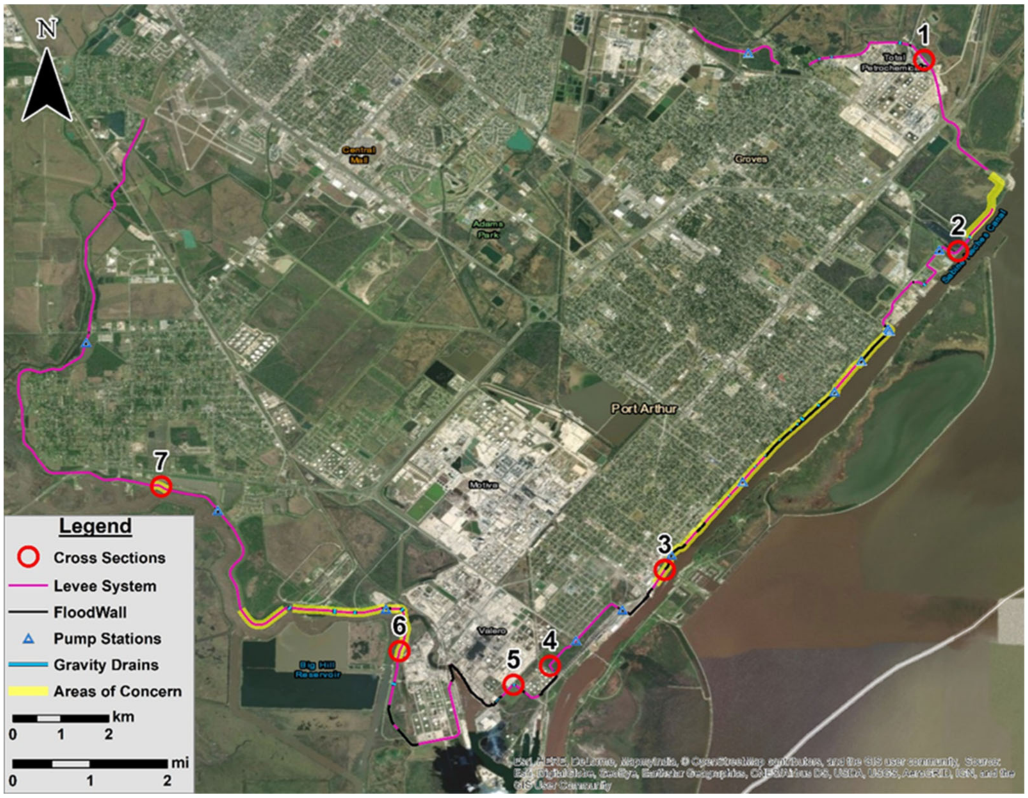
v. 11.1

WMS 11.1 Tutorial

GSSHA – Compound Flooding

Learn how to integrate the outputs of two hydraulic models, the Advanced CIRCulation (ADCIRC) model and the Gridded Surface Subsurface Hydrologic Analysis (GSSHA) model to simulate compound flooding.



Objectives

This tutorial shows how to simulate compound flooding.

Prerequisite Tutorials

Required Components

- Data
- Drainage
- Map
- Hydrology
- 2D Grid
- GSSHA

Time

- 60 minutes

1 Introduction

See Buffalo Bayou Presentation for a summary of the model objectives, results, and explanation of the input data and creation of the model.

2 Getting Started

Starting WMS new at the beginning of each tutorial is recommended. This resets the data, display options, and other WMS settings to their defaults. To do this:

1. If necessary, launch WMS.
2. If WMS is already running, press *Ctrl-N* or select *File* | **New…** to ensure that the program settings are restored to their default state.
3. A dialog may appear asking to save changes. Click **Don't Save** to clear all data.

The graphics window of WMS should refresh to show an empty space.

4. Click **Open** to bring up the *Open* dialog under the File menu.
5. Change the *Files of type* to "WMS XMDF Project File (*.wms)".
6. Navigate to *CF_PortA_WMS* and select "CF_PortA.wms" then click **Open** to close the *Open* dialog and import the project file.

7. WMS will say that your file already has a land use table in it, do you want to read this file, check O.K., Do this twice.

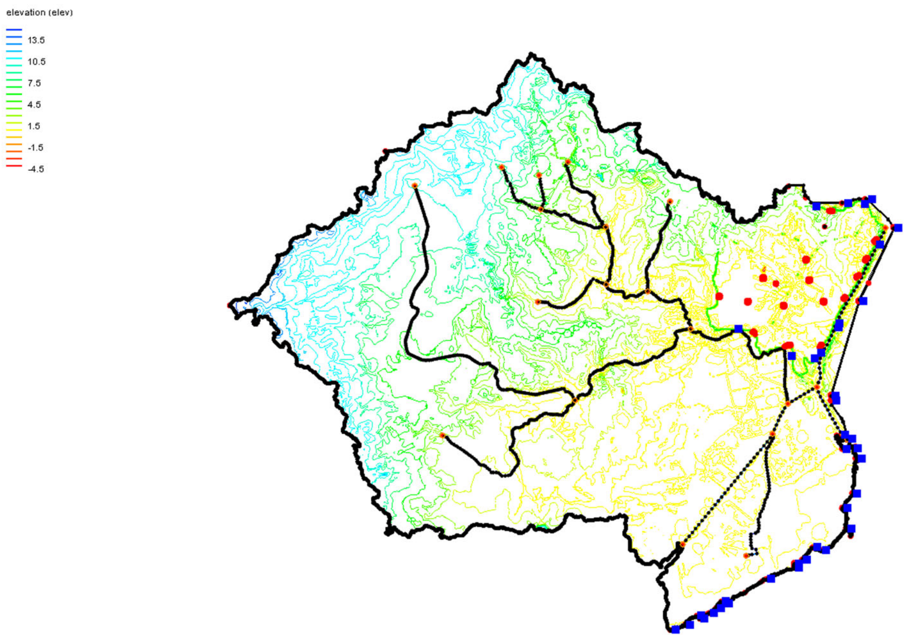
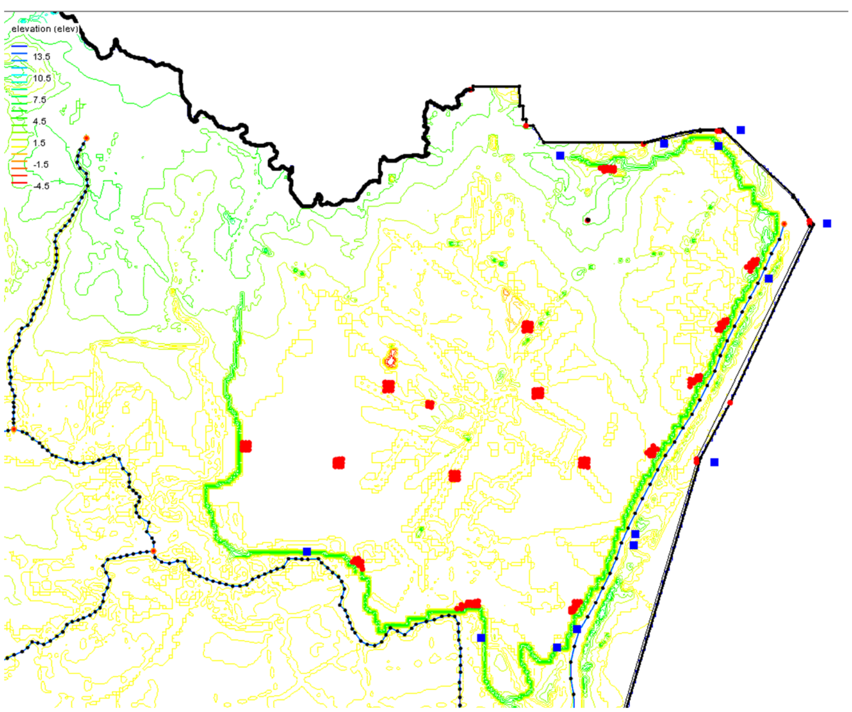


Figure 1 Initial project

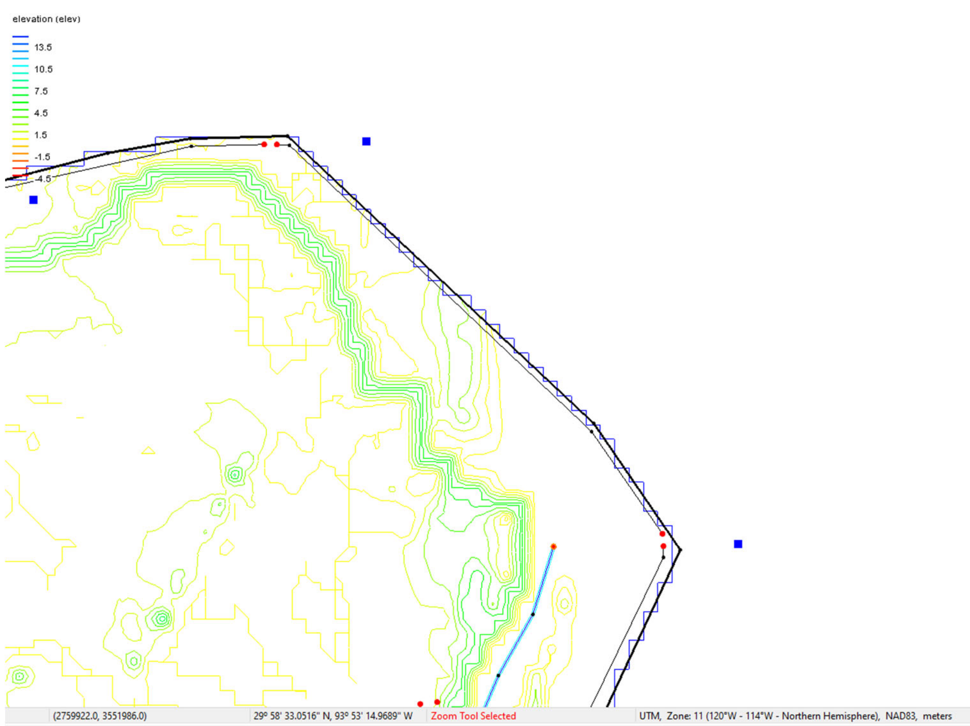
3 Display ADCIRC boundary conditions

Let us take a look at how the levees are used in this GSSHA model. Use the pan tool to blow up on the portion of the model that contains the levee as shown in the next figure.

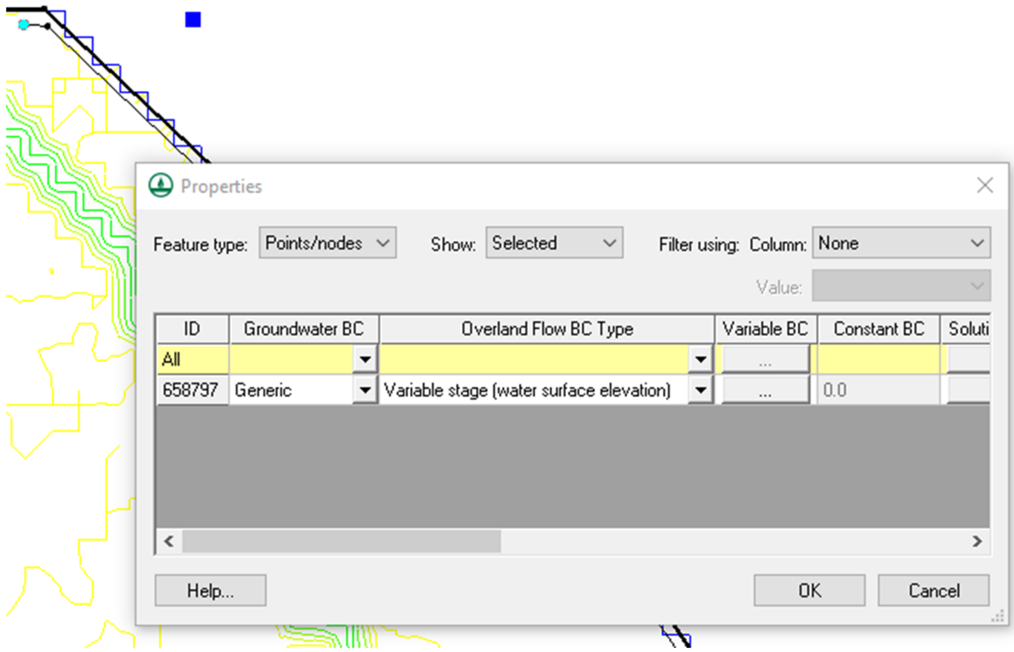


3.1 Display ADCIRC boundaries

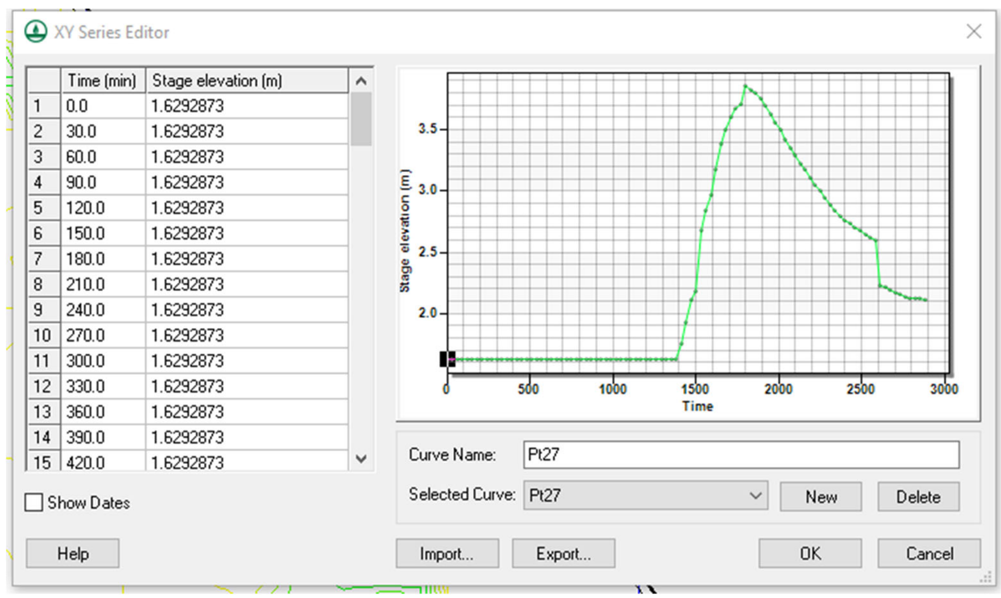
1. There are 2 types of ADCIRC boundaries, there are river/lake boundaries and overland flow boundaries. WMS has the capability of incorporating the river/lake boundary but not the overland flow boundaries. The overland flow boundaries must be added via text editor to run in GSSHA (see section 5).
2. The boundary conditions shown here are the boundaries on the river/lake which can be added in WMS.
3. Click on the GIS data in the Project Explorer and toggle on and off the ADCIRC_points.shp file. Click off the levee_points, we will come back to them later.
4. Double click on the GSSHA coverages to switch to Map Module.
5. Under GIS data double click on the ADCIRC_points.shp shape file.
6. Click on the Identify icon, this shows the location information for the added ADCIRC boundary condition location.
7. Zoom in on the model and as shown to the 2 most northeasterly boundary conditions take up most of the screen.



8. Click on the GSSHA coverage, this puts WMS in the Map Module
9. Click the select node tool 
10. Note that the blue boundary condition GIS points are near the red dots that mark the boundary conditions along the edge of the GSSHA model, double click on the red dot to bring up the boundary condition point/notes as shown below:



11. Select the variable BC icon to bring up the following dialog box:



to bring up the XY Series Editor. This show the time and water level stages for the ADCIRC point nearby (blue square). Note that the time is time from the beginning of the run, and it show the storm wave for 2 days. This f **New Coverage** to open the *Properties* dialog.

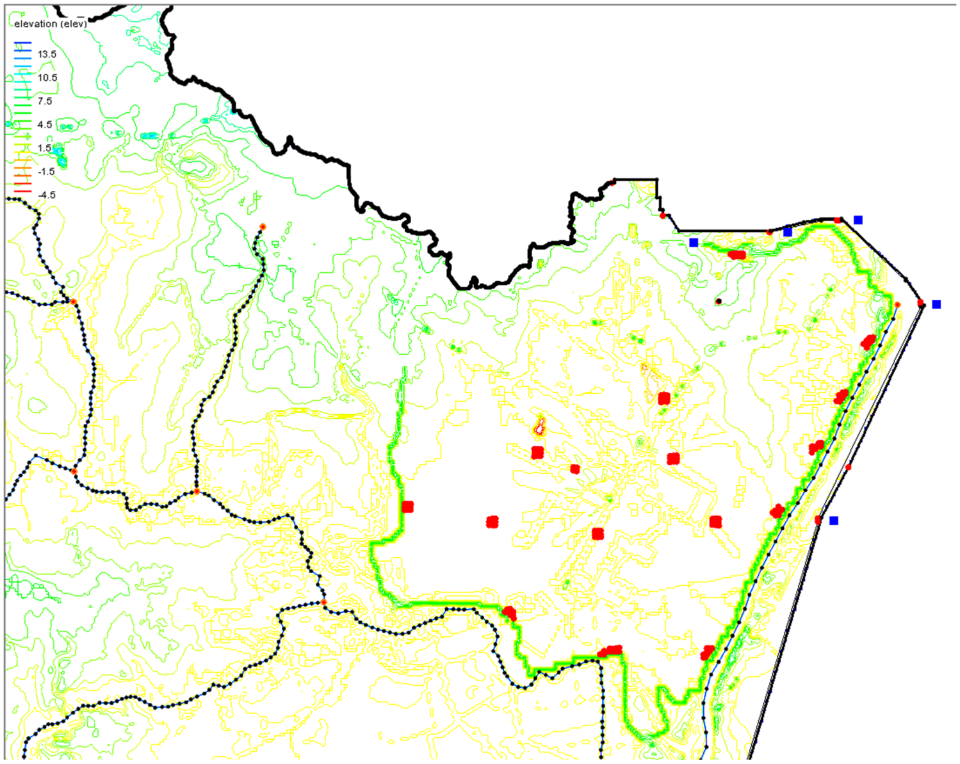
12. Pick another curve name (such as Pt25) for this boundary condition. This dialog box can be used to bring in any water level boundary condition required. Click O.K. several times.

13. Then save this *.wms file with the file menu to a *.wms file. Use another name other than CF_PortA.wms.

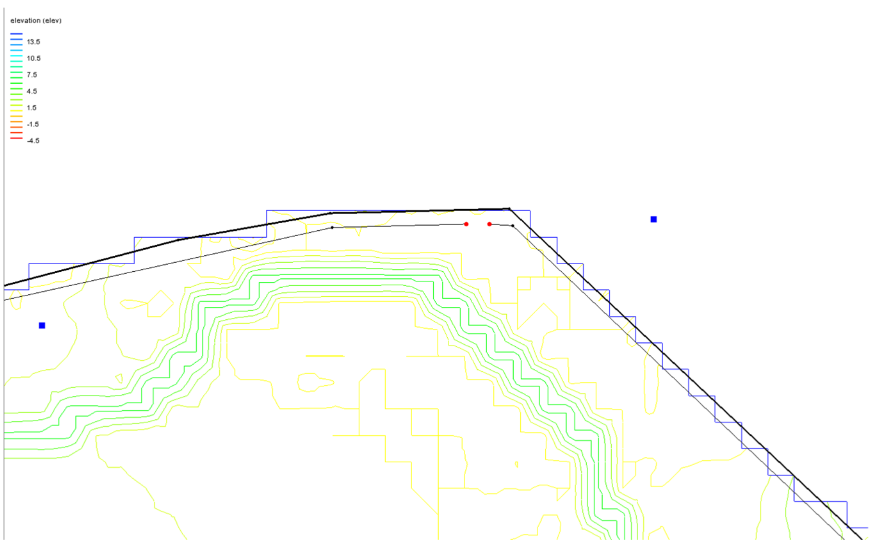
14. This has changed the ADCIRC boundary condition.

3.2 Review levee topography in GSSHA and WMS

1. Frame the model by selecting the frame icon: 
2. Zoom in on the portion of the model shown:



3. Zoom in on a portion of the levee shown as the green line as shown below



Note that the levee contours are within the DEM used to create elevations for the GSSHA model gird. In the Project explorer click on the Continuous Map/elevation dataset.

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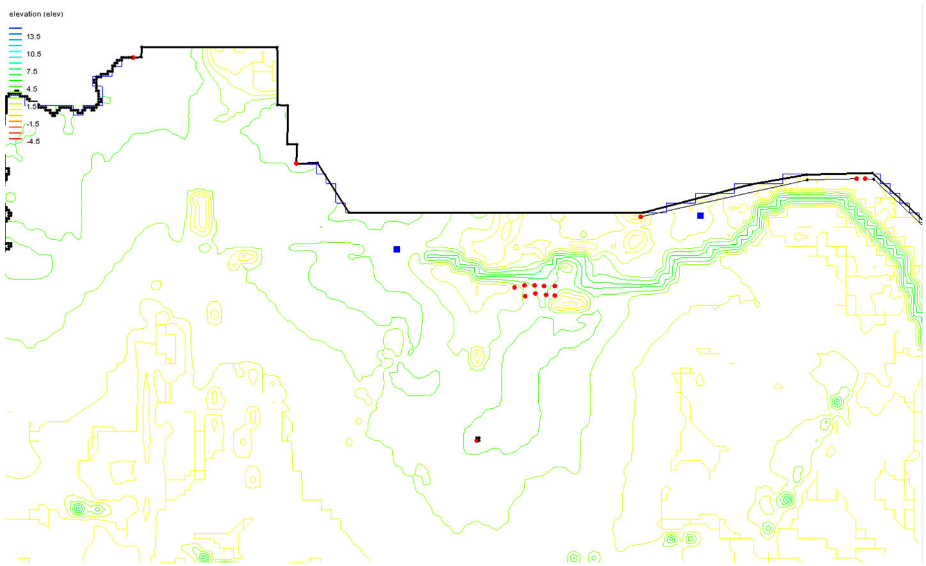
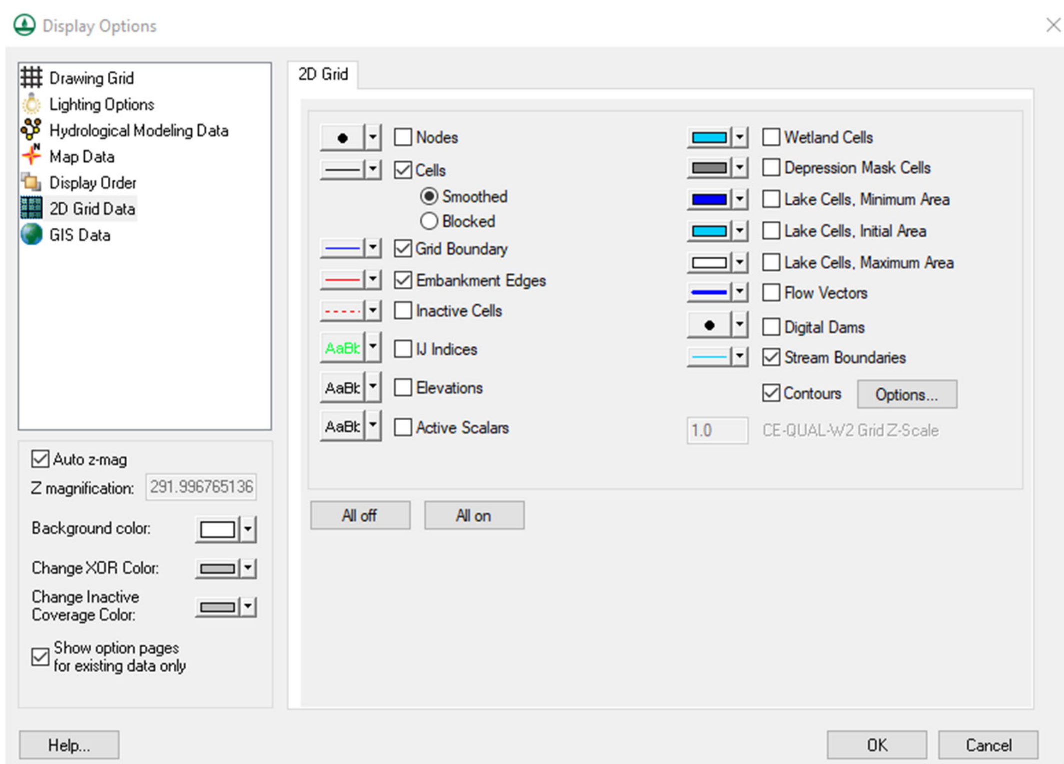
4 Review and Alter Pumping well data

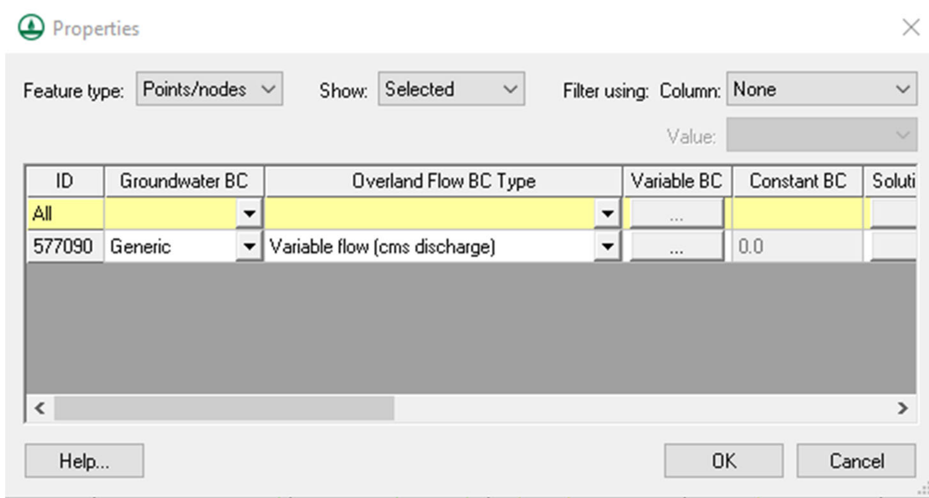
1. Frame the model using the frame icon: 
2. Zoom on the model so that once of the array of red dots that represents the pumping wells as shown.



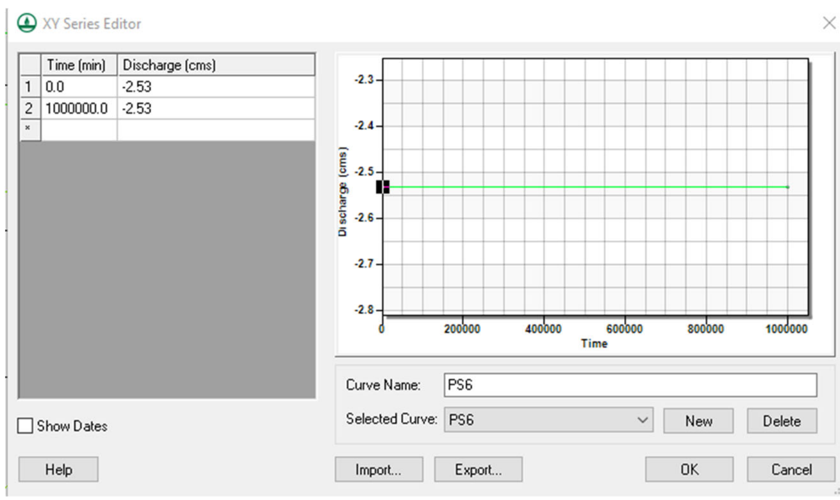
3. Zoom in again to display the points showing the red dots largely as shown.
4. Under the Display menu, turn on the Cells side lines. Click O.K.



5. Click on the GSSHA coverage.
6. Click on the select node tool: 
7. Double click on one of the red nodes and bring up the dialog box:



8. Double click on the Variable BC dialog and bring up the following box:



This shows the curve names used to create the pumping withdrawal for this cell. Change the pumping to another curve, such as PS17. This changes the pumping water taken from the overland flow plane, and this represents the pumping station water pumped over the levee into the river.

5 Overland Flow ADCIRC Boundaries

The overland flow boundaries in GSSHA provided by ADCIRC cannot be added into the GSSHA model with WMS, and must be added into the GSSHA model with a text editor. We will show how this is accomplished.

1. Navigate over to the directory CF_PortA_gssha.
2. Open the project file: CF_PortA.prj with a text editor.
3. The following cards are added to the GSSHA project file as shown below:

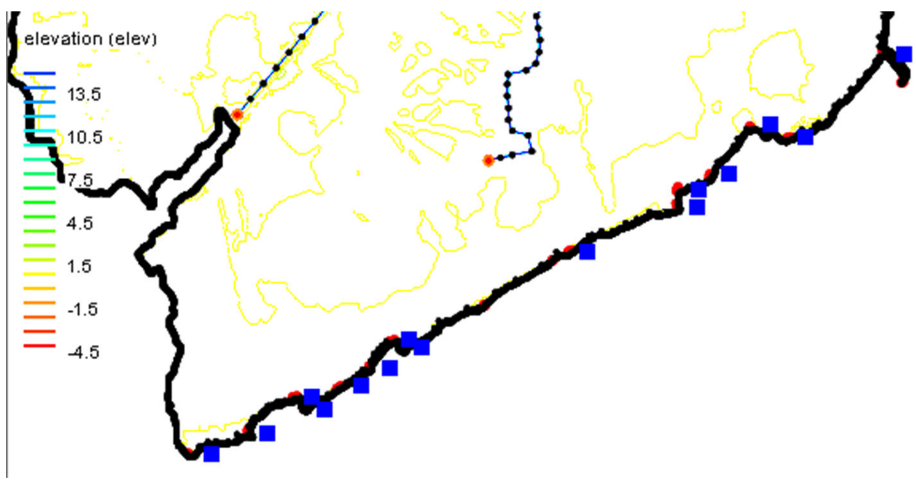
```
OVERTYPE                    ADE
OVERLAND_MOMENTUM
OV_BOUNDARY
XYBDYINPUT_OV_STAGE_INTERP "adcirc_stages_adjusted.txt"
```

4. An additional file is required that provides these inputs for the GSSHA model. This file is “adcirc_stages_adjusted.txt. Open this file with a text editor, with some of this file shown below:

adcirc_stages_adjusted.txt

```
XY_OV_DEPTH_INTERP
26
X                              389356.57   390727.04   391929.52   392157.12   393105.82   393824.81
Y                              3280746.01  3280936.34  3281535.26  3281196.40  3281549.29  3281796.38
2008    9    5    18    30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    19    0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    19    30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    20    0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    20    30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    21    0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    21    30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    22    0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    22    30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    23    0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    5    23    30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    0     0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    0     30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    1     0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    1     30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    2     0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    2     30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    3     0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    3     30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    4     0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    4     30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    5     0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    5     30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    6     0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    6     30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    7     0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    7     30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    8     0     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
2008    9    6    8     30    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
```

5. Scroll through this file, this file shows for the 26 required points the ADCIRC boundary for the overland flow plane. This portion of the model requiring these boundaries is shown below:



6 Hydrographs on the Levees from River/Ocean Storm Surge and Landside Water levels.

We will show the GSSHA model outputs on the 8 points along the Levee, with the hydrographs used for SEEP2D modeling.

1. Restart WMS and under the file menu select File new file.
2. Switch to the grid module,
3. Under the directory CF_PortA_gssha read in the file: CF_PortA.prj.

1. Under the GSSHA menu select the read solution file. Under select file pick CF_PortA.prj.
2. It will take a while for the depth file to be read in.
3. While that is working, use a text editor to open the file: levee_hydrographs.lpt, this file shows the hydrographs of combined compound flooding. This file shows the resulting total flow impacting the 16 levee points.

levee_hydrographs.lpt

0.00000000	1.454010	0.000000	0.000000	0.000000	0.000000
30.00000000	1.443687	0.000000	0.000000	0.000000	0.000000
60.00000000	1.442761	0.000000	0.000000	0.000000	0.000000
90.00000000	1.442257	0.000000	0.000000	0.000000	0.000000
120.00000000	1.441786	0.000000	0.000000	0.000000	0.000000
150.00000000	1.441262	0.000000	0.000000	0.000000	0.000000
180.00000000	1.440769	0.000000	0.000000	0.000000	0.000000
210.00000000	1.440276	0.000000	0.000000	0.000000	0.000000
240.00000000	1.439755	0.000000	0.000000	0.000000	0.000000
270.00000000	1.439293	0.000000	0.000000	0.000000	0.000000
300.00000000	1.438745	0.000000	0.000000	0.000000	0.000000
330.00000000	1.438287	0.000000	0.000000	0.000000	0.000000
360.00000000	1.437775	0.000000	0.000000	0.000000	0.000000
390.00000000	1.437266	0.000000	0.000000	0.000000	0.000000
420.00000000	1.436801	0.000000	0.000000	0.000000	0.000000
450.00000000	1.436268	0.000000	0.000000	0.000000	0.000000
480.00000000	1.435780	0.000000	0.000000	0.000000	0.000000
510.00000000	1.435301	0.000000	0.000000	0.000000	0.000000
540.00000000	1.434774	0.000000	0.000000	0.000000	0.000000
570.00000000	1.434286	0.000000	0.000000	0.000000	0.000000
600.00000000	1.433808	0.000000	0.000000	0.000000	0.000000
630.00000000	1.433294	0.000000	0.000000	0.000000	0.000000
660.00000000	1.432786	0.000000	0.000000	0.000000	0.000000
690.00000000	1.432305	0.000000	0.000000	0.000000	0.000000
720.00000000	1.431810	0.000000	0.000000	0.000000	0.000000
750.00000000	1.431298	0.000000	0.000000	0.000000	0.000000
780.00000000	1.430798	0.000000	0.000000	0.000000	0.000000
810.00000000	1.430309	0.000000	0.000000	0.000000	0.000000
840.00000000	1.429822	0.000000	0.000000	0.000000	0.000000

4. Look at the flood_grid and depth files in the project explorer to see the total maximum flood depth and the overland flow depth at the many different time periods.