resources Conservation Service (NRCS) Data Gateway at: https://datagateway.nrcs.usda.gov/
- United States Geological Survey (USGS) at: https://earthexplorer.usgs.gov/

A multitude of other sources can be found using the SMS search function, which opens a browser window directed to the Aquaveos Wiki page with imagery related links. In the SMS application select ***Web***, and then ***Find Data*** and ***Image*** from the drop down menus. For this exercise, we will use previously downloaded imagery.

1) On the SMS toolbar select ***File*** and then ***Open*** from the drop down menu.
2) In the Open window navigate to ***GenCade\Hands_On_Example\Aerials***, highlight the file ***2008_Galveston.jpg*** and press the ***Open*** button.



3) SMS automatically detects and applies the world files associated with the JPG file, but we want to verify it.
4) Right click on the image name in the SMS table of contents and select ***Projection*** from the drop down menu to bring up the Display Projection window. Press the ***Set Projection*** button to bring up the Select Projection window. Make sure these parameters are set:
   - **Projection:** UTM
   - **Zone:** 15 (96°W–90°W–Northern Hemisphere)
   - **Datum:** NAD83
   - **Planar Units:** Meters
5) Press the ***OK*** button to close the Select Projection window.
6) Back in the Display Projection window make sure the vertical projection parameters are:
   - **Projection:** Local
   - **Units:** Meters
7) Press ***OK*** to close the Display Projection window.
8) Save the project by selecting ***File*** and then ***Save Project*** on the drop down menu.

Images can also be loaded into SMS by dragging and dropping the file from Windows Explorer into the SMS table of contents.

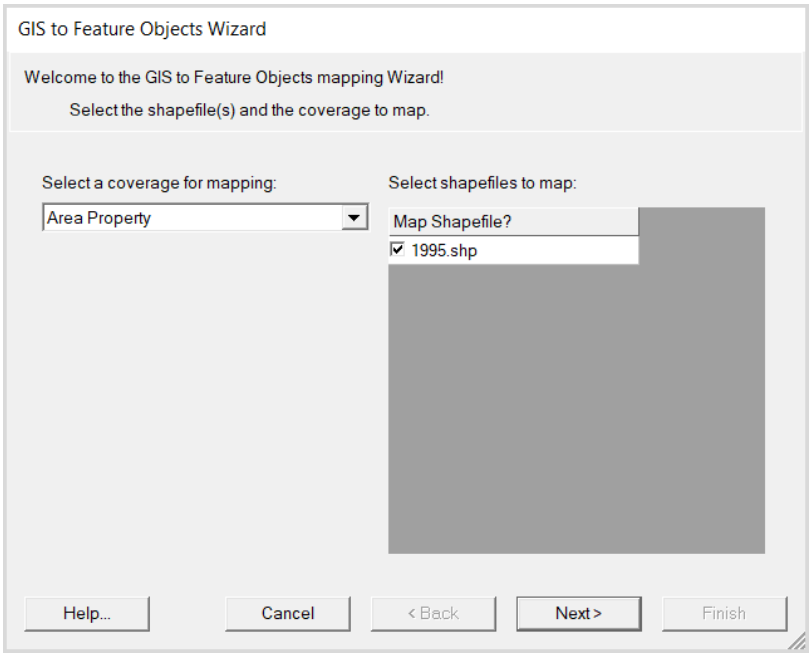
2.3 Initial Shoreline

The initial shoreline represents the shoreline condition from which model calculations begin. The regional contour represents the equilibrium shape of the shoreline in a regional context. A regional contour can be an offshore contour, shoreline, or any other contour that accurately represents the regional shoreline trends. Shoreline position data is obtainable from various sources, including:

- Aerials imagery or charts.
- Elevation derived from survey data.
- ArcGIS software using data from ArcGIS Online.
- In the case of this example, the initial shoreline is derived from the Texas Shoreline Change Project.

Tutorial Fast Track – Steps 1 through 9 below demonstrate manipulating a data source using SMS mapping features to construct a shoreline arc that is suitable for GenCade grid creation. If you are a first time user, skip to step 10 and import the pre-constructed shoreline arc. When creating a real project, reference Step 1 through 9 to create the shoreline.

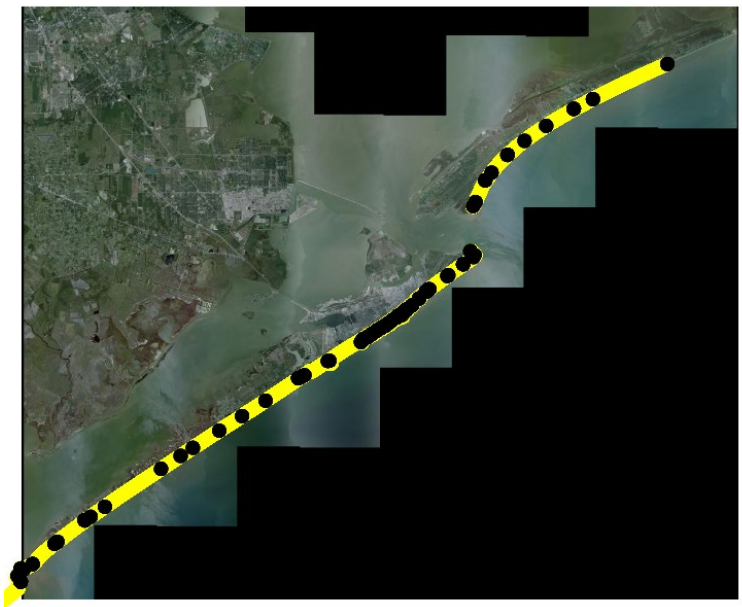
1. On the SMS toolbar select ***File*** and then ***Open*** from the drop down menu. Navigate to ***Gencade\Hands_On_Example\Shoreline Data*** and then select ***1995.shp***. Press ***Open*** to load the file.



2. On the SMS toolbar select ***Mapping*** then ***Shapes -> Feature Objects*** from the drop down menu to bring up the GIS to Feature Objects Wizard window. Make sure the box next to the file named 1995.shp is checked, and then press the ***Next*** button.

3. The second window of the GIS to Feature Objects Wizard appears giving us the ability to map individual attribute fields. Use the default of ***Not Mapped*** in each column, then press ***Finish***.

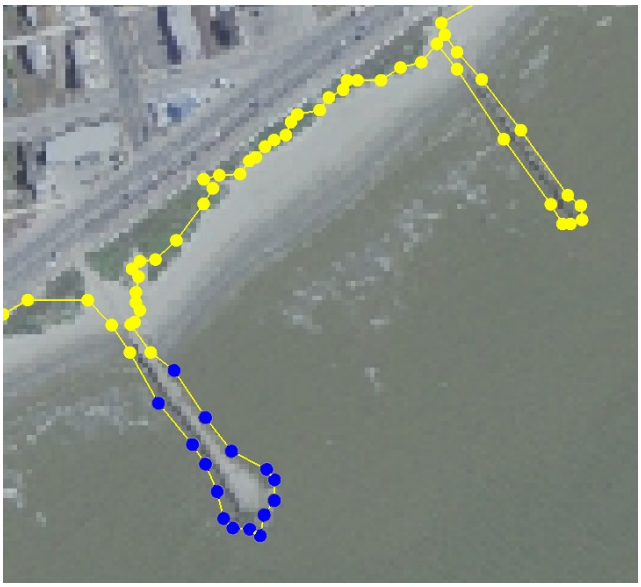
The 1995 shoreline feature is loaded as a series of disconnected lines and nodes. It does not go completely to the edge of the Galveston image in the upper right corner, and in the bottom left corner, it goes beyond the image area. In order for the GenCade to run properly, the shoreline must be one continuous, smooth line segment. The instructions below provide guidance on how to accomplish this process.



4) Zoom in on the shoreline to the coordinates 325872.0, 3241032.0 and you will see this line work, although likely represented in a different color.

5) On the SMS toolbar of icons, press the ***Feature Arc Selection*** button, and then select an arc to delete. The arc will turn dark blue, and pressing the ***Delete*** button on your keyboard brings up a window asking you to confirm the deletion. Press the ***Yes*** button to continue.

It is vitally important to understand what you are going to delete before confirming the deletion. SMS does not have the ability to undo an edit. It is also advisable to save your work regularly.

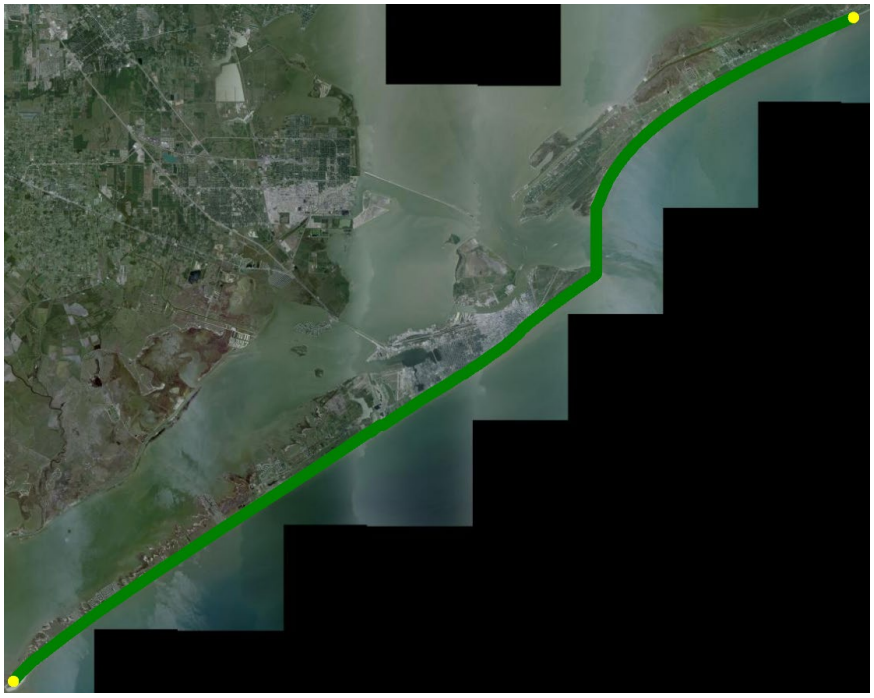


6) Press the **F*eature Point Selection*** button to begin editing arcs by deleting individual vertices. Select multiple vertices to edit holding down the ***Shift*** button on your keyboard and selecting one after the other using the cursor and left mouse button. If there are a number of contiguous vertices to delete, hold the ***Shift*** button on the keyboard, while at the same time holding down the left mouse button and drawing a box around them with the cursor. As with arc deletion, press ***Delete*** on the keyboard and then confirm the deletion by pressing the ***Yes*** button.

7) The ***Create Feature Arc***  tool is used to create an arc in an area that is missing shoreline. Put the cursor where the shoreline segment begins and press the left mouse button. Press the same button at each point along the shoreline where a vertex needs to be placed, and then double click the left mouse button where the segment needs to be terminated.

8) Once we have cleaned up all unneeded shoreline segments, and added segments to areas with no shoreline, we end up with a number of arcs that are contiguous in nature, but that are not one entity.

9) Press the **F*eature Point Selection***  button, hold down the ***Shift*** button on the keyboard while pressing the left button on the mouse and drawing a box around arc segments that are not in one piece. Do not be alarmed if only some vertices inside the box turn blue. Only the vertices at the end of isolated segments will be selected. Right click on one of the blue vertices and choose ***Convert to Vertices***.



10) It is important to learn how to develop a shoreline in SMS, but in the interest of time, a previously created smoothed, continuous shoreline will be used to generate the grid. On the SMS toolbar select ***File*** and then ***Open*** from the drop down menu. Navigate to ***\\GenCade\Hands_On_Example\Map Files***, select ***1995_shoreline.map***, and then press the ***Open*** button. The shoreline information will be loaded in SMS. Right click on the ***1995.shp*** file under the GIS Data section in the table of contents and select ***Delete*** from the drop down menu. Press ***Yes*** when asked to confirm the deletion.

2.4 Create the Regional Contour

Creating the regional contour sets the offshore boundary of GenCade, which is used to define the angle between the shoreline and the near-shore bottom contour where wave information is applied. Carefully consider placement of the regional contour as it has a significant effect on the model results. There are a number of ways to obtain the regional contour, including:

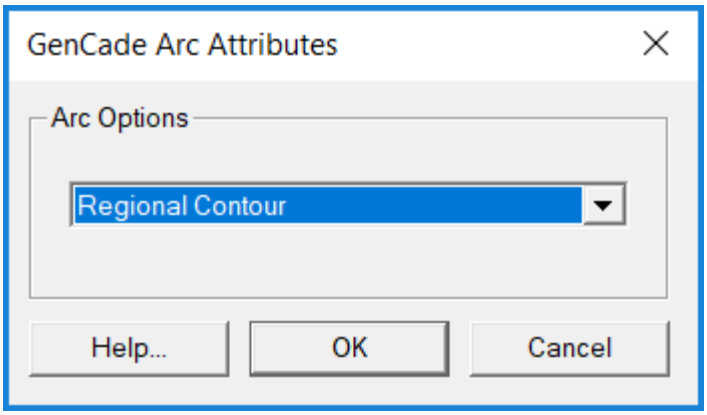
- Use the smoothed initial shoreline.
- Trace it from aerial imagery or charts.
- Use a contoured elevation generated from survey data.
- Combine multiple shoreline segments to create it.

GenCade is a 1-line model, which means if the domain is free of jetties, inlets, groins, beach fills or any other feature that could disrupt the along-shore transport, the model will eventually produce a straight shoreline, regardless of the actual coastline shape. When the model is ran for a long time, roughly 100 years or more, the regional contour option forces GenCade to match the profile of the regional coastline. This ensures GenCade produces the actual coastline profile if the model has no barriers or beach nourishments

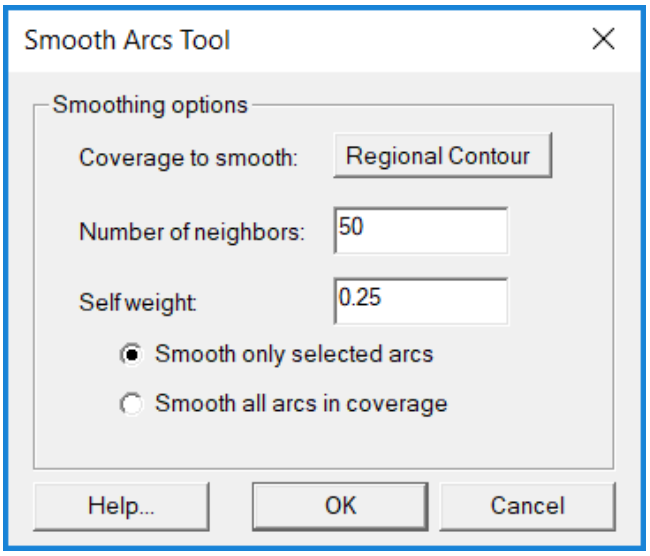
For this example, the regional contour is defined from the previously created and loaded initial shoreline. This contour will be manipulated after the introductory instructional material has been completed to provide a clear example of how changes in the regional contour influence model results.

1) In the SMS table of contents right-click on ***Initial Shoreline*** and select ***Duplicate*** from the drop down menu.
2) Right-click on ***Initial Shoreline (2)***, select ***Rename*** from the drop down menu, and change the name to ***My Regional Contour***.

3) In the table of contents highlight ***My Regional Contour*** again, press the ***Select Feature Arc***  tool, and in the map area left-click anywhere on the regional contour line to select it. The regional contour line appears as a different color from the initial shoreline feature.

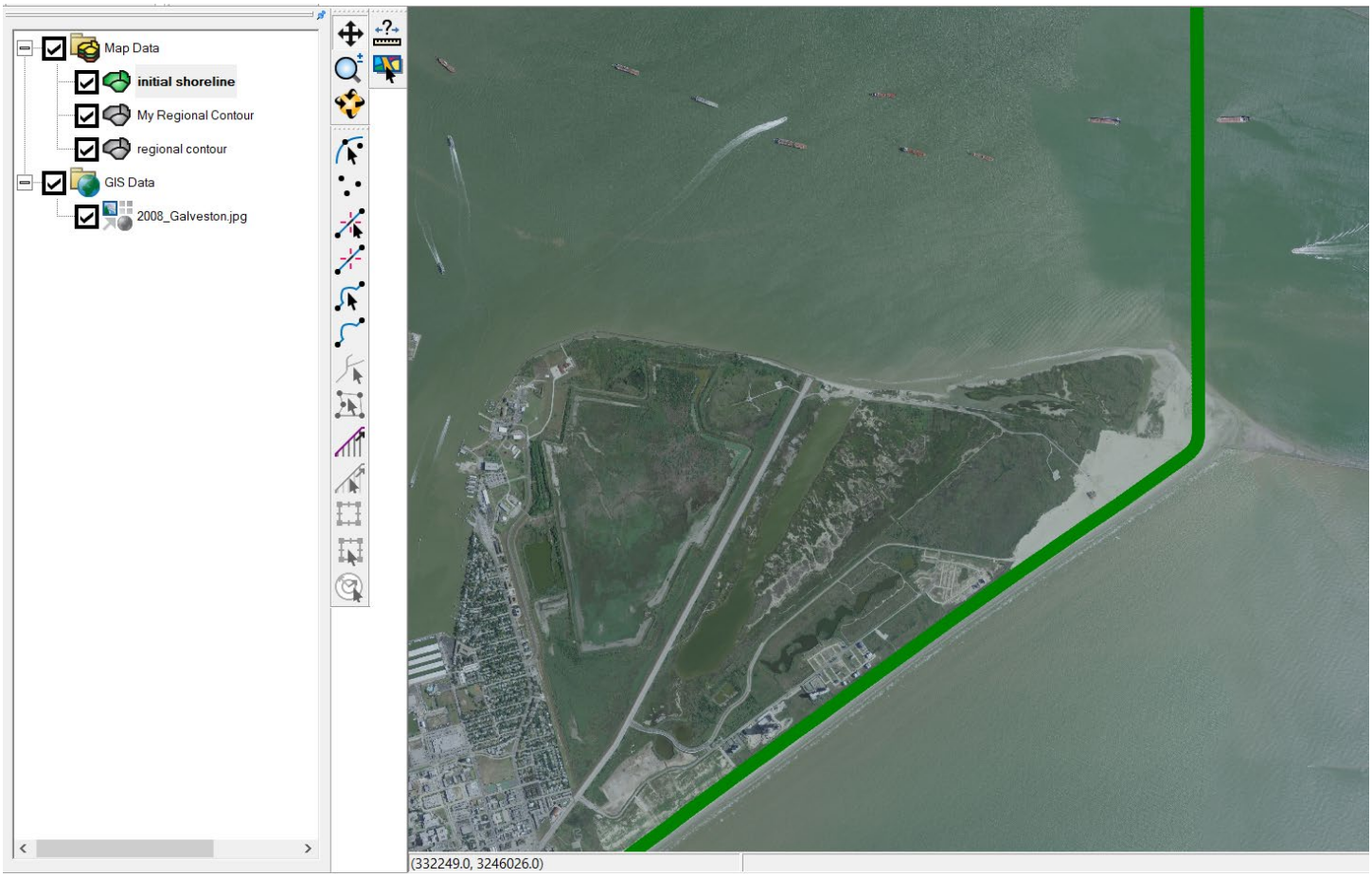


4) Right-click on the regional contour line and select ***Attributes*** from the drop down menu to bring up the GenCade Arc Attributes window. Select ***Regional Contour*** from the list and press the ***OK*** button.



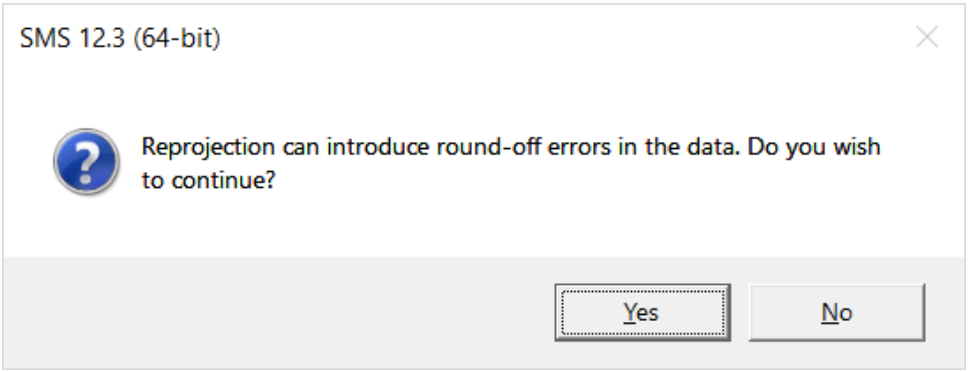
5) Right-click on the regional contour again and select ***Smooth Arc(s)*** from the drop down menu to bring up the Smooth Arcs Tool window.

6) Set ***Number of Neighbors to 50*** and ***Self Weight to 0.25***, and then press the ***OK*** button. This process smooths the contour, giving better model stability.

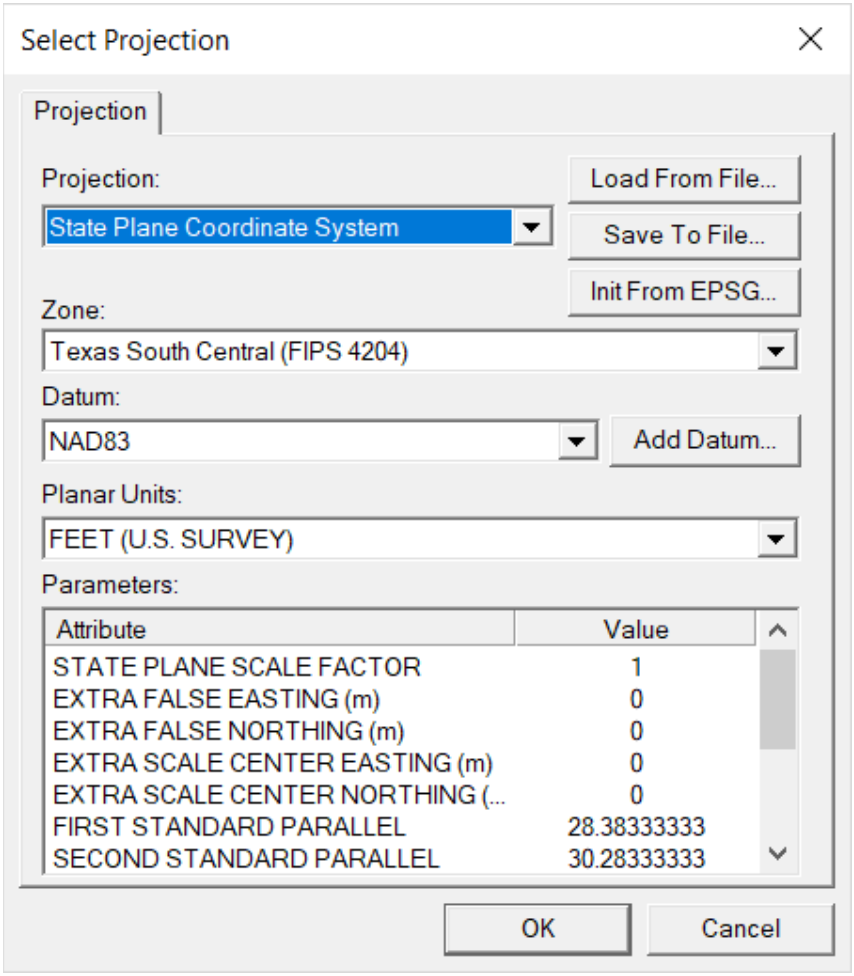


7) Inspect the regional contour line to verify that it follows the shoreline trend. If needed, modify vertices so the contour matches regional trends. Similar to creating the initial shoreline, establishing the regional contour can also be time consuming. In the interest of time, a modified regional contour line has been provided. Navigate to ***\\GenCade\Hands_On_Example\Map Files***, select ***regional_contour.map*** then press ***Open*** to load it. Pan the SMS map to roughly 332550.0, 3245975.0, as shown above, then sequentially highlight ***initial shoreline, my regional contour***, and then ***regional contour*** to see how the provided regional contour has been modified to make sure it is seaward of the initial shoreline. Right click on ***My Regional Contour*** in the table of contents and select ***Delete*** from the drop down menu. Press ***Yes*** when asked to confirm the deletion. Complete the same deletion process for the ***Area Property*** file.

8) Select the regional contour and initial shoreline by holding down the ***CTRL*** button and left clicking on each coverage name in the table of contents. Right click on either coverage name and select ***Merge Coverages*** from the drop down menu. Press the ***No*** button when the pop up asks if you want to delete the source coverages. The new coverage, ***Merge Coverage*** will appear in the table of contents, when asked, ***"Do you want to delete the coverage used to make the merged coverage"***, press the ***Yes*** button.



9) To build the grid we need to reproject the coverages to the State Plane Coordinate System. In the main menu, select ***Display*** and then ***Reproject All*** from the drop down menu. You will see this warning box, press ***Yes***.



10) In the Reproject All Objects window, press the ***Set Projection*** button.

11) In the Select Projection window set the following parameters:

- **Projection:** State Plane Coordinate System
- **Zone:** Texas South Central (FIPS 4204)
- **Datum:** NAD83
- **Planar Units:** Feet (U.S. Survey)

Press the ***OK*** button and back in the Reproject All Objects window set:

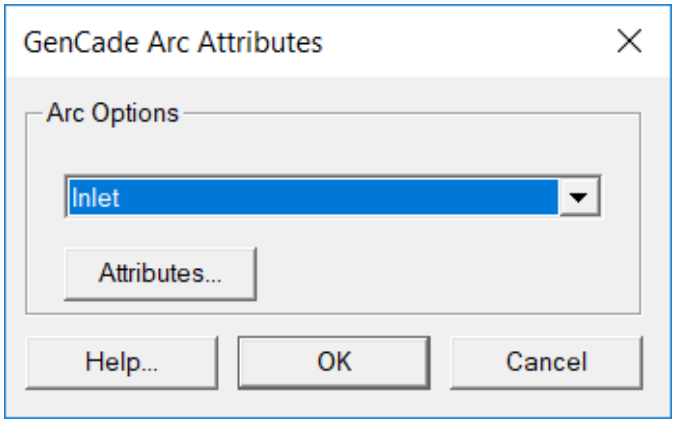
- **Projection:** Local
- **Units:** Feet (U.S. Survey)

Press the ***OK*** button again to close the window.

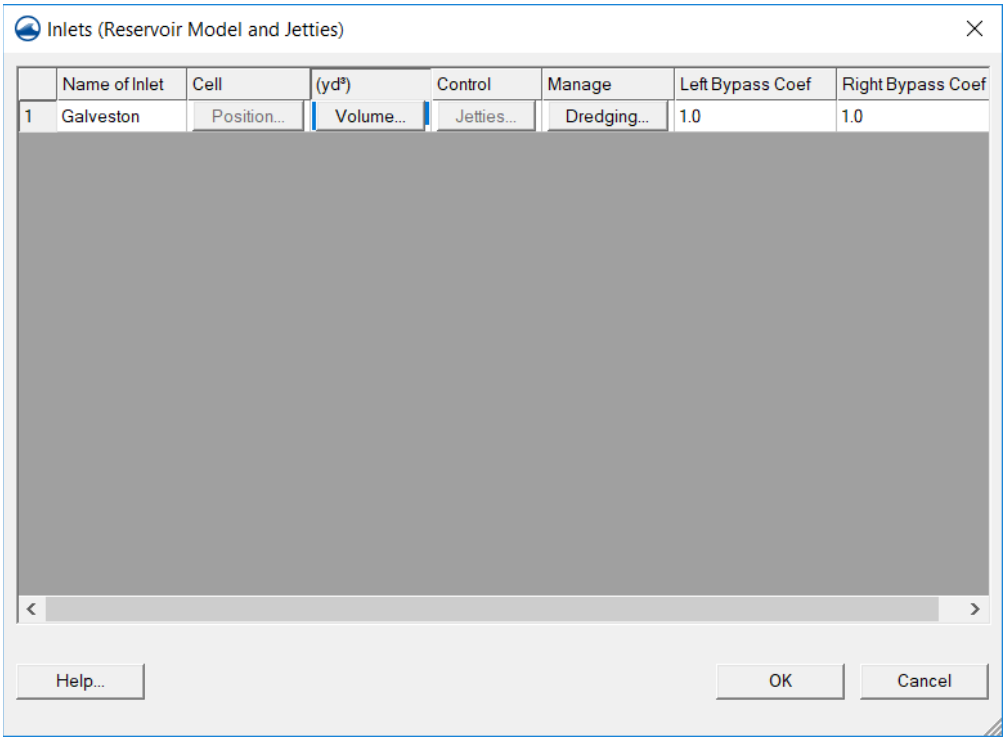
2.5 Create an Inlet

Inlets can affect along-shore transport and, thus, are an important consideration in predicting shoreline change. The following steps will add an inlet to the GenCade model:

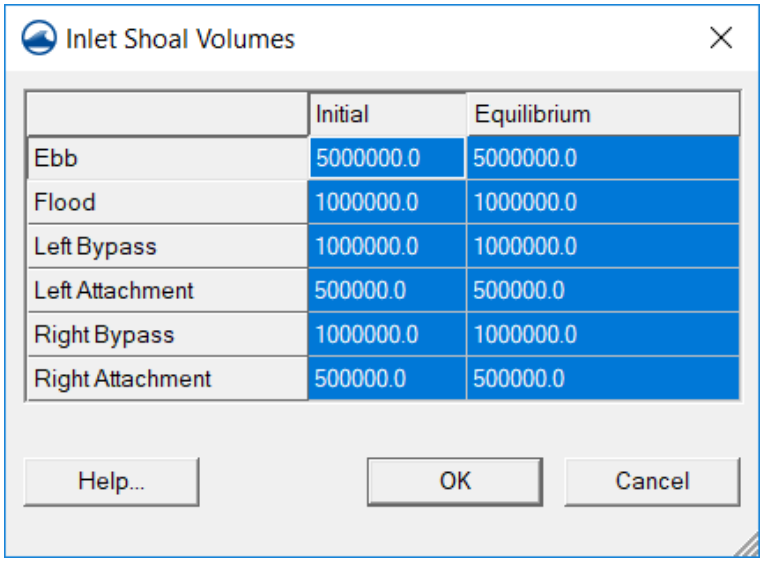
1) To find the Galveston Inlet, pan the SMS map to the coordinates 332550.0, 3245975.0.



2) Begin the process of creating an arc extending across the inlet by pressing the ***Create Feature Arc*** button, move the mouse to the desired starting location and press the left button, then move the mouse to the end and double click the mouse button.
3) Press the ***Select Feature Arc*** button and double click on the line that was just created to bring up the GenCade Arc Attributes window.



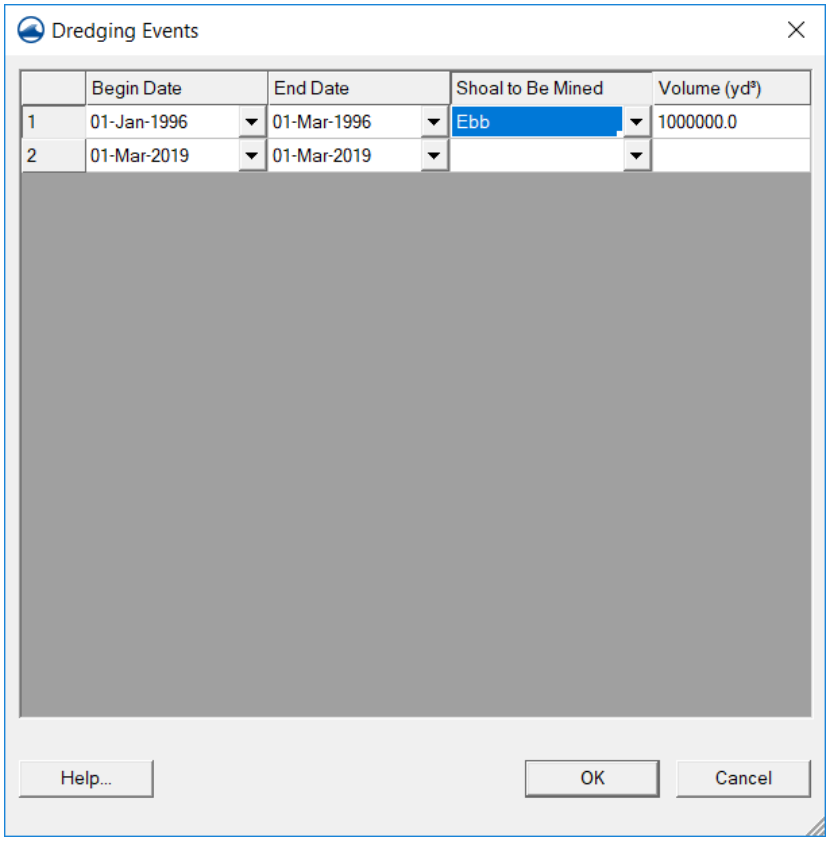
4) Press the ***Attributes*** button to open the Inlets Reservoir Model and Jetties window, and then select the ***Volume*** tab to bring up the Inlet Shoal Volumes window.



5) Enter the ***Initial*** and ***Equilibrium*** values for each category as shown in the image to the left. *Do not use a comma to separate zeroes as it will cause an issue with data entry.*
6) Press the ***OK*** button to close the Inlet Shoal Volumes window.

7) Back in the Inlets (Reservoir Model and Jetties) window, select the Dredging tab.

Shoal volumes entered in this example are for illustration purposes only. Actual shoal volumes should be measured with surveys, or predicted using various relationships. For more information see: *Walton, T.L., Jr., and Adams, W.D. (1976). "Capacity of inlet outer bars to store sand," Proc. 15th Coastal Eng. Conf., ASCE, 1,919-1,937.*



8) In the Dredging Events window set the following values:
   - **Begin Date:** 01-Jan-1996
   - **End Date:** 01-Mar-1996
   - **Shoal to be Mined:** Ebb
   - **Volume (yd3):** 1,000,000

9) Press ***OK*** to close the Dredging Events window.

10) In the Inlets (Reservoir Model and Jetties) window, make sure the ***Left Bypass Coef*** and ***Right Bypass Coef*** are set to 1.0.

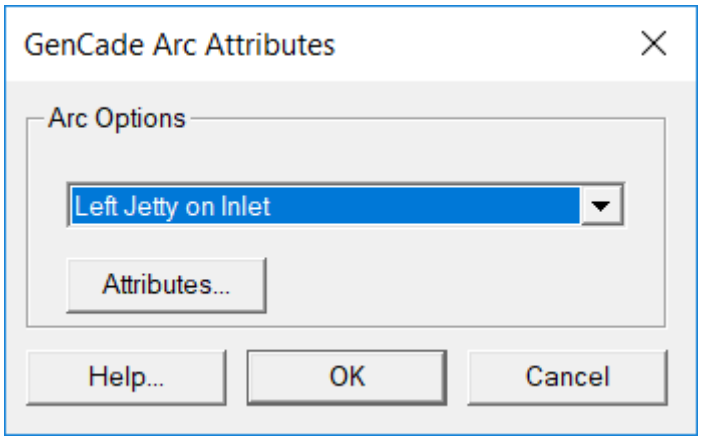
11) Press the OK buttons to close all the windows. The line representing your inlet should now be a bright blue color.

12) Save the project.

2.6 Jetties

Add jetties to the GenCade model using these steps:

1) Make sure you are at the Galveston Inlet, located at coordinates 332550.0, 3245975.0.
2) Select the ***Create Feature Arc*** button and create an arc over the jetty on the north side of the inlet.



3) Choose the ***Select Feature Arc*** button and double click on the line to bring up the GenCade Arc Attributes window. Select ***Left Jetty on Inlet*** from the drop down menu.

> Left and right are defined by an observer standing on the beach looking seaward.

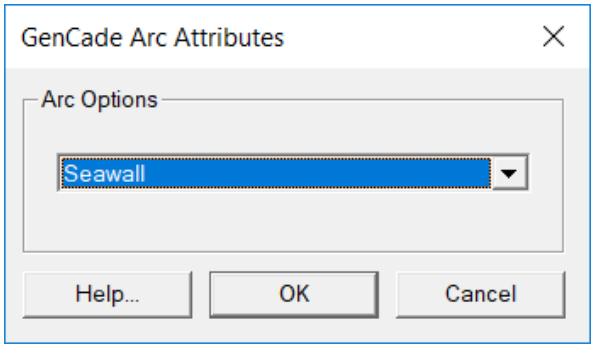
4) Press the ***Attributes*** button to open the Groins window.
5) Set the ***Permeability*** to 0.5, put a check mark in the ***diffracting*** box, and set the ***Seaward Depth (ft)*** to 25.
6) Press the ***OK*** button to close the Groins window then ***OK*** again to close the GenCade Arc Attributes table.
7) Complete steps two through six for the jetty on the south side of the Galveston Inlet, except in the GenCade Arc Attributes window choose ***Right Jetty on Inlet*** and in the Groins window set ***Permeability*** to 0.3, make sure the ***diffracting*** box is checked, and set the ***Seaward Depth (ft)*** to 25. Press the ***OK*** button twice.

2.7 Seawalls

1) Activate the ***Create Feature Arc*** button and create a seawall feature south of the inlet where the seawall is visible along the urban area of the image.

2) Activate the ***Select Feature Point*** button, hold down the ***Shift*** key and select each node of the seawall feature. Right click on one of the nodes and select ***Convert to Vertices*** from the drop down menu.

> When creating a new feature arc do not click on an existing arc, doing so will split the existing arc. Should you do so, select the newly formed node on the existing line, right click and choose ***Convert to Vertices*** from the drop down menu. Then select the existing arc again, right click and select ***Attributes*** from the drop down menu and set the line attribution as necessary.

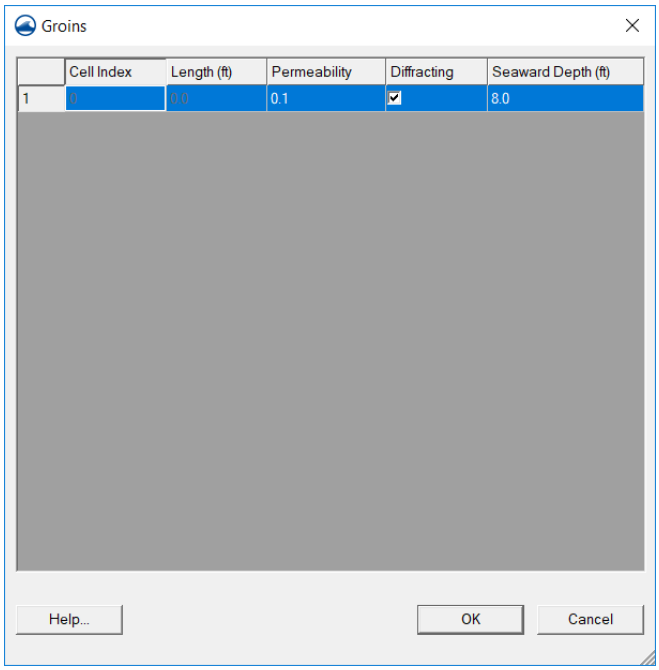


3) Activate the ***Select Feature Arc*** button, highlight the seawall feature, right click on the selected seawall and choose ***Attributes*** from the drop down menu. In the GenCade Arc Attributes window select ***Seawall*** from the drop down menu and then press ***OK***.

2.8 Groins

Zoom in on the image to the north of where you ended the seawall feature. There is a series of groins here, add a few of them to the GenCade model using this process:

1) Activate the ***Create Feature Arc*** button and place an arc on a couple of groins.
2) Activate the **Select Feature Arc** button and select a groin feature.
3) Right click on the groin and select ***Attributes*** from the drop down menu.
4) In the GenCade Arc Attributes window select ***Groin*** and then press the ***Attributes*** button.



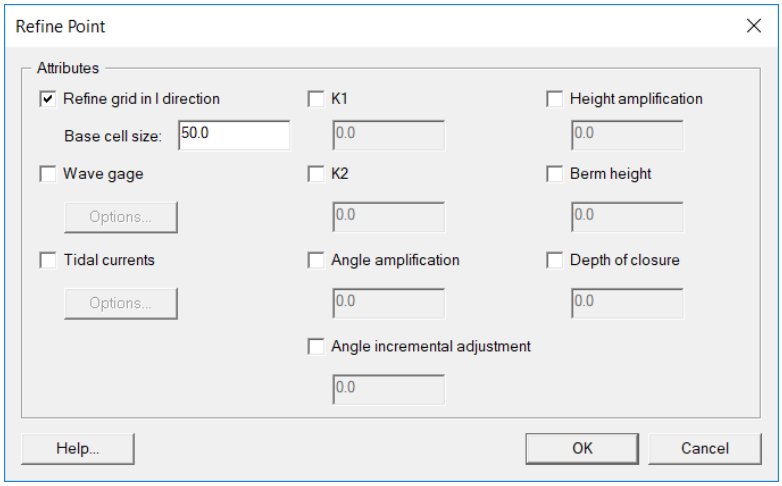
5) In the Groins window set the following parameters:
   - **Permeability:** 0.1
   - **Diffracting:** Checked
   - **Seaward depth:** 8 feet
6) Press the ***OK*** button twice to close both windows.
7) Repeat steps two through six for each groin feature.

2.9 Refine Points

Refine points allows increased grid resolution near structures or rapidly changing shorelines. Using fewer grid cells decreases the model run time so if possible, it is better to use a coarse grid and redefine points as needed. Any place where there is a steep gradient in the shoreline or the termination of a structure will benefit from a finer grid resolution. Oftentimes, redefining points is an iterative process so the better the initial visual inspection, the fewer times redefine points will need to be ran.

1) Zoom in to one of the groins where it intersects with the shoreline.
2) Activate the ***Create Feature Point***  button and add a point on either side of the groin and one at the seaward end of the groin.

> Do not create refine points on any line feature. SMS will treat it as a node on the line instead of a refine point. If you have done this, the Refine Point window discussed in the next step will not appear when you select Node Attributes.



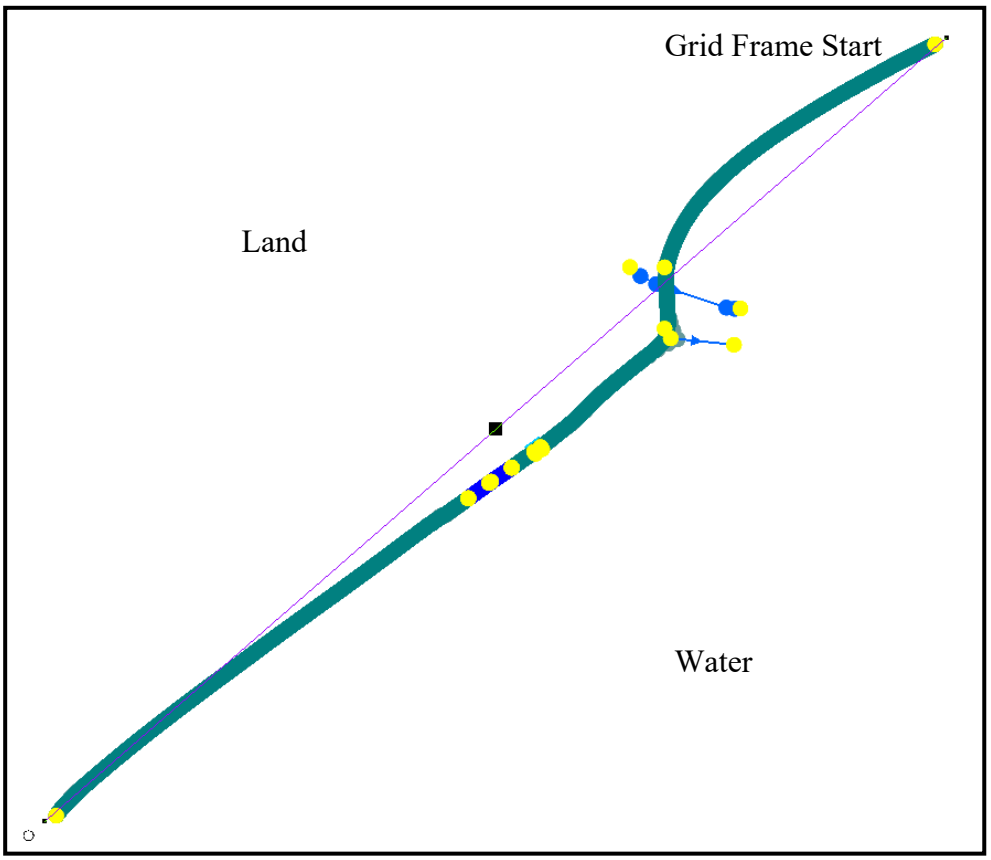
3) Activate the ***Select Feature Point*** button, hold down the ***Shift*** key, select the new points, and then right click on one and choose ***Node Attributes*** from the drop down menu.

4) In the Redefine Point window check the box next to ***Redefine Grid in l Direction***, then enter ***50.0*** for the ***Base Cell Size***, and then press the ***OK*** button to close the window.

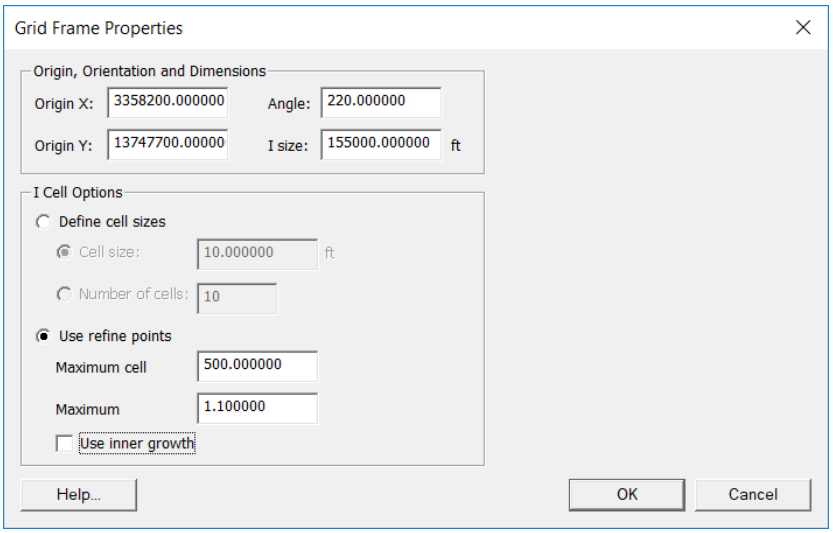
5) Set a few more refine points for the model, for instance on all groins and/or at the ends of the seawall.

2.10 Grid Frame

The GenCade grid frame is a linear segment that runs the length of the modelling area and generally parallels the shoreline. The width of the area is large enough to encompass coastal structures, wave input, and all other features. To build the grid frame follow these steps:



1) Activate the ***Create 1-D Grid Frame*** button and define the study area by clicking on one end of the study area and then the other. The grid should start on the end of the study area where an observer looking down the coastline would have the water on their left and land on their right.
2) Activate the ***Select 1-D Grid Frame*** button, and then click inside the small, hollow square that appears at the center point of the line. It will turn black. By holding down the mouse button on the square, the line can be moved perpendicular to the shoreline. There are small black dots at the end of the line that can be manipulated in the same way, except that movement is parallel to the coastline, resulting in a lengthening or shortening of the grid frame line.



3) Right click on the line and select ***Properties*** from the drop down menu.
4) In the Grid Frame Properties window set the following values:
   - **Origin X:** 3,358,200
   - **Origin Y:** 13.747.700
   - **Angle:** 220º
   - **I Size:** 155,000

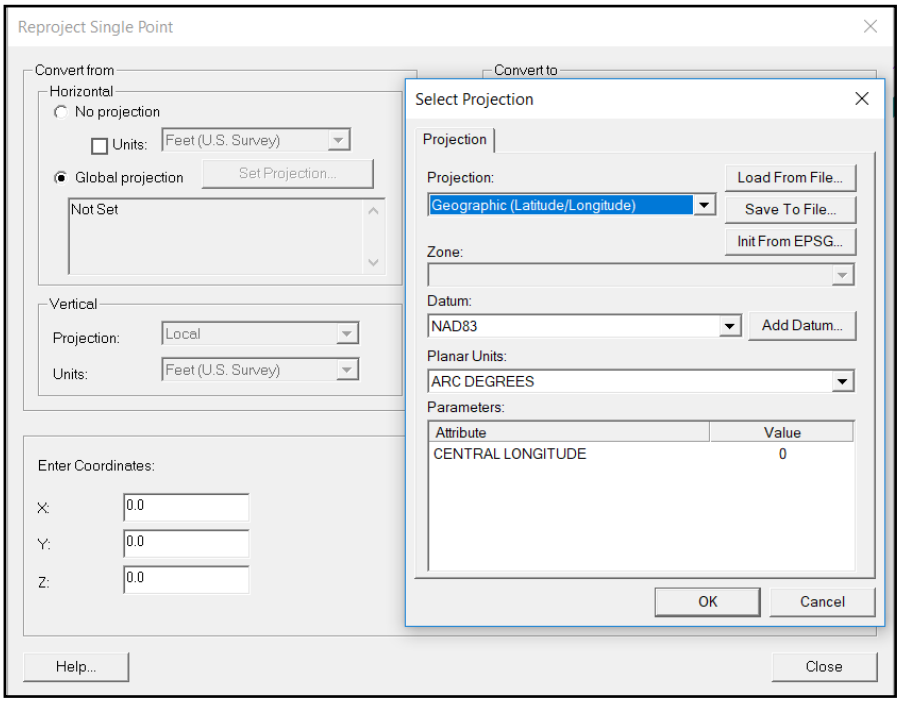
   Check ***Use Refine Points*** and set these parameters:
   - **Maximum Cell:** 500
   - **Maximum Bias (shown as "Maximum" in screenshot):** 1.1

Make sure ***Use Inner Growth*** is not checked; as this will result in the cells between the two refine points growing in size, instead of remaining at the preferred finer scale.

2.11 Wave Data

Waves provide the forcing for shoreline change, and while GenCade requires the shore normal convention to run, SMS will accept wave data in meteorological, oceanographic or Cartesian units and convert them to shore normal convention for the model. Real wave data often has gaps and/or errant data therefore, wave data must be processed before it can be applied in GenCade.

In this example, a simple averaged wave condition will be applied to demonstrate how to load wave data. In this example, you will learn to define the offshore location of the source of the wave data and convert the wave data coordinate system from geographic to state plane.



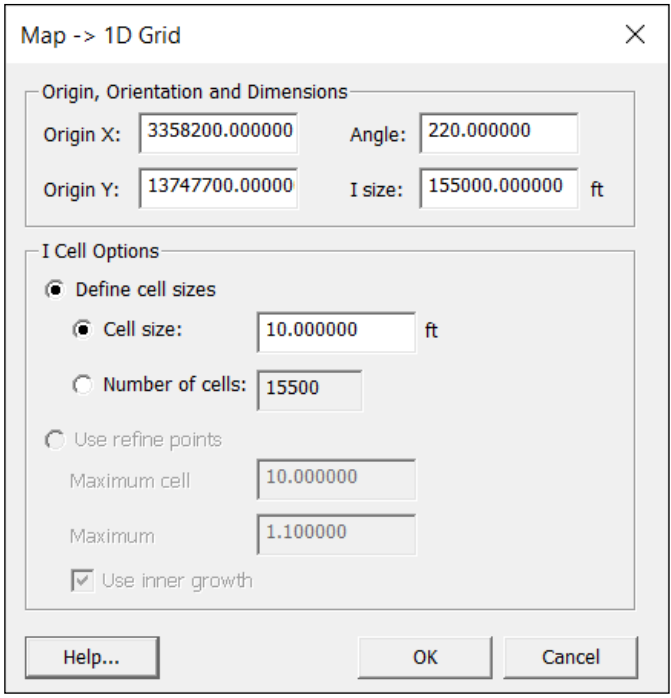
1) To add wave data to SMS choose ***Display*** from the main menu and then ***Single Point Projection*** from the drop down menu.

2) Within the Reproject Single Point window, on the ***Convert From*** side select ***Global Projection*** and then press the ***Set Projection*** button.

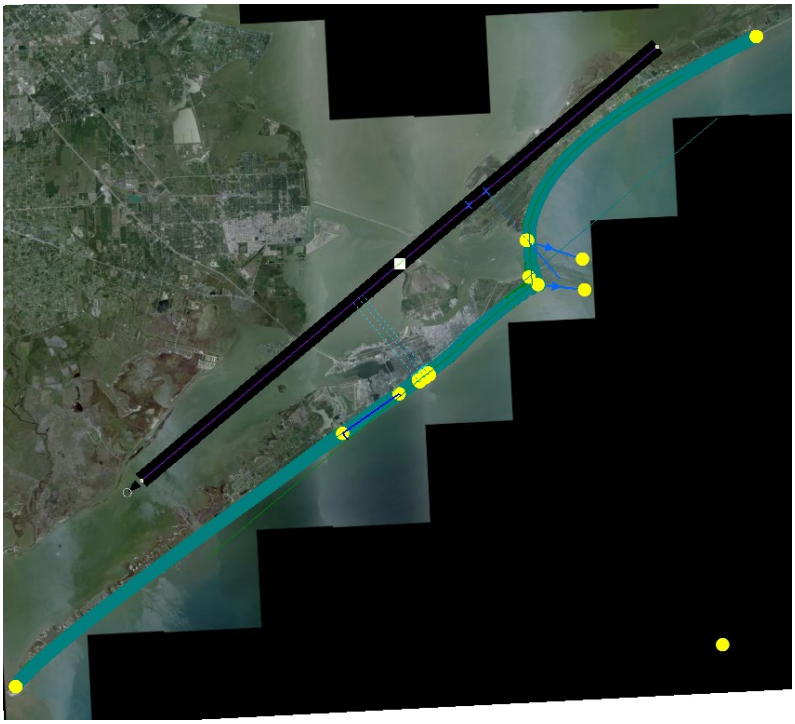
3) Within the Select Projection window set the following parameters:
   - **Projection:** Geographic (Latitude/Longitude)
   - **Datum:** NAD83
   - **Planar Units:** Arc Degrees

   Press ***OK*** to close the window.

4) Back in the Reproject Single Point window set the ***Vertical*** parameters to:
   - **Projection:** Local
   - **Units:** Feet (U.S. Survey)
5) On the ***Convert To*** side, select ***Global Projection***, press the ***Set Projection*** button, and in the Select Projection window set the following parameters:
   - **Projection:** State Plane Coordinate System
   - **Zone:** Texas South Central (FIPS 4204)
   - **Datum:** NAD83
   - **Planar Units:** Feet (U.S. Survey)
6) Back in the Reproject Single Point window set the ***Vertical*** parameters to:
   - **Projection:** Local
   - **Units:** Feet (U.S. Survey)
7) Set the ***Enter Coordinates*** section to these parameters:
   - **X:** -94.6, **Y:** 29.1, **Z:** 50
8) Select the box next to ***Create Feature Point*** and then press the ***Close*** button.



Next, we need to establish the grid's X-axis so the model knows the orientation of the waves, which will allow the data to be entered in shore normal convention.



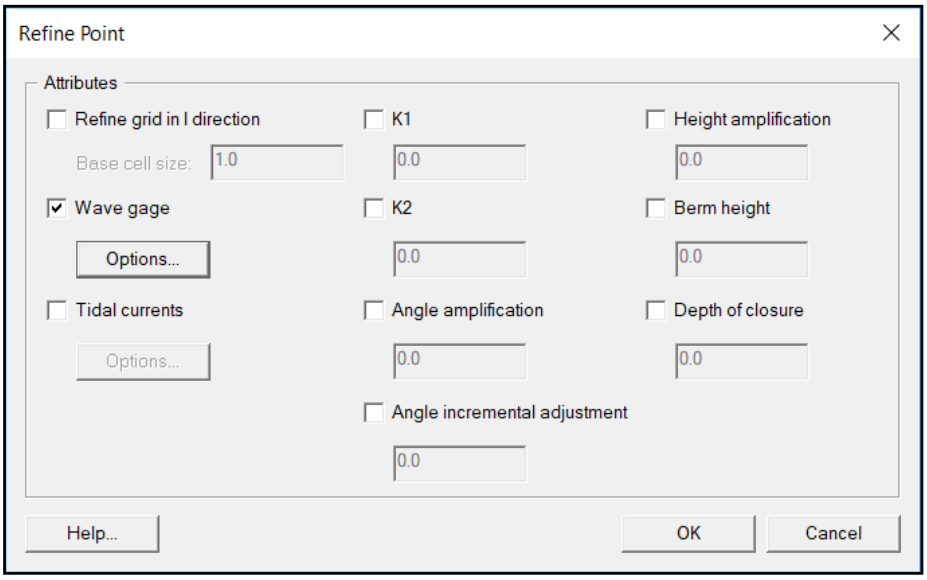
9) In the table of contents, right click on ***Merge Coverage***, then select ***Convert*** and ***Map → 1D Grid*** from the drop down menu.

10) The Map → 1D Grid window will appear with the values you populated in step 4 of section 2-10 earlier in this document. If that is not the case, make sure to set the values now.

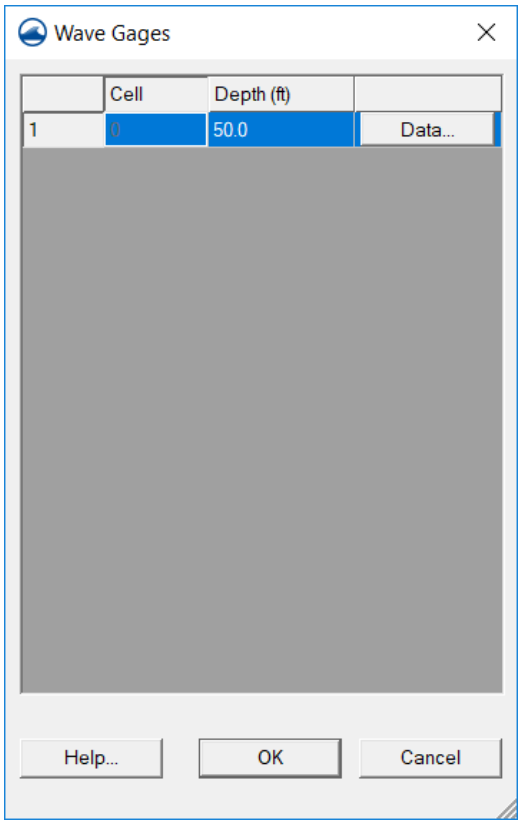
11) Press ***OK*** to close the window and create the grid.

12) Here we can see the shoreline and associated features we added, the 1D grid, and the point offshore that represents the wave source.

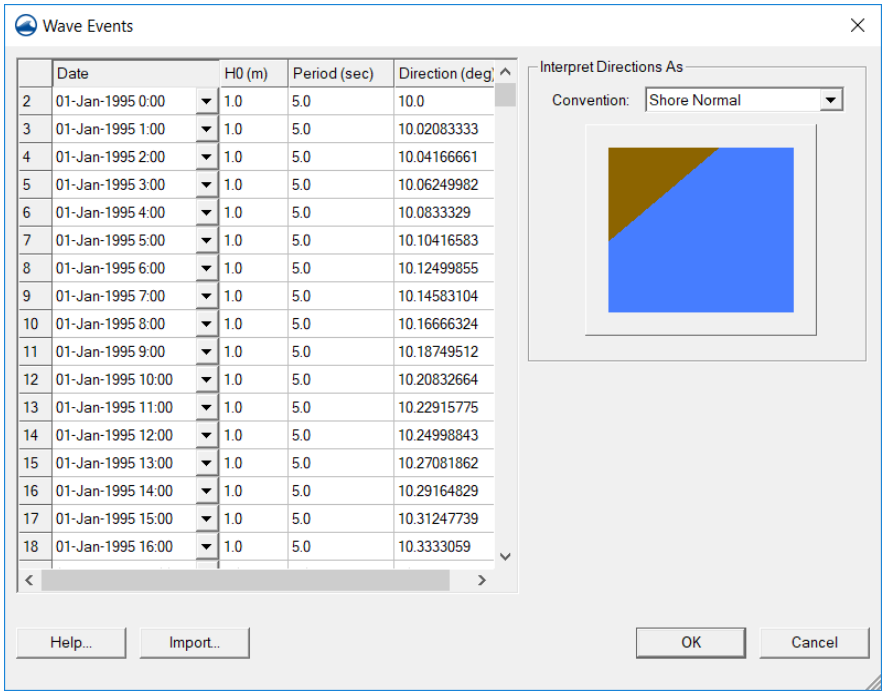
13) Make sure ***Merge Coverage*** is still highlighted in blue, if not click on it, and then press the ***Select Feature Point*** button to activate it. Double click on the wave source point in the Gulf of Mexico.



14) In the Refine Point window that appears, place a check mark in the box next to ***Wave Gage***, and then press the ***Options*** button.

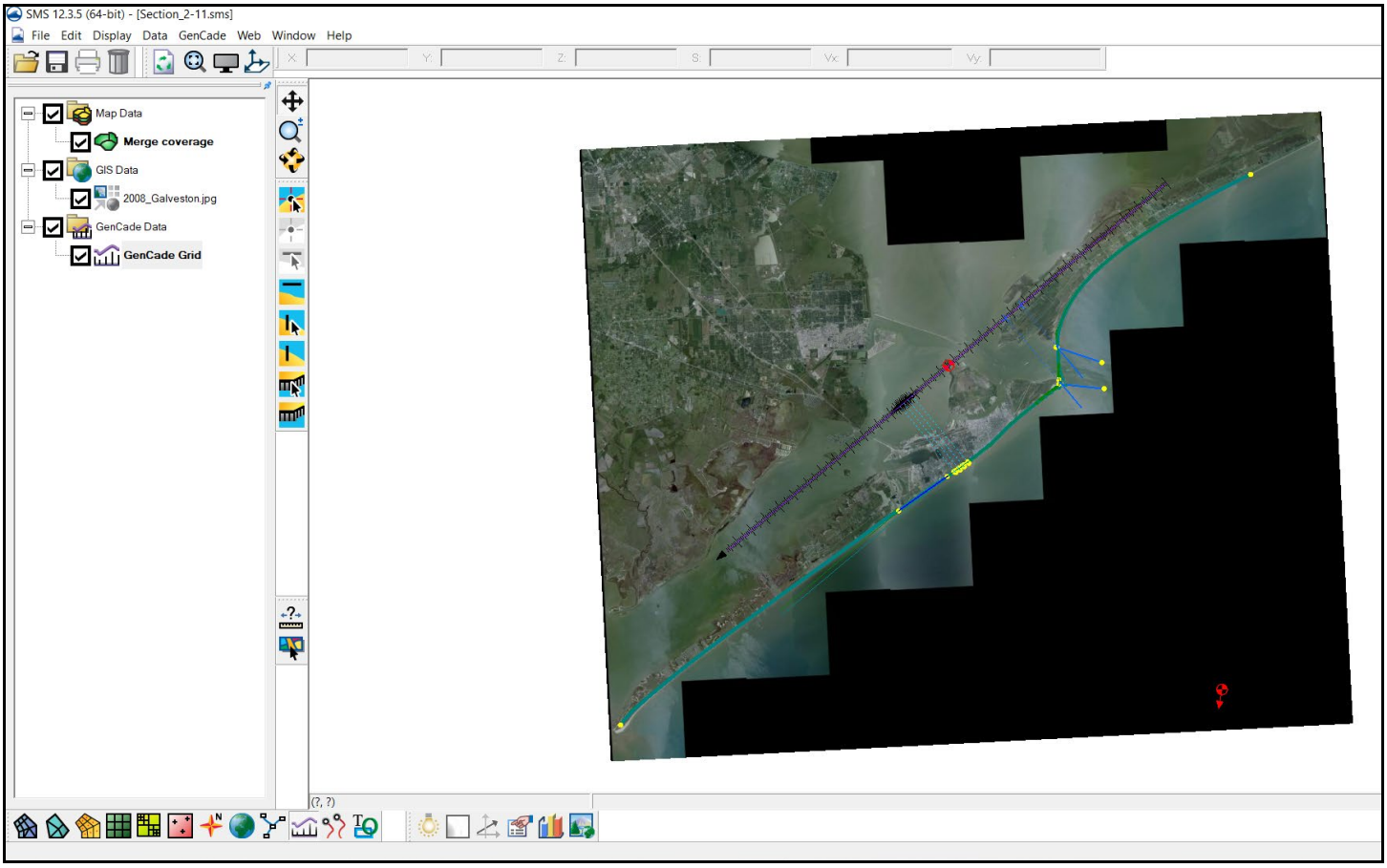


15) In the Wave Gages window, for ***Depth (ft)*** enter ***50*** and then press the ***Data*** button to open the Wave Events window.
16) Open Windows Explorer, navigate to ***\\GenCade\Hands_On_Example\Wave Data***, and open the file ***Waves_Averaged.xlsx***. Using the column headers in Excel, highlight the four columns of data, right click somewhere in the highlighted area, and select ***Copy*** from the menu.

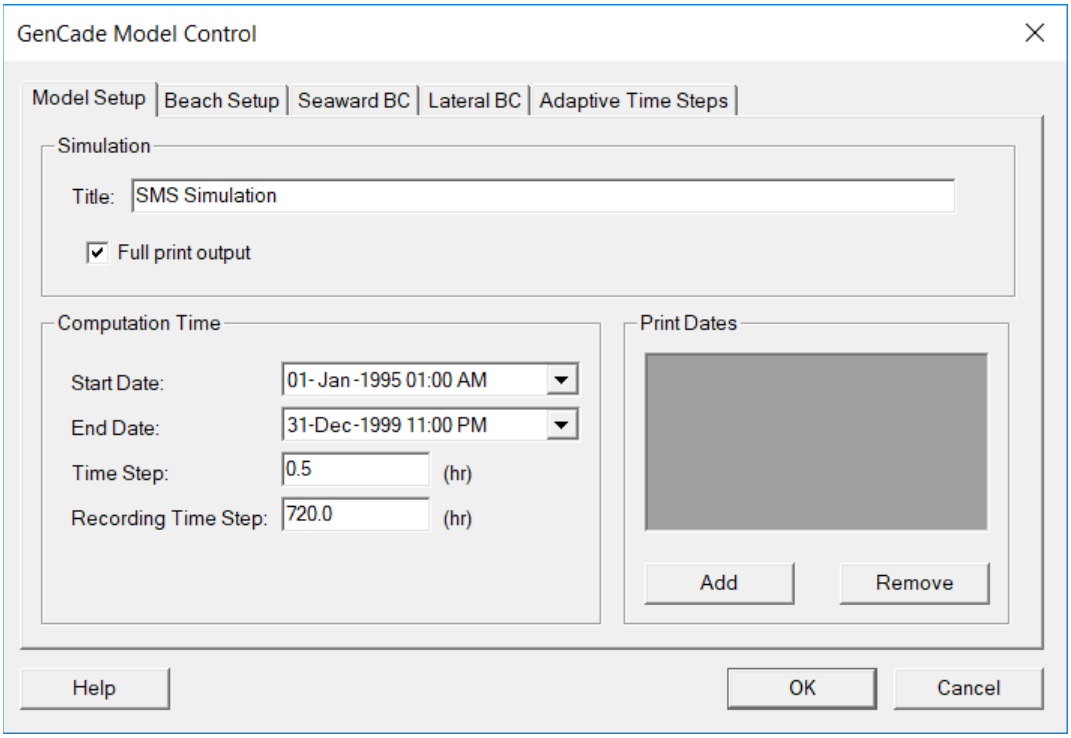


17) Back in the SMS Wave Events window, right click the ***Date*** column header and select ***Paste*** from the pop up menu. It may take a minute or two to populate the data.
18) Press the ***OK*** button three times to close the Wave Events, Wave Gages, and Refine Point windows.
19) While it may already be present, right clicking on ***Merge Coverage*** then selecting ***Convert*** and ***Map → 1D Grid*** from the drop down menus will show the location and direction of the wave data.

20) Highlight ***GenCade Data*** in the table of contents and a GenCade tab will appear in the toolbar at the top of the SMS application.
21) Select the ***GenCade*** tab and select ***Edit Wave Data*** from the drop down menu. This opens the Wave Gages window where you populated wave data in steps 15, 16, and 17. Press the ***Data*** column header to open the Wave Data window, change ***Convention*** to ***Shore Normal,*** then press OK twice to close the Wave Events and Wave Gages windows.
22) We have finished entering features and values for the GenCade model, your SMS application should look similar to the image below.


SMS 12.3.5 (64-bit) - [Section_2-11.sms]
File Edit Display Data GenCade Web Window Help
Map Data
Merge coverage
GIS Data
2008_Galveston.jpg
GenCade Data
GenCade Grid

3. Setup and Run the GenCade Model



1) Click on ***GenCade Data*** in the table of contents, select ***GenCade*** from the toolbar at the top, and then select ***Model Control*** from the drop down menu to open the GenCade Model Control window.

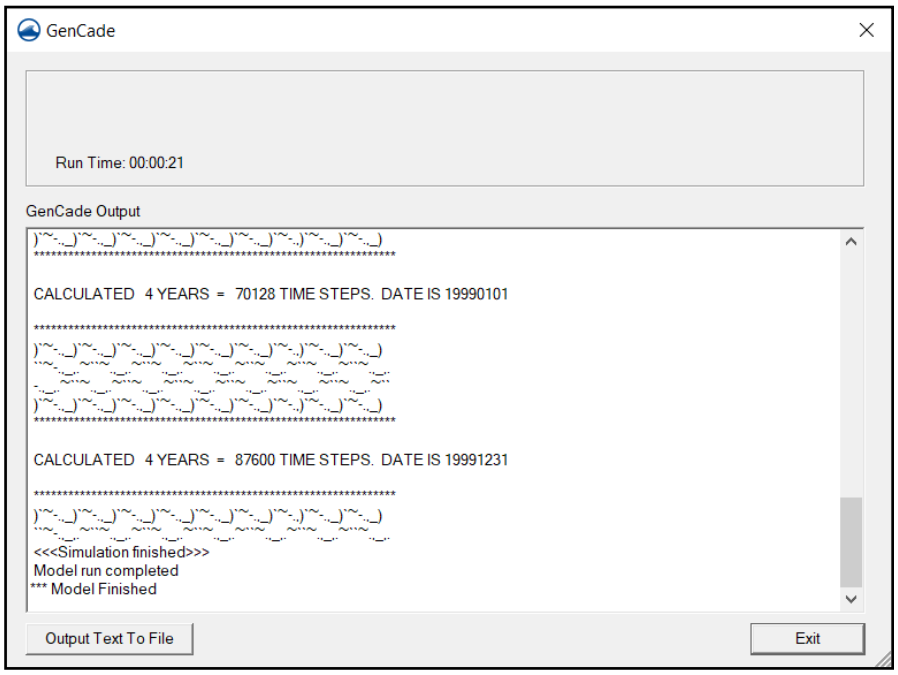
2) Make sure the ***Model Setup*** tab is highlighted and set the following parameters:
   - **Full Print Output** is checked.
   - **Start Date:** 01-Jan-1995 01:00 AM
   - **End Date:** 31-Dec-1999 11:00 PM
   - **Time Step:** 0.5
   - **Recording Time Step:** 720.0

3) Select the ***Beach Setup*** tab, and enter these parameters:
   - **Effective Grain Size:** 0.17
   - **Average Berm Height:** 3.0
   - **Depth of Closure:** 20.0
   - **K1:** 0.4
   - **K2:** 0.2

4) Select the ***Seaward BC*** tab and enter these parameters:
   - **Number of Cells in the Offshore Contour Smoothing Window:** 51

5) Select the ***Lateral BC*** tab and enter these parameters:
   Left Lateral BC Type: Pinned
   Right Lateral BC Type: Moving
   Shoreline Displacement Velocity: -10 feet per Simulation Period

6) On the main SMS toolbar, select ***File,*** then ***Save As*** from the drop down menu. Press the ***Create New Folder*** button in the Windows ***Open*** dialog window and name it Initial Run, and then set ***File Name*** to ***Initial Run.sms*** and press ***Save***.



7) Make sure ***GenCade Grid*** is highlighted in the table of contents, choose ***GenCade*** on the toolbar and select ***Run GenCade*** from the drop down menu. The model writes information as it runs, and might take a minute or two.

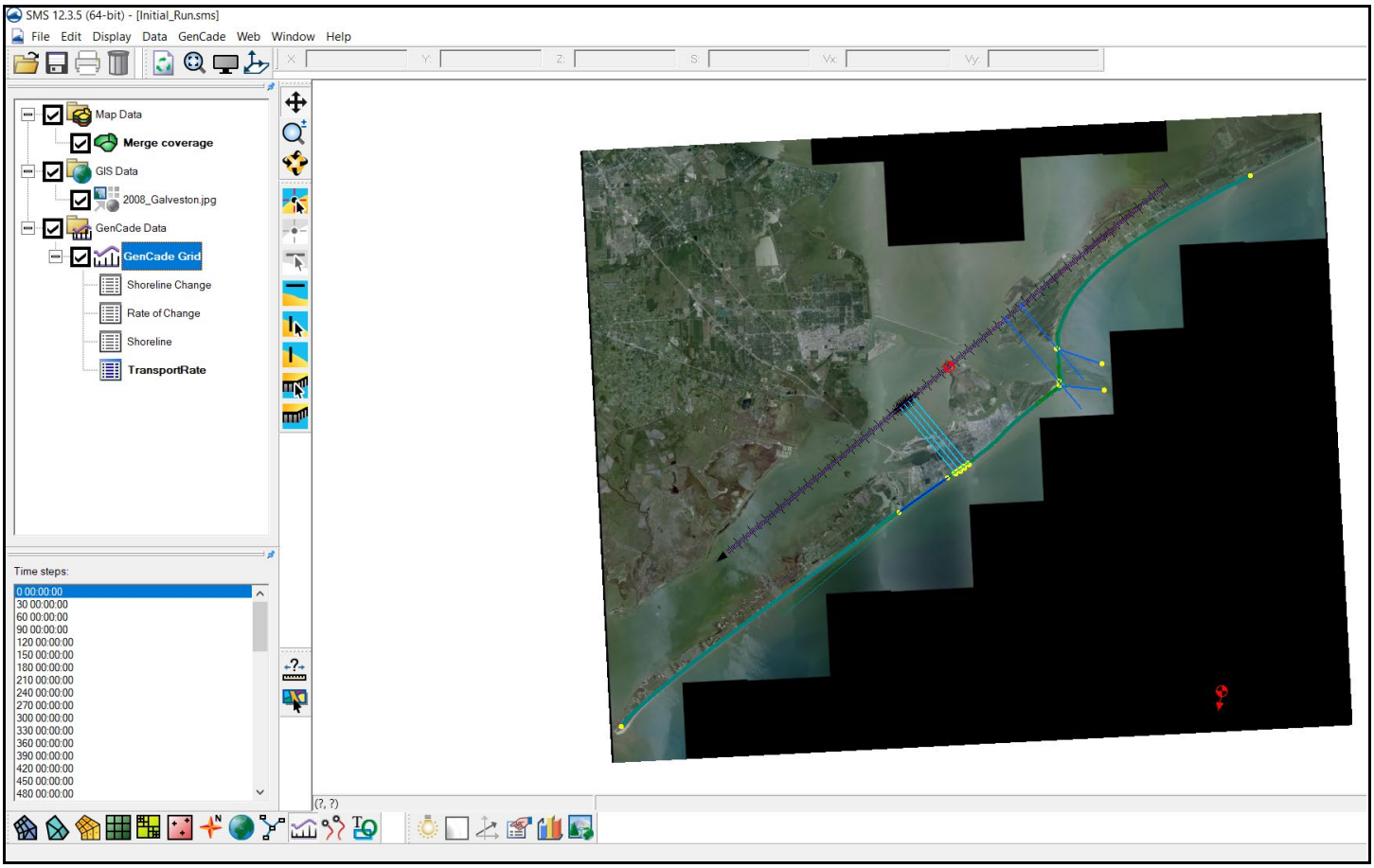
8) When the model stops running, in the ***GenCade*** window press the ***Exit*** button.

4. Visualize Results in SMS

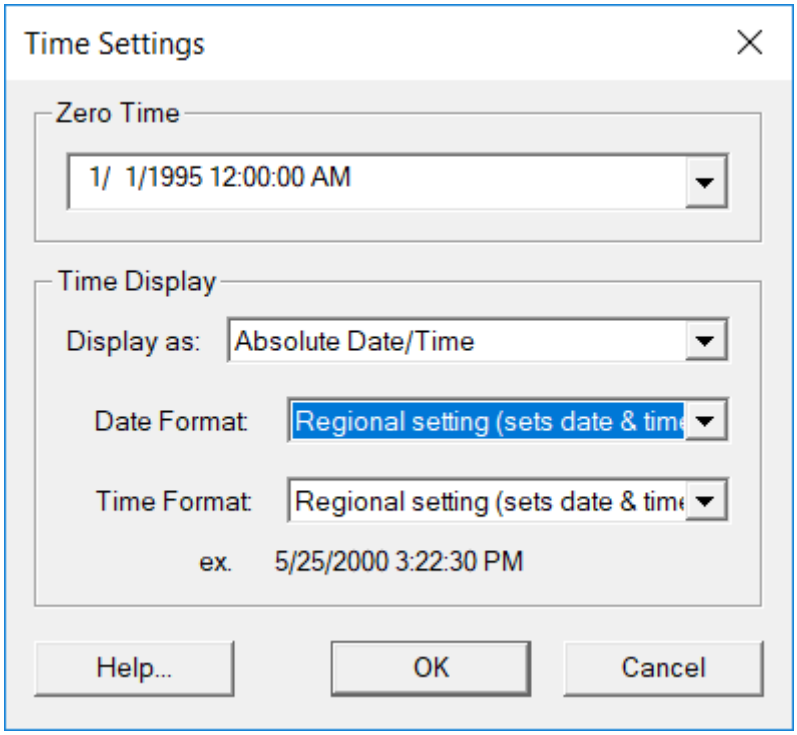
In this section, we are viewing model results in SMS but they are viewable in other applications, which is covered in Section 7. Open Windows Explorer and navigate to ***GenCade\Hands_On_Example\Run_Initial***. There are many files present in this folder but only the following files are included in this example:

- *Shoreline Change File (*.slo)* includes the shoreline position at each recorded time step.
- *Inlet Shoal Volume File (*.irv)* shows volume outputs for each component at each recorded time step.
- *Initial Shoreline Position File (*.shi)* shows the initial shoreline position.
- *Longshore Transport File (*.qtr)* shows the calculated net transport at each recorded time step.
- *Grid Size File (*.shdx)* allows the conversion of model output to horizontal space, with each number in the file representing the size of each grid cell.
- *Print File (*.prt)* includes all information saved during the model run including, shoreline position and change, breaking wave angle, offshore wave angle to the x-axis, and transport to the left and right after each year. SMS cannot open this file.

1. ***Open*** the files ***run_initial.slo*** and ***run_initial.qtr***. Four new datasets are available in the GenCade table of contents including, Shoreline Change, Rate of Change, Shoreline, and Transport Rate. Additionally, at the bottom of the GenCade table of contents there is a Time Steps window.



2. See how the model's graphic window updates by successively highlighting each of the four new datasets. To change the colors and width of the lines, choose ***Display*** on the main toolbar and then ***Display Options*** from the drop down menu.

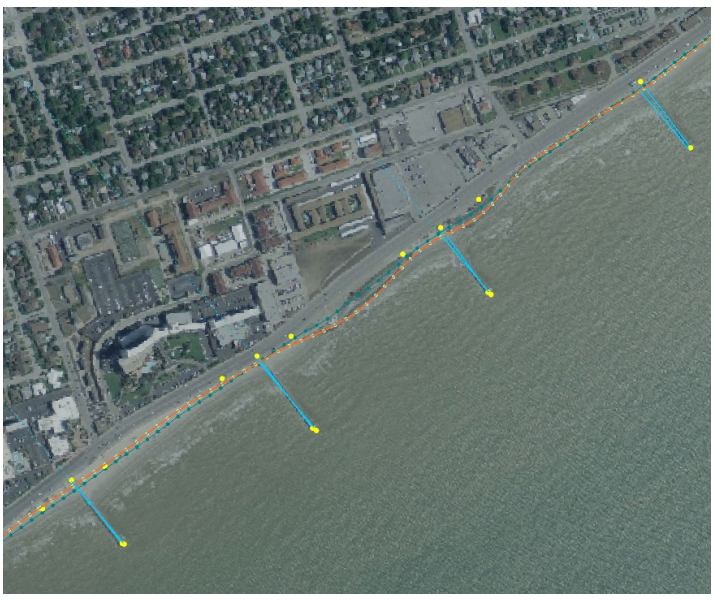


3. The Time Steps window defaults to relative model time shown in 30-day increments. To modify the Time Steps window information to absolute time, which is more user friendly, right click in the gray area to the right of the Time Steps heading, and choose ***Time Settings*** from the drop down menu to open the Time Settings window.
4. In the Time Settings window, change ***Zero Time to 1/1/1995***, which is the first wave data point we put in the model. Change ***Display As*** to ***Absolute Date/Time***, and then press ***OK***.

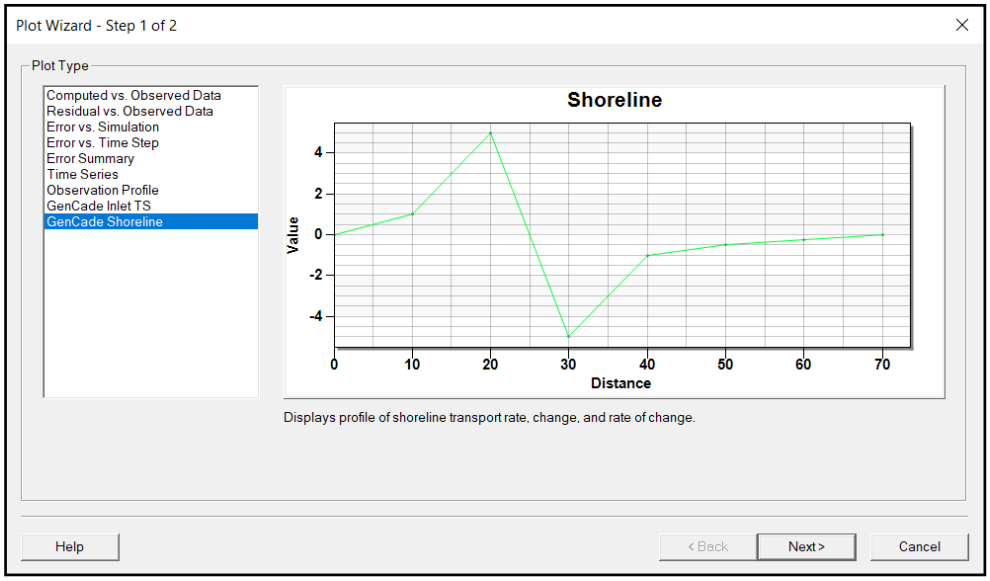
5. Highlight one of the time entries in the Time Step window. The up and down arrows on the keyboard can be used to scroll through the list. Observe how the information in the graphics window changes.

Transport rate, shoreline change, and rate of change are shown relative to the GenCade grid. The shoreline position is shown in the selected coordinate system.

6. Click on the Shoreline dataset in the table of contents and zoom to an area of the shoreline. In the two images below, at zero time (left image) the initial shoreline (bright aqua) and calculated shoreline (burnt orange) are on top of each other. After five years have passed (right image), the calculated shoreline has moved seaward as sedimentation has occurred between the groins.



7. Create a video of the graphic window extents over the five-year time lapse by selecting ***Data*** from the main menu and then ***Film Loop*** from the drop down menu. The Film Loop Setup window will appear and we will use all default values. Press the ***Next*** button to move from the General Options section to the Time Options section. Press the ***Next*** button again to move to the final Display Options section, and then press ***Finish*** to create the video loop, which will automatically open when finished.



8. Create a plot of the shoreline by choosing ***Display***, and then ***Plot Wizard*** from the drop down menu. Change ***Plot Type*** to ***GenCade Shoreline***, and then press ***Next***.

9. Under ***Dataset,*** make sure the ***Archive Dataset*** option is selected, under ***Time Step*** make sure the ***Archived Time Step*** option is selected, and then press ***Finish***. The plot results window will open and be the same size as the SMS application window. Grabbing an edge of the plot window allows resizing. Right click in the plot window and choose ***Display Options*** from the pop up menu. In the Shoreline Customization window, make some aesthetic choices, and then press the ***Apply*** button. If figures or plots need to be printed or exported, press the ***Export*** button but if not, press the ***OK*** button to make the changes permanent.

10. Create an inlet time-series graph by choosing ***Display*** on the main menu, select ***Plot Wizard*** from the drop down menu, in the ***Plot Type*** section choose ***GenCade Inlet TS***, and then press the ***Next*** button. For ***Inlet,*** choose Galveston, set ***Start Time*** to ***1/1/1995***, and ***End Time*** to ***12/6/1999***. Under ***Datasets*** put a check mark next to ***Ebb***, and then press the ***Finish*** button. If desired, customize the plot.

5. Model Calibration and Verification

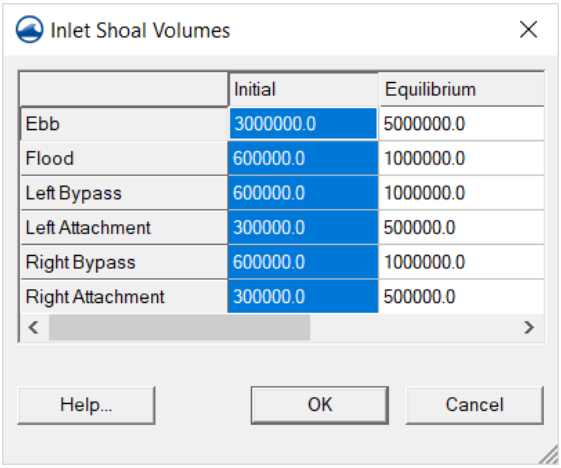
While there is not sufficient time in this workshop to calibrate and verify a model, it is an important step. This is the point where it would occur. The general process requires starting with a known condition, running the model over a period for existing data then comparing model results to measured data. Varying the empirical transport coefficients K1 and K2 can result in model data matching measured data although, in practice a lack of existing data or an initially misunderstood process requires varying other aspects of model setup to obtain calibration. Ideally, using the same model setup and another period for which data exists to simulate. This verifies the model accurately represents the physical processes involved, allowing us to ensure our engineering decisions are based on a verified model.

6. Modifying GenCade Parameters for Project Analyses

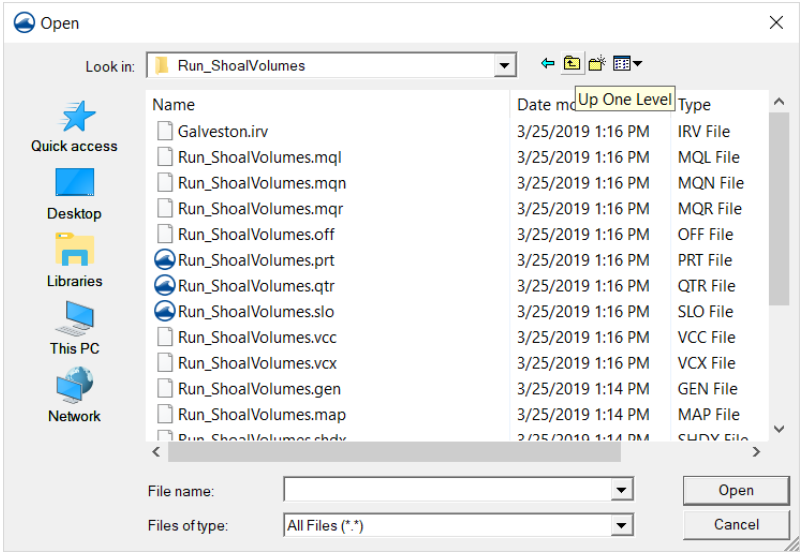
We now have a working GenCade model we can use to modify model parameters to evaluate how potential projects might affect beach nourishment, dredging, jetties, groins, breakwaters, or seawalls.

6.1 Modify Shoal Volumes

1) Open Windows Explorer, and navigate to ***\\GenCade\Hands_On_Example\Run_Initial*** and open the file ***Run_Initial.sms***. On the SMS toolbar select ***File*** and then ***Save as…*** from the drop down menu. In the Save As window, navigate to ***\\GenCade\Hands_On_Example\Run_ShoalVolumes*** and save the the file ***Run_ShoalVolumes.sms***.



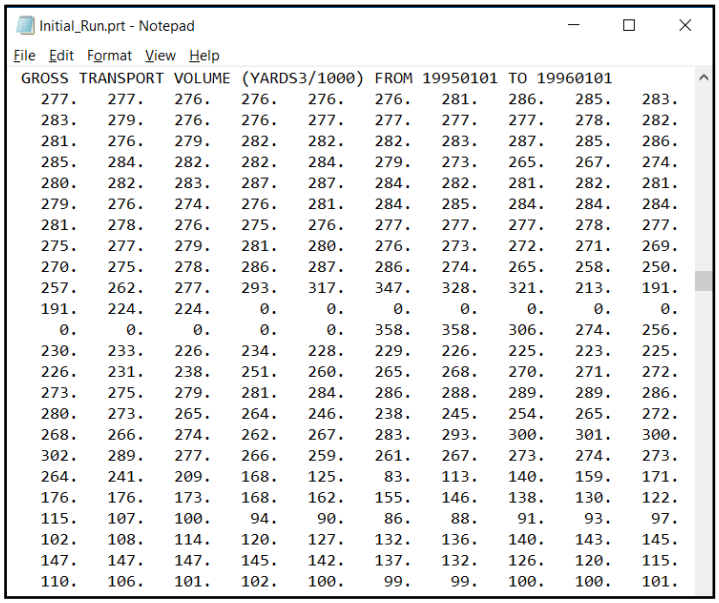
2) Highlight ***GenCade Data*** in the SMS table of contents; choose ***GenCade*** from the main toolbar and then ***Edit Inlets*** from the drop down menu.
3) In the Inlets Reservoir Model and Jetties window, under the ***Yd^3*** column, press the ***Volume*** button to open the Inlet Shoal Volumes window. Change the values in the Initial column to what appears in the image to the left. Press ***OK***.
4) Back in the Inlets Reservoir Model and Jetties window, enter the ***Name of Inlet*** as ***Galveston***. Press ***OK***.
5) Select ***GenCade***, and then ***Model Control*** from the drop down menu. Make sure the ***Model Setup*** tab is selected and that the ***Start Date*** is set to ***01-Jan-1995 01:00 AM*** and the ***End Date*** is set to ***31-Dec-1999 11:00 PM***.
6) Press the ***Save*** button, then select ***GenCade*** on the main menu and ***Run GenCade*** from the drop down menu.
7) Choose ***File***, then ***Open*** from the drop down menu, select ***shoal_volumes.slo*** and then press the ***Open*** button.
8) Once again choose ***Open***, and then ***File*** from the drop down menu. Press the ***Up One Level*** button in the Open window, double click on the folder ***Run_ShoalVolumes***, select ***Run_Initial.slo*** then Press the ***Open*** button.



The easiest way to modify inlet shoal volumes is by selecting ***GenCade*** on the SMS toolbar and then selecting ***Edit Inlets*** from the drop down menu. This example demonstrates this technique however, when working with a real project it is best to modify inlet shoal volumes by making changes in the conceptual model. To do so, highlight ***merge contours*** in the table of contents, press the ***Select Feature Arc*** button, double click on the inlet feature to bring up the GeoCade Arc Attributes window, select the ***Attributes*** button, enter the new inlet shoal volumes, and then press ***OK*** twice to close both windows. Right click on merge contours again and select ***Convert***, and then ***Map → 1D*** from the drop down menu. The shoal values will now match in both locations.

6.2 Modify Empirical Transport Coefficient, K1

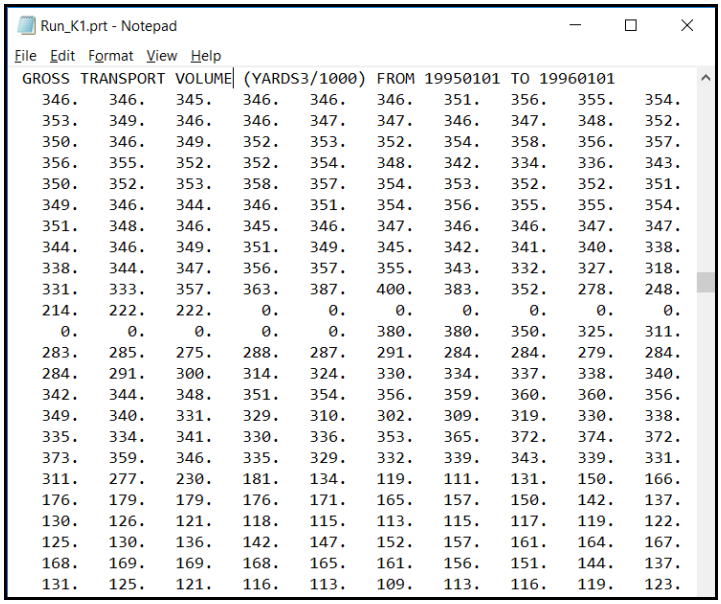
1) Open the file ***Run_Initial.sms*** at ***\\GenCade\Hands_On_Example\Run_Initial.*** On the SMS toolbar select ***File*** and then ***Save as…*** from the drop down menu. In the Save As window, navigate to ***\\GenCade\Hands_On_Example\Run_K1*** and save the file as ***Run_K1.sms***.
2) Press ***GenCade*** on the toolbar and select ***Model Control*** from the drop down menu to open the GenCade Model Control window. Select the ***Beach Setup*** tab and change ***K1*** to ***0.5***. Select the ***Model Setup*** tab and make sure ***Start Date*** is set to ***01-Jan-1995 01:00 AM*** and the ***End Date*** is set to ***31-Dec-1999 11:00 PM***. Press ***OK***.
3) ***Save*** the model then choose ***GenCade*** and ***Run GenCade***.
4) In the ***Run_Initial*** folder, there is a file named ***Run_Initial.prt*** and in the ***Run_K1*** folder, there is a file named ***Run_K1.prt***. Open both of these files with Notepad and either scroll down to the heading, or search for ***Gross Transport Volume*** in both files, which is the beginning of sediment transport data based on each year for which the model was ran. Calculations for three other sediment transport values include, ***Net Transport Volume, Transport Volume to the Left, and Transport Volume to the Right***. The images below show the beginning of the transport comparison between a K1 value of 0.4 in the Run_Initial.sms file (left) and a K1 value of 0.5 in the Run_K1.sms file (right).


Initial_Run.prt - Notepad

File Edit Format View Help

GROSS TRANSPORT VOLUME (YARDS3/1000) FROM 19950101 TO 19960101

277.	277.	276.	276.	276.	276.	281.	286.	285.	283.
283.	279.	276.	276.	277.	277.	277.	277.	278.	282.
281.	276.	279.	282.	282.	282.	283.	287.	285.	286.
285.	284.	282.	282.	284.	279.	273.	265.	267.	274.
280.	282.	283.	287.	287.	284.	282.	281.	282.	281.
279.	276.	274.	276.	281.	284.	285.	284.	284.	284.
281.	278.	276.	275.	276.	277.	277.	277.	278.	277.
275.	277.	279.	281.	280.	276.	273.	272.	271.	269.
270.	275.	278.	286.	287.	286.	274.	265.	258.	250.
257.	262.	277.	293.	317.	347.	328.	321.	213.	191.
191.	224.	224.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	358.	358.	306.	274.	256.
230.	233.	226.	234.	228.	229.	226.	225.	223.	225.
226.	231.	238.	251.	260.	265.	268.	270.	271.	272.
273.	275.	279.	281.	284.	286.	288.	289.	289.	286.
280.	273.	265.	264.	246.	238.	245.	254.	265.	272.
268.	266.	274.	262.	267.	283.	293.	300.	301.	300.
302.	289.	277.	266.	259.	261.	267.	273.	274.	273.
264.	241.	209.	168.	125.	83.	113.	140.	159.	171.
176.	176.	173.	168.	162.	155.	146.	138.	130.	122.
115.	107.	100.	94.	90.	86.	88.	91.	93.	97.
102.	108.	114.	120.	127.	132.	136.	140.	143.	145.
147.	147.	147.	145.	142.	137.	132.	126.	120.	115.
110.	106.	101.	102.	100.	99.	99.	100.	100.	101.


Run_K1.prt - Notepad

File Edit Format View Help

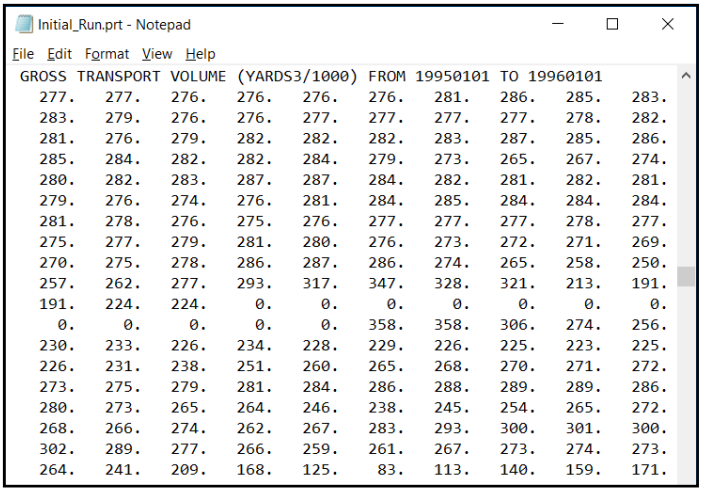
GROSS TRANSPORT VOLUME (YARDS3/1000) FROM 19950101 TO 19960101

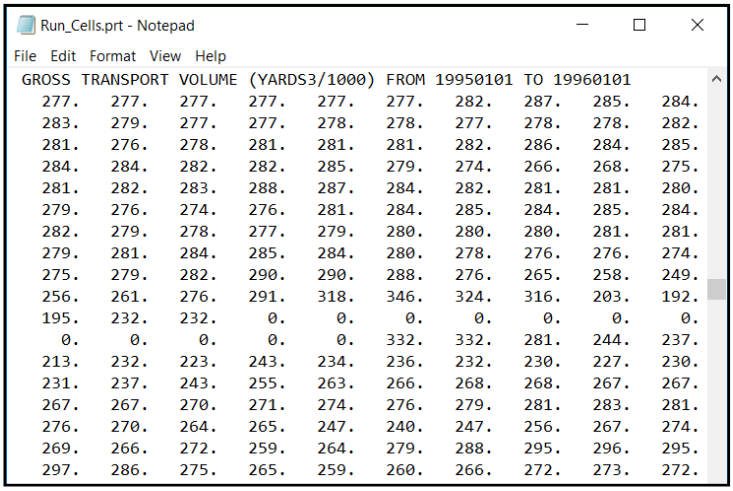
346.	346.	345.	346.	346.	346.	351.	356.	355.	354.
353.	349.	346.	346.	347.	347.	346.	347.	348.	352.
350.	346.	349.	352.	353.	352.	354.	358.	356.	357.
356.	355.	352.	352.	354.	348.	342.	334.	336.	343.
350.	352.	353.	358.	357.	354.	353.	352.	352.	351.
349.	346.	344.	346.	351.	354.	356.	355.	355.	354.
351.	348.	346.	345.	346.	347.	346.	346.	347.	347.
344.	346.	349.	351.	349.	345.	342.	341.	340.	338.
338.	344.	347.	356.	357.	355.	343.	332.	327.	318.
331.	333.	357.	363.	387.	400.	383.	352.	278.	248.
214.	222.	222.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	380.	380.	350.	325.	311.
283.	285.	275.	288.	287.	291.	284.	284.	279.	284.
284.	291.	300.	314.	324.	330.	334.	337.	338.	340.
342.	344.	348.	351.	354.	356.	359.	360.	360.	356.
349.	340.	331.	329.	310.	302.	309.	319.	330.	338.
335.	334.	341.	330.	336.	353.	365.	372.	374.	372.
373.	359.	346.	335.	329.	332.	339.	343.	339.	331.
311.	277.	230.	181.	134.	119.	111.	131.	150.	166.
176.	179.	179.	176.	171.	165.	157.	150.	142.	137.
130.	126.	121.	118.	115.	113.	115.	117.	119.	122.
125.	130.	136.	142.	147.	152.	157.	161.	164.	167.
168.	169.	169.	168.	165.	161.	156.	151.	144.	137.
131.	125.	121.	116.	113.	109.	113.	116.	119.	123.

6.3 Modify Number of Cells in Offshore Contour Smoothing Window

The appropriate value for this number should always be determined through sensitivity analysis.

1) Open the file ***Run_Initial.sms*** at ***\\GenCade\Hands_On_Example\Run_Initial.*** On the SMS toolbar select ***File*** and then ***Save as…*** from the drop down menu. In the Save As window, navigate to ***\\GenCade\Hands_On_Example\Run_Cells*** and save the file as ***Run_Cells.sms***.
2) Press ***GenCade*** on the toolbar and select ***Model Control*** from the drop down menu to open the GenCade Model Control window. Select the ***Seaward BC*** tab and change the ***Number of Cells in Offshore Contour Smoothing Window*** to ***11***. Select the ***Model Setup*** tab and make sure ***Start Date*** is set to ***01-Jan-1995 01:00 AM*** and the ***End Date*** is set to ***31-Dec-1999 11:00 PM***. Press ***OK***.
3) ***Save*** the model then choose ***GenCade*** and ***Run GenCade***.
4) In the ***Run_Initial*** folder, there is a file named ***Run_Initial.prt*** and in the ***Run_Cells*** folder, there is a file named ***Run_Cells.prt***. Open both of these files with Notepad and either scroll down to the heading, or search for ***Gross Transport Volume*** in both files, which is the beginning of sediment transport data based on each year for which the model was ran. Calculations for three other sediment transport values include, ***Net Transport Volume, Transport Volume to the Left, and Transport Volume to the Right***. The images below show the beginning of the transport comparison between a cell value of 51 in the Run_Initial.sms file (left) and a cell value of 11 in the Run_Cells.sms file (right).

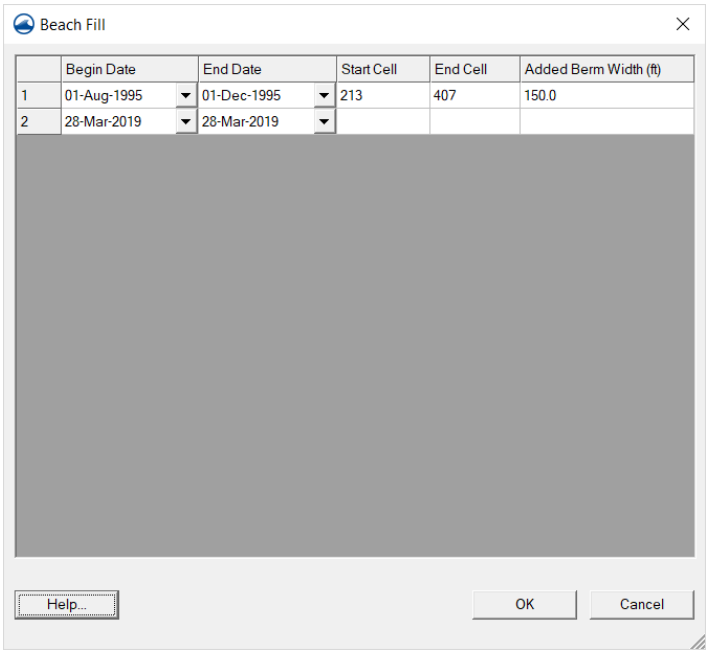




6.4 Delete the Regional Contour

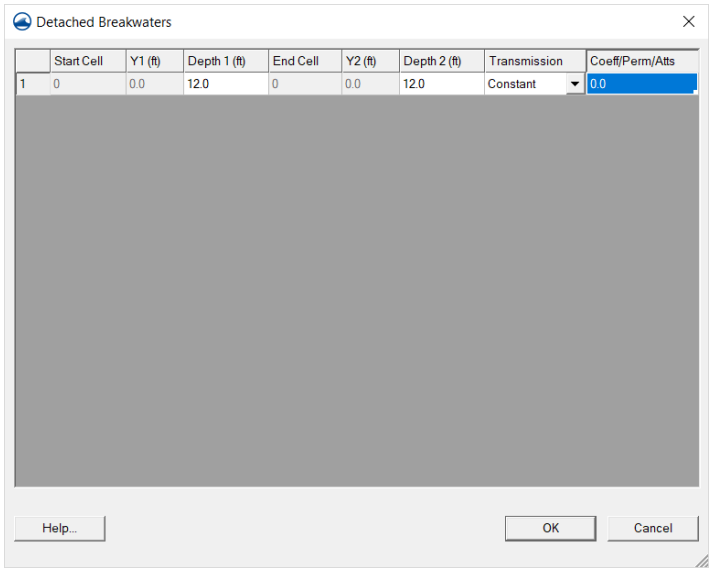
1) Open the file ***Run_Initial.sms*** at ***\\GenCade\Hands_On_Example\Run_Initial.*** On the SMS toolbar select ***File*** and then ***Save as…*** from the drop down menu. In the Save As window, navigate to ***\\GenCade\Hands_On_Example\Run_NoContour*** and save the file as ***Run_NoContour.sms***.
2) Right click on ***GenCade Grid*** in the table of contents and select ***Delete*** from the drop down menu.
3) Press the ***Select Feature Arc*** button and select the regional contour in the graphics display. It is easiest to isolate this line from the initial shoreline on the south side of the inlet. Right click on the selected regional contour and select ***Delete*** from the drop down menu.
4) Right click on ***Merge Coverage*** in the SMS table of contents, select **Convert** and then ***Map → 1D*** from the drop down menu.
5) You will likely need to reset all of the GenCade model parameters, which are found in Section 3 of this document. Press ***OK*** to close the window.
6) ***Save*** the model then choose ***GenCade*** and ***Run GenCade***.
7) Examine the results near the inlet and on the west end of the seawall.

6.5 Add Beach Nourishment



1) Open the file ***Run_Initial.sms*** at ***\\GenCade\Hands_On_Example\Run_Initial.*** On the SMS toolbar select ***File*** and then ***Save as…*** from the drop down menu. In the Save As window, navigate to ***\\GenCade\Hands_On_Example\Run_BeachFill*** and save the file as ***Run_BeachFill.sms***.
2) Select ***GenCade*** on the SMS toolbar and select ***Edit Beach Fills…*** from the drop down menu, and enter the following parameters:
    - **Start Date:** 8/1/1995
    - **End Date:** 12/1/1995
    - **Start Cell:** 213
    - **End Cell:** 407
    - **Added Berm Width:** 150 ft
3) Select ***GenCade*** and then ***Model Control*** from the drop down menu. Select the ***Model Setup*** tab and make sure ***Start Date*** is set to ***01-Jan-1995 01:00 AM*** and the ***End Date*** is set to ***31-Dec-1999 11:00 PM***. Press ***OK***.
4) ***Save*** the model, select ***GenCade*** and ***Run GenCade*** from the drop down menu, and then evaluate the results.

6.6 Add Breakwater Feature



1) Open the file ***Run_Initial.sms*** at ***\\GenCade\Hands_On_Example\Run_Initial.*** On the SMS toolbar select ***File*** and then ***Save as…*** from the drop down menu. In the Save As window, navigate to ***\\GenCade\Hands_On_Example\Run_Breakwater*** and save the file as ***Run_Breakwater.sms***.
2) Right click on ***GenCade Grid*** in the table of contents and select ***Delete*** from the drop down menu.
3) Select the ***Create Feature Arc*** tool and draw a breakwater at a location of your choosing.
4) Double click on the arc and choose ***Breakwater*** in the GenCade Arc Attributes window, press the ***Attributes*** button and enter these parameters:
    - **Depth 1:** 12
    - **Depth 2:** 12
    - **Transmission:** Constant
    - **Coeff/Perm/Atts:** 0
5) Right click on ***Merge Coverage*** in the SMS table of contents, select **Convert** and then ***Map → 1D*** from the drop down menu.
6) You will likely need to reset all of the GenCade model parameters, which are found in Section 3 of this document. Press ***OK*** to close the window.

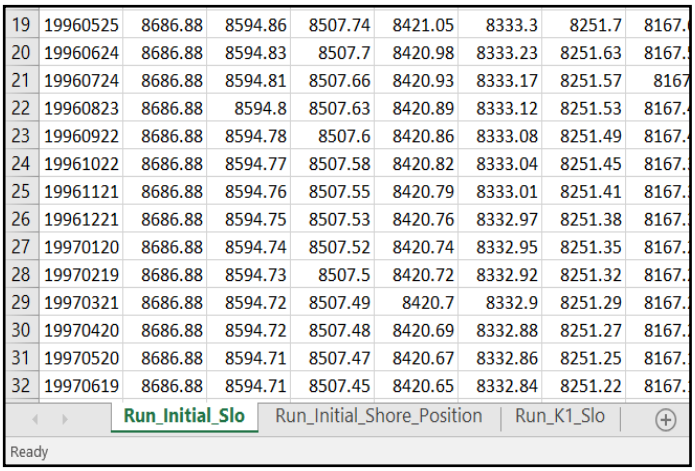
7) ***Save*** the model then choose ***GenCade*** and ***Run GenCade***.

7. Processing Data in Excel

It is often necessary to analyze data in programs other than SMS. The following tasks demonstrate some typical tasks in Excel working with GenCade output files.

> MatLab software is required to complete the process outlined below. The directory ***\\GenCade\Hands_On_Example\Excel*** contains the output files from these scripts. You will be asked to load the results at the appropriate time. The file ***Final_Excel_Plots.xlsx*** is also in this directory and includes the results of this section.

1) ***Open*** Microsoft Excel with a ***Blank Workbook***. In Excel select ***File***, ***Open***, and ***Browse***, then navigate to ***\\GenCade\Hands_On_Example\Run_Initial*** and open ***Run_Initial.slo***. Excel will open the Text Import Window.
2) Set the ***file type that best suits your data*** to ***Delimited***, press the ***Next*** button twice, and then ***Finish***.
3) On the Excel toolbar, select ***File*** and then ***Save As***. In the Save As window navigate to ***\\GenCade\Hands_On_Example\Excel***, change the ***Save as Type*** to ***Microsoft Excel (*.xlsx)*** and then enter the file name ***MyWork.xlsx.***



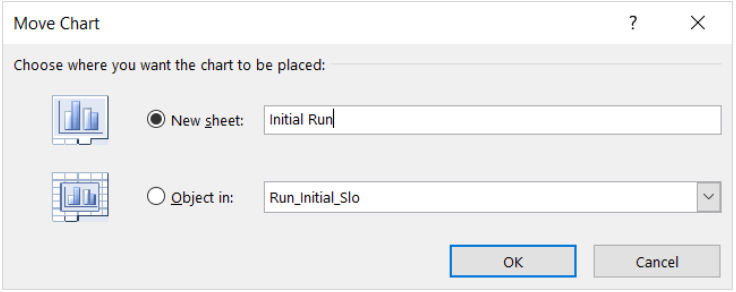
19	19960525	8686.88	8594.86	8507.74	8421.05	8333.3	8251.7	8167.
20	19960624	8686.88	8594.83	8507.7	8420.98	8333.23	8251.63	8167.
21	19960724	8686.88	8594.81	8507.66	8420.93	8333.17	8251.57	8167
22	19960823	8686.88	8594.8	8507.63	8420.89	8333.12	8251.53	8167.
23	19960922	8686.88	8594.78	8507.6	8420.86	8333.08	8251.49	8167.
24	19961022	8686.88	8594.77	8507.58	8420.82	8333.04	8251.45	8167.
25	19961121	8686.88	8594.76	8507.55	8420.79	8333.01	8251.41	8167.
26	19961221	8686.88	8594.75	8507.53	8420.76	8332.97	8251.38	8167.
27	19970120	8686.88	8594.74	8507.52	8420.74	8332.95	8251.35	8167.
28	19970219	8686.88	8594.73	8507.5	8420.72	8332.92	8251.32	8167.
29	19970321	8686.88	8594.72	8507.49	8420.7	8332.9	8251.29	8167.
30	19970420	8686.88	8594.72	8507.48	8420.69	8332.88	8251.27	8167.
31	19970520	8686.88	8594.71	8507.47	8420.67	8332.86	8251.25	8167.
32	19970619	8686.88	8594.71	8507.45	8420.65	8332.84	8251.22	8167.

Run_Initial_Slo | Run_Initial_Shore_Position | Run_K1_Slo

Ready

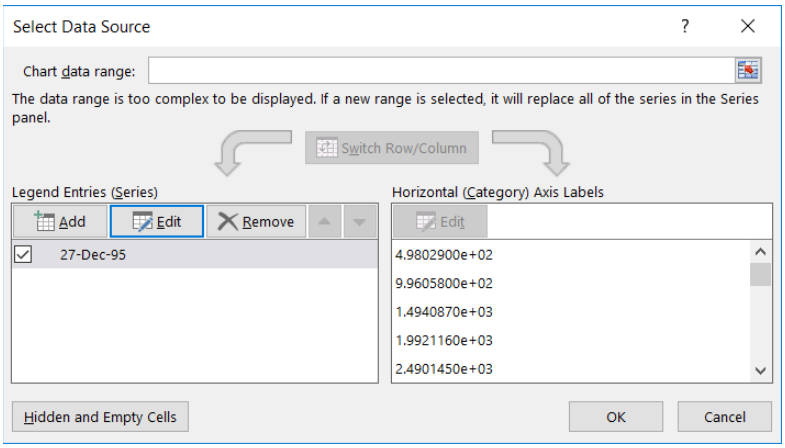
4) Since we created refine points earlier in the model to create a grid with variable spacing, we will need to use the ***Run_Initial.shdx*** file to determine the position of each cell. This file is a matrix with each entry representing the size of a cell. In Excel, press ***File***, ***Open*** and then navigate to ***\\GenCade\Hands_On_Example\Excel***, select the file ***Run_Initial_Shore_Position.out***. In the Text Import window, set the file type that best suits your data to ***Delimited***, press the ***Next*** button twice and then the ***Finish*** button. Copy the resulting column of data into the ***MyWork.xlsx*** file under a new sheet named ***Shore_Position_SHDX***.

5) In Excel select ***File***, ***Open***, and ***Browse***, then navigate to ***\\GenCade\Hands_On_Example\Run_K1*** and open ***Run_K1.slo***. Excel will open the Text Import Window.
6) Set the file type that best suits your data to ***Delimited***, press the ***Next*** button twice, and then ***Finish***.
7) Copy the resulting data into ***MyWork.xlsx*** under a new sheet named, ***Run_K1_Slo***.
8) In the ***Run_Initial_Slo*** sheet, select the row with the value ***19951227*** in the first column. On the Excel ribbon select the ***Insert*** tab, in the ***Charts*** section select the bottom middle button to ***Insert Scatter (X, Y) or Bubble Chart***, and in the drop down select ***Scatter with Smooth Lines***.



9) Right click to the right of "Chart Title" in the new chart and select ***Move Chart*** from the drop down menu.

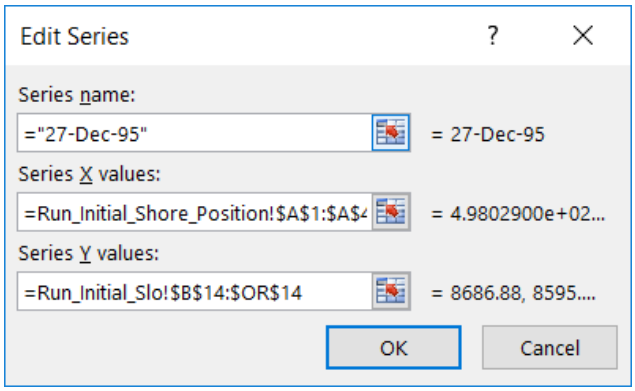
10) Select ***New Sheet***, name it ***Run_Initial***, and then press the ***OK*** button.



11) Choose the ***Run_Initial_Slo*** sheet and then select an entire row by left clicking on the row number to the left of the date ***19951227***.

12) Right click in the cross hatched region of the chart and choose ***Select Data*** from the drop down menu to bring up the Select Data Source window.

13) Click the ***Edit*** button to bring up the Edit Series window.

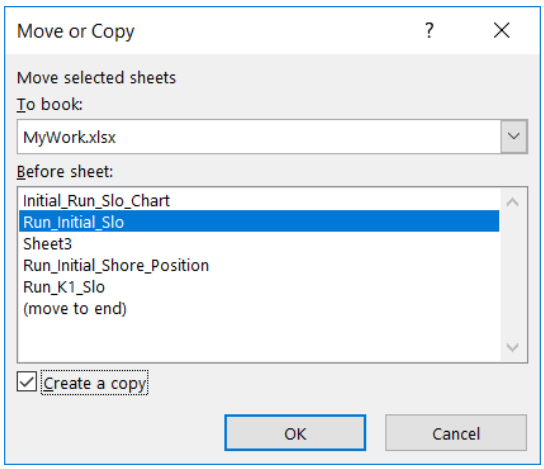


14) Enter the ***Series Name*** as ***27-Dec-95***.

15) Select the button with the small red arrow for ***Series X Values*** and the Edit Series window will appear. Select the ***Run_Initial_Shore_Position*** sheet, and then select the column header for the data to include all values. Press ***Enter*** on the keyboard to accept the values.

16) Select button for the ***Series Y Values***, and then highlight the entire row of data for the date ***19951227***, excluding the first column. Press ***Enter*** to accept the values.

17) Press ***OK*** to close the Edit Series window, and then ***OK*** again to close the Select Data Source window. Change the chart's sheet name to ***"Run_Initial_Slo_Chart"***.



18) Right click on the ***Run_Initial_Slo*** sheet and select ***Move or Copy*** from the menu. Highlight ***Run_Initial_Slo*** and place a check next to ***Create a Copy***. Press the ***OK*** button. Rename the new ***Run_Initial_Slo (2)*** sheet to ***Run_Initial_Change***.

19) The file ***Run_Initial.shi*** contains the initial shoreline position in a matrix format. A Matlab program has converted this information to a single row in the ***Run_Initial_SHI.out*** file located at ***\\GeoCade\Hands_On_Example\Excel***.

20) Create a new sheet in Excel and name it ***Initial_Shoreline***. Using ***File***, ***Open***, and ***Browse***, load the ***SHI.out*** file in Excel. ***Copy*** the row of data, excluding the first empty cell, and ***paste*** it into the ***Initial_Shoreline*** sheet.

21) In cell ***B2*** of the ***Run_Initial_Change*** sheet, enter the formula ***=Run_Initial_Slo!B2-Initial_Shoreline!A$1.*** ***Copy*** cell ***B2*** and ***paste*** the formula from cell B2 to the bottom right corner of the data on the sheet. The result will be values where positive indicates accretion and negative indicates recession of the shoreline.

22) Using the instructions provided over the last several steps, create a new Excel sheet and name it ***Run_K1_Change***. ***Copy/paste*** the values from ***Run_K1_Slo*** into ***Run_K1_Change***, in cell ***B2*** enter the formula ***=Run_K1_Slo!B2-Initial_Shoreline!A$1***, and then ***copy/paste*** the formula to all data cells in the sheet.

8. Supplemental Data for Example Model Setup

This section contains model setup parameters and cell addresses used for the inlet and other structures in this example. Advanced users can use this section to quickly locate data needed for the example.

Table 3. GenCade model setup parameters.

Parameter	**Value**
Start Date	1/1/1995 0:00
End Date	1/1/2000 0:00
Time Step	1
Recording Time Step	720
Effective Grain Size, mm	0.17
Average Berm Height, ft	3
Depth of Closure, ft	20
K1	0.4
K2	0.2
Height Amplification Factor	1
Angle Amplification Factor	1
Angle Offset	0
Wave Components to Apply	Primary
Number of cells in offshore contour smoothing window	51
Left Lateral Boundary Condition	Pinned
Right Later Boundary Condition, ft per sim. period	Moving (-10)

Table 4. Conceptual grid frame parameters.

Parameter	**Value**
Origin X, ft	3,358,200
Origin Y, ft	13,747,700
Angle, º	220
I size, ft	155,000
Use refine points	yes
Maximum cell size, ft	500
Maximum bias	1.1
Use inner growth	no

Table 5. Inlet cell locations.

	Beginning Cell	Ending Cell
Inlet	104	115
Left Bypass	101	102
Right Bypass	117	118

Table 6. Seawall segment locations.

Start Cell	Y1, ft	End Cell	Y2, ft
157	21,830	201	22,558
201	22,558	244	22,984
244	22,984	270	23,232
270	23,232	347	23,603
347	23,603	382	23,627
382	23,627	422	23,527
422	23,527	469	23,506
469	23,506	532	23,284
532	23,284	692	22,628
692	22,628	742	22,349
742	22,349	842	21,994
842	21,994	976	21,538

Table 7. Groin locations and parameters.

Cell Index	Length, ft	Permeability	Seaward Depth, ft
247	23,582	0.1	8
303	23,911	0.1	8
336	24,019	0.1	8
366	24,142	0.1	8
397	24,108	0.1	8
414	24,210	0.1	8
443	24,101	0.1	8
472	24,125	0.1	8
496	23,968	0.1	8
519	23,870	0.1	8
550	23,735	0.1	8
578	23,682	0.1	8
606	23,510	0.1	8
636	23,217	0.1	8
656	23,490	0.1	8

Table 8. Beach fill parameters.

Begin Date	End Date	Start Cell	End Cell	Added Berm Width, ft
1-Aug-95	1-Dec-95	213	703	150

Table 9. Breakwater parameters.

Start Cell	Y1, ft	Depth 1, ft	End Cell	Y2, ft	Depth 2, ft	Transmission	Coefficient
706	23,331	12	961	22,192	12	Constant	0