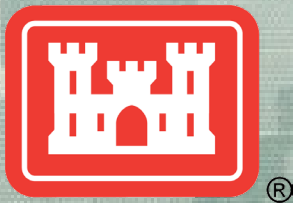# Creating a Bathymetric Database & Datum Conversion
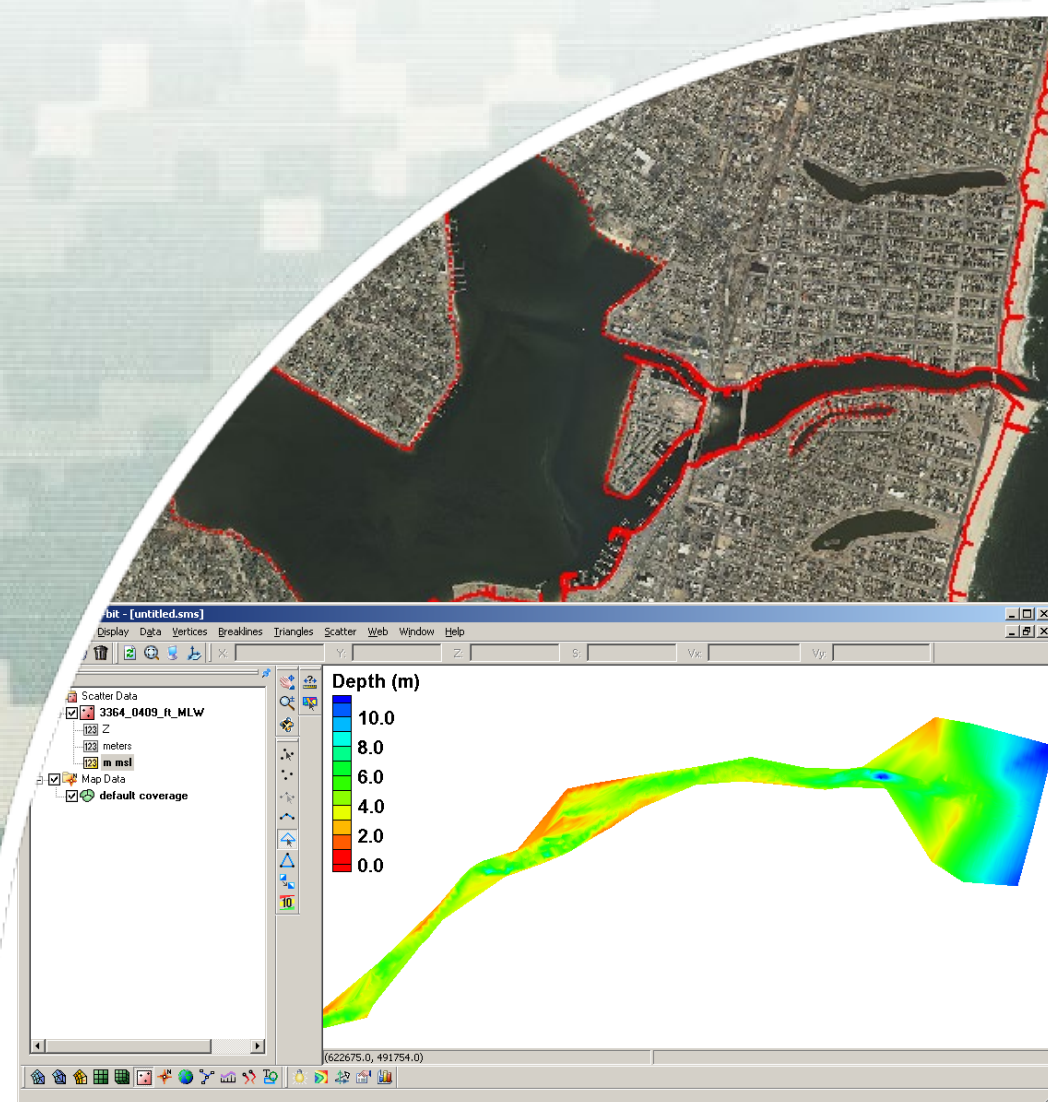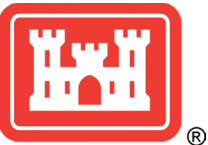
Mitchell Brown

Civil Engineering Technician

Mitchell.E.Brown@usace.army.mil

CIRP

Mission Support

Technology Transfer

Research & Development

US Army Corps of Engineers

BUILDING STRONG®

- Introduction to working with bathymetric datasets

  - *Importing Datasets (xyz, points, shapefiles, other ascii)*

- *Datum Conversion*

 - *SMS conversion (Corpscon; Global Mapper)*

Multiple Bathymetric Datasets

- Limited bay bathymetry

- NOAA – Offshore datasets

- LIDAR – Shoreline and nearshore (important for structure resolution)

- Channel
  - ► NJ State maintains north channel and north bay channel
  - ► Federally maintained entrance and south channel (15 years)

- NAN-supported field data collection
  - ► Included bathymetry of the backbay (Spring High Tide)

CIRP
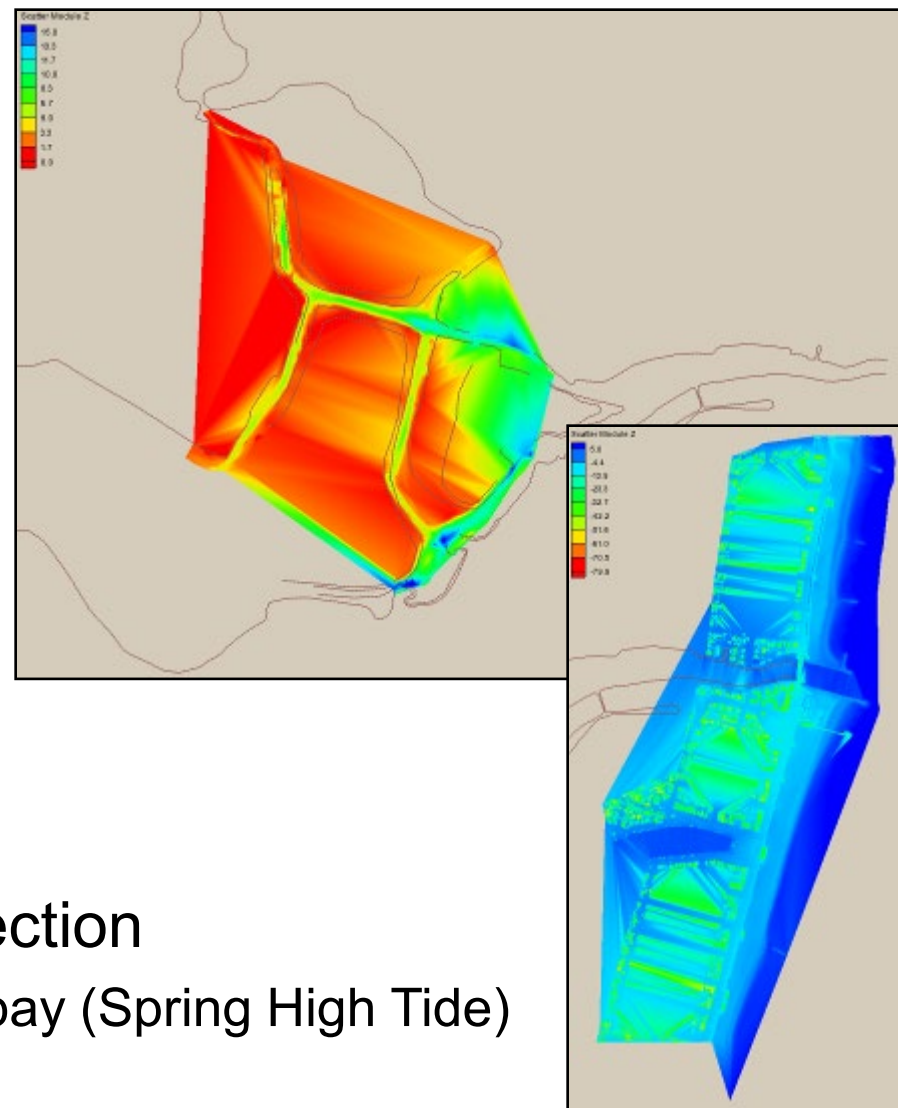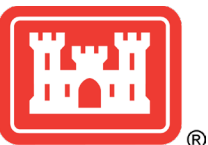
Horizontal Projection & Datum: Pick a system in metric units that is planar (UTM; State Plane)

Vertical Projection & Datum: Must be in metric as well; Datum is not necessary (Local)

…Need to convert all bathymetric data

Tides and Currents (NOAA)

https://tidesandcurrents.noaa.gov/stations.html?type=Datums

- Based on a Cartesian or Quadtree (telescoping) grid
  - Planar coordinate system
  - CMS Model computation is in metric and depths are positive from zero
    - SMS 13.1 and later works with elevations, but exports depths to CMS files
  - Grid is generated based on a single bathymetry stored in SMS scatterset or raster format
  - Vertical datum is not specified and is assumed local
    - The boundary condition forcing (tidal) must be in the same datum as the bathymetry
    - Typically modeling grids are brought to a mean datum such as mean sea level (msl) or mean tide level (mtl)
- → This requires that all imported datasets projections are defined, and final dataset uses a unified projection, datum, and units
  - Shark River Inlet bathymetry will be converted to State Plane horizontal coordinates in meters with the vertical datum set to MSL in meters
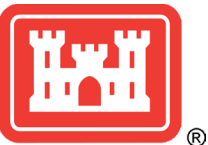
Converting Depths to Elevations
(CMS Requirement)
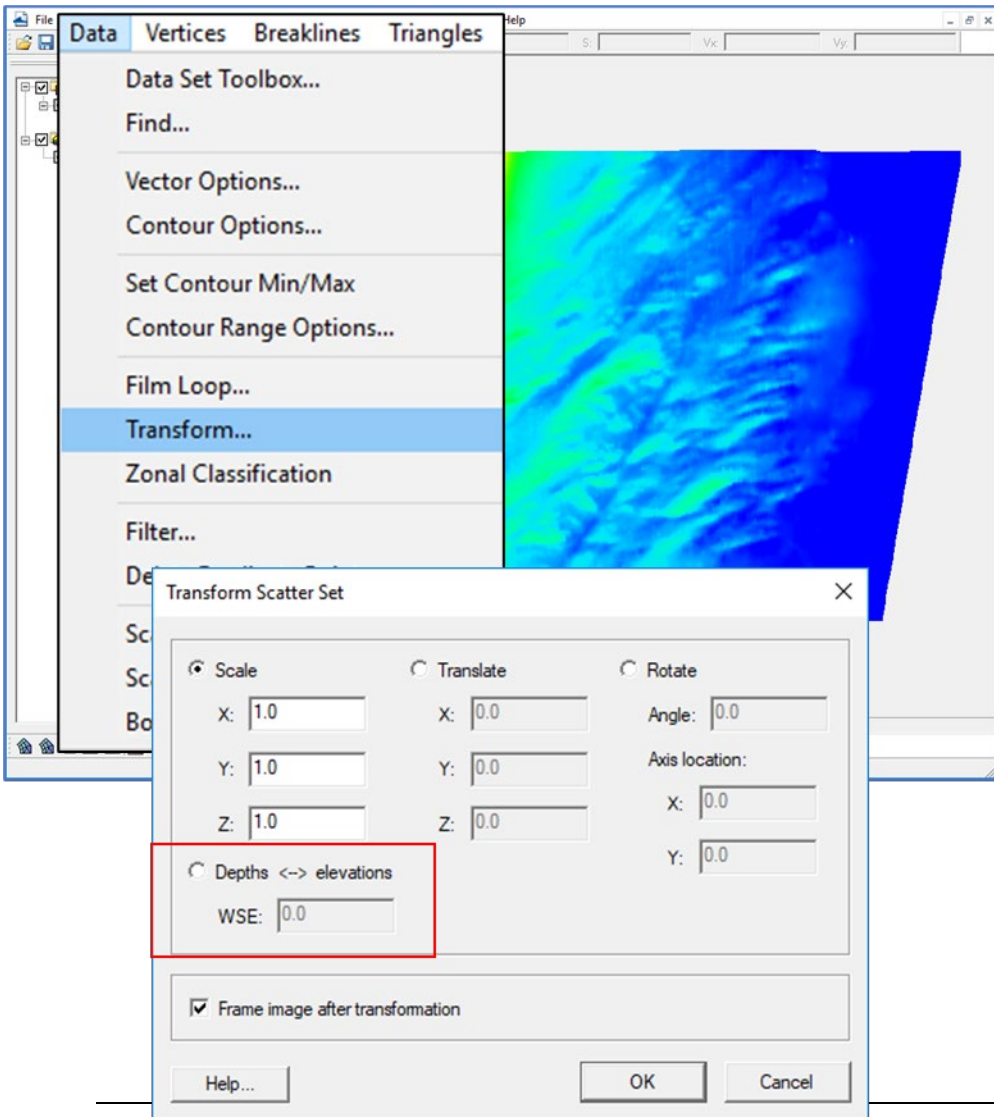
When loading old projects, SMS 13.1 will sometimes change the sign of the depth dataset. This does not always work. Check the sign of the deep water.

Data → Transform
Can adjust scatterset data by scaling, translating (adding/subtracting), or rotating horizontal or vertical

Select Depths ←→ Elevations
Flips sign from depths to elevations (positive down to positive up).
Necessary for CMS model calculation.
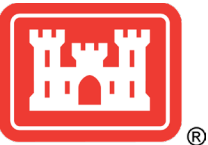
15 Year Record of Bathymetry

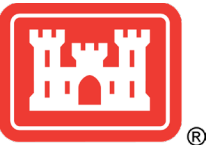| Date	Survey Type	Date	Survey Type
1-Jan-1995	Condition	28-Mar-2007	Condition
6-Jan-1998	Condition	30-Aug-2007	Before Dredge
6-May-1999	Condition	4-Jan-2008	After Dredge
11-Apr-2000	Condition	25-Mar-2008	Condition
16-Apr-2002	Condition	9-Jun-2008	After Dredge
6-Dec-2002	Before Dredge	31-Oct-2008	After Dredge
18-Jan-2003	After Dredge	8-Dec-2008	Before Dredge
7-Jul-2003	Condition	6-Jan-2009	After Dredge
7-Aug-2003	After Dredge	15-Apr-2009	Before Dredge
28-Apr-2004	Condition	1-May-2009	After Dredge
10-Jun-2005	Condition	20-Aug-2009	Before Dredge
23-Dec-2005	After Dredge	10-Dec-2009	After Dredge
23-May-2006	Condition	6-Jan-2010	After Dredge
27-Nov-2006	Condition		
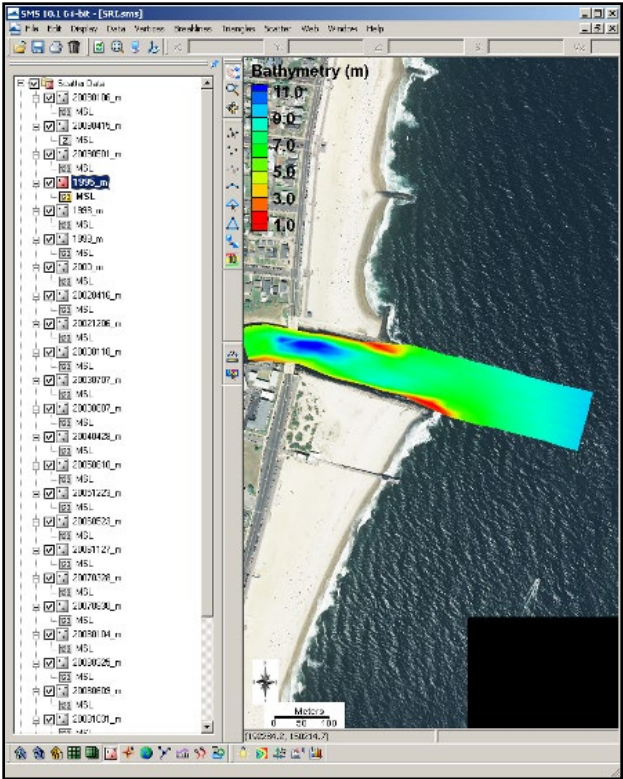
Horizontal Datum:

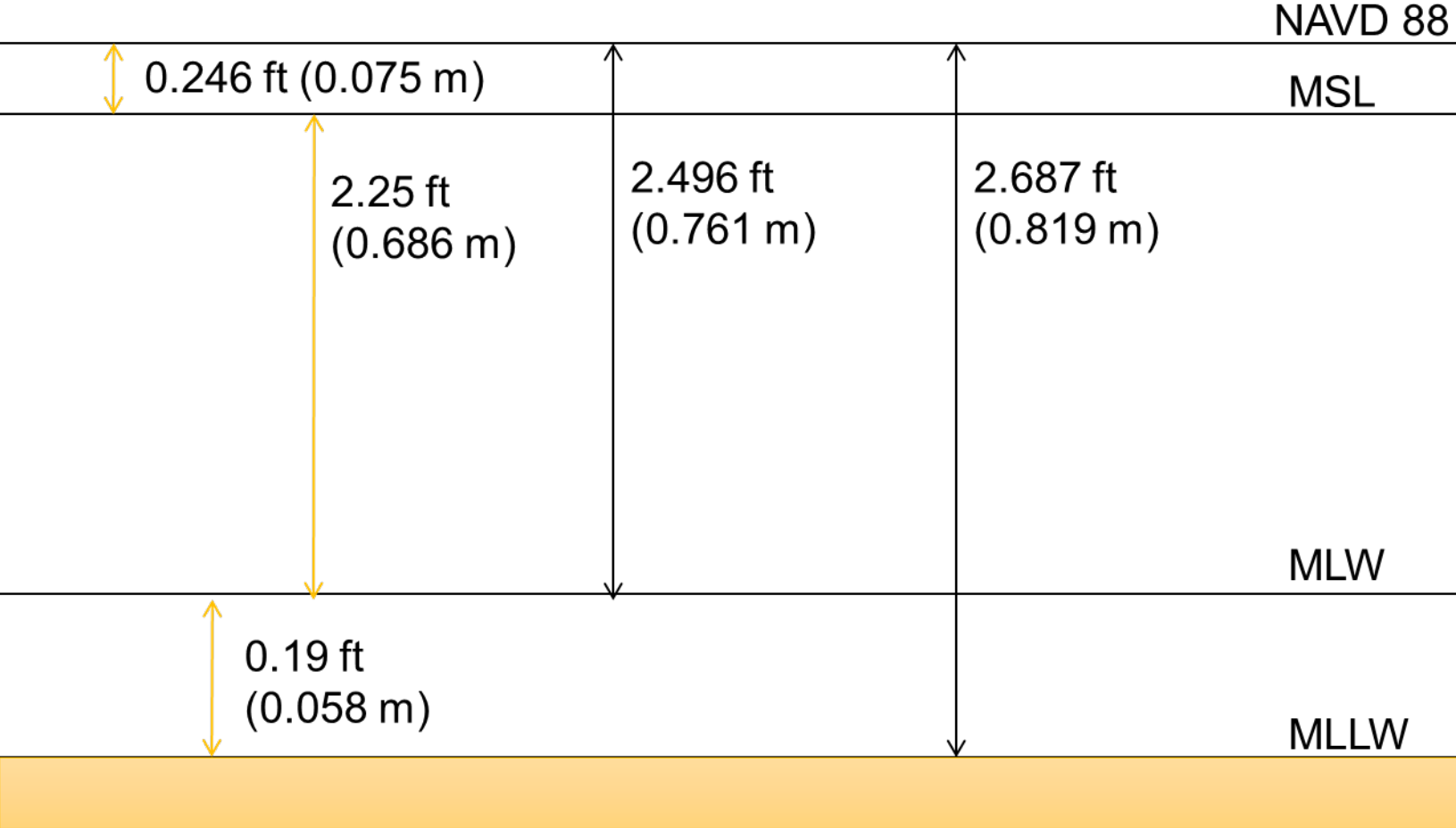　　　State Plane NAD27 New Jersey 2900 (ft)

Vertical Datum:

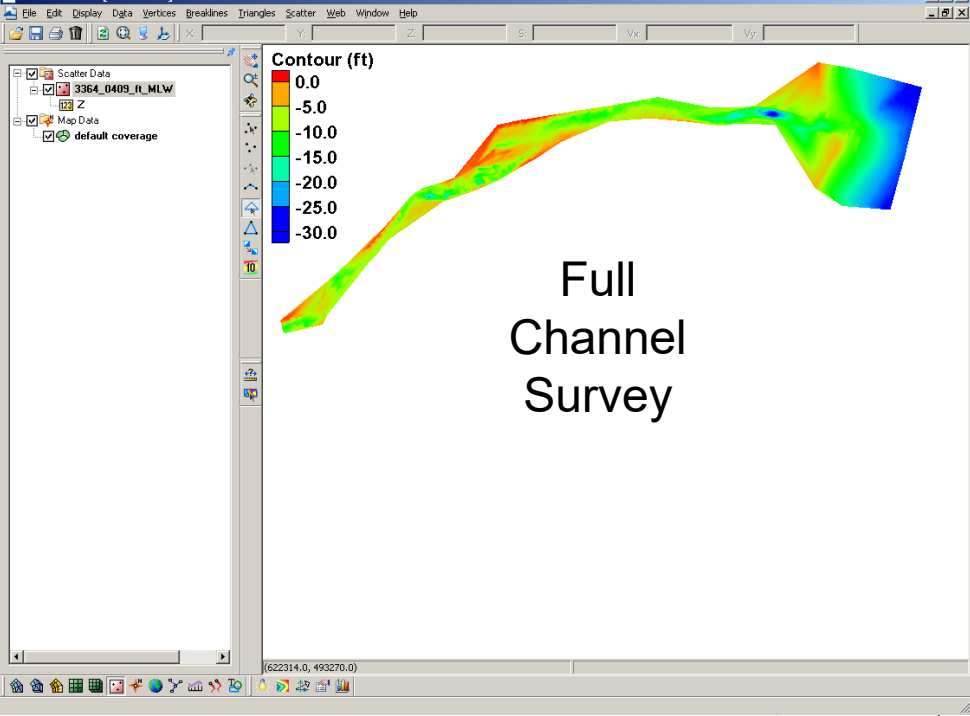　　　MLW (ft) – COE Datum (not local NOAA benchmark)

NOAA (Long Branch)

NAVD 88

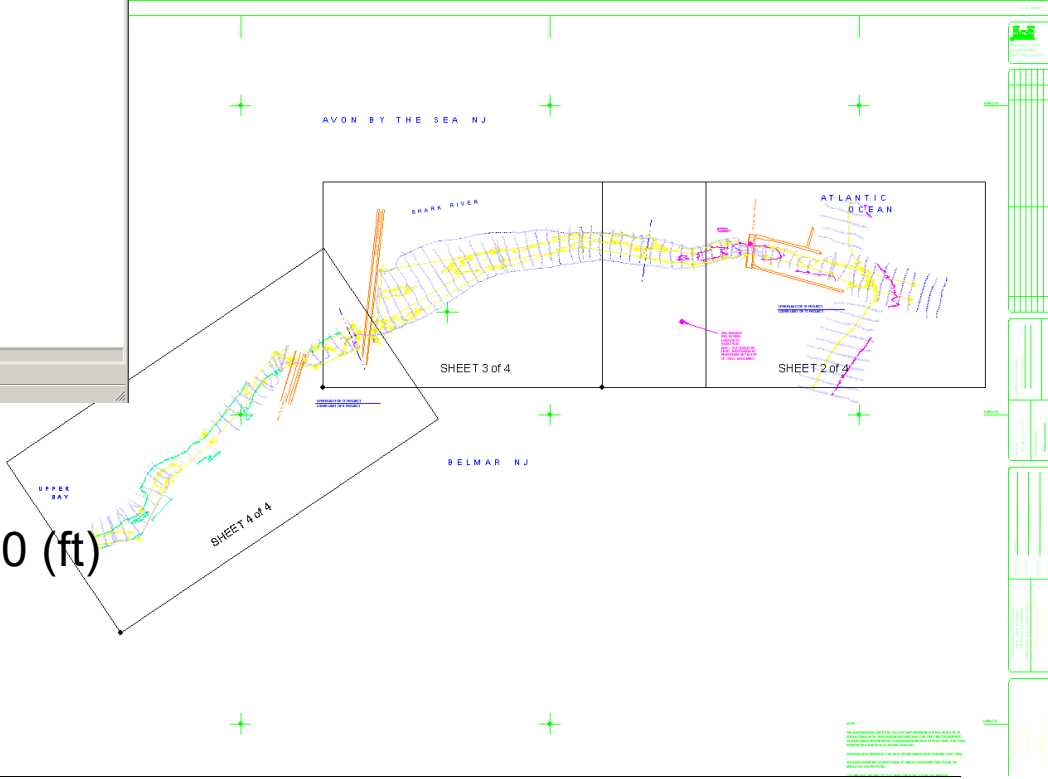0.246 ft (0.075 m)

MSL

2.25 ft
(0.686 m)

2.496 ft
(0.761 m)

2.687 ft
(0.819 m)

MLW

0.19 ft
(0.058 m)

MLLW

MLW → MSL
2.25 ft (0.686 m)

Full
Channel
Survey

Horizontal Datum:

State Plane NAD27 New Jersey 2900 (ft)

Vertical Datum:
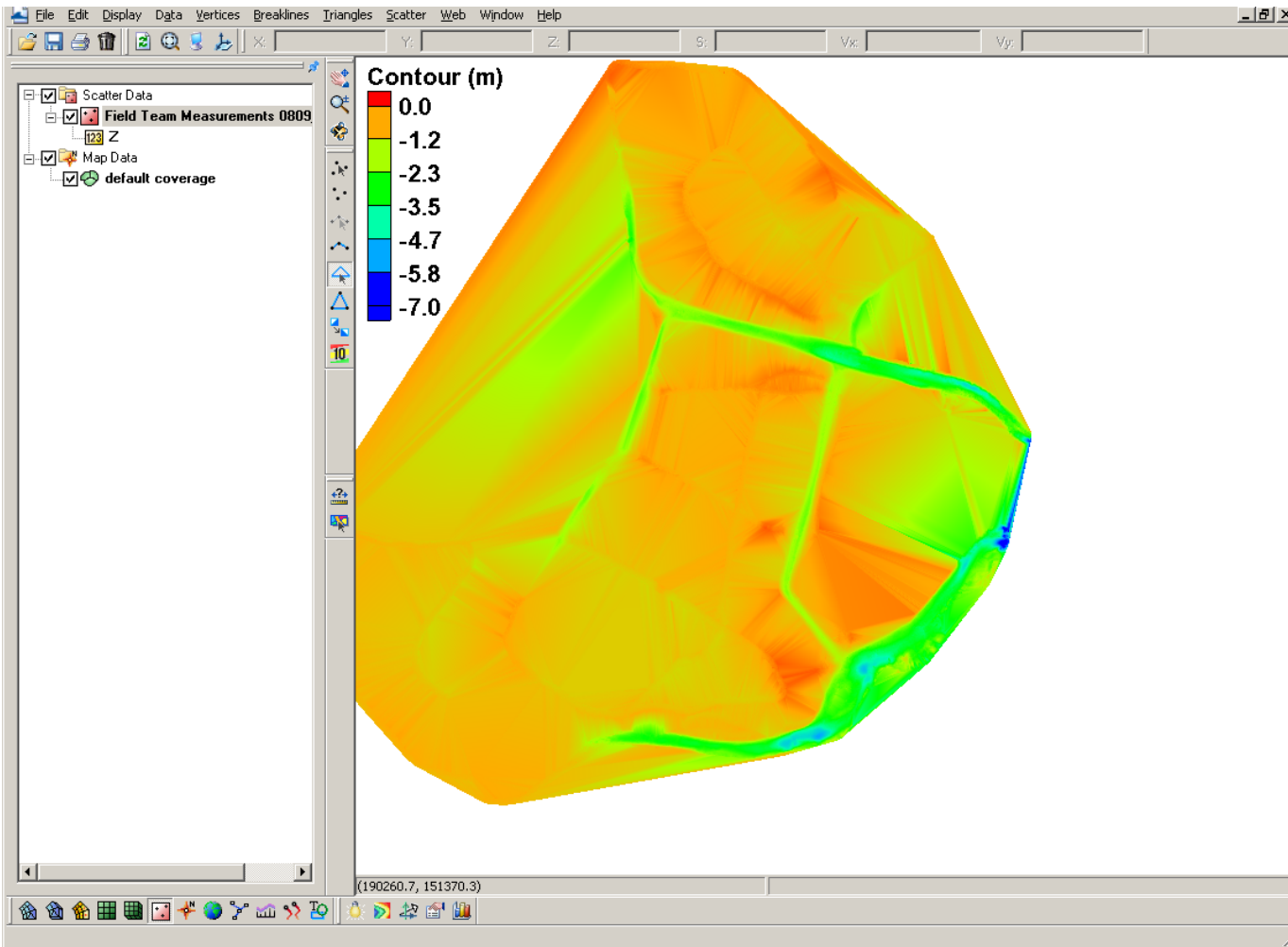
MLW (ft)

10

Dataset Toolbox | Data Calculator

June 2009
Survey

Provided conversion from local datum
to MSL:

MLW → MSL
2.25 ft (0.686 m)

XYZ pulled out of drawing and
changed to ASCII format

Horizontal Datum:

State Plane NAD83 New Jersey 2900 (m)

Vertical Datum:

NAVD88 (m)
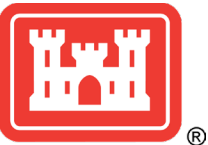
LIDAR

- Files are emailed in separate sections from the NOAA CSC Archive
  - Typically, several to 10s of files that are 5 - 100 mb in size
- Compiling takes time
  - Points have been sampled/filtered and cropped to area of interest

Horizontal Datum:

State Plane NAD83 New Jersey 2900 (ft)

Vertical Datum:

NAVD88 (ft)

Depth (ft)
82.0
65.0
48.0
31.0
14.0
-3.0
-20.0
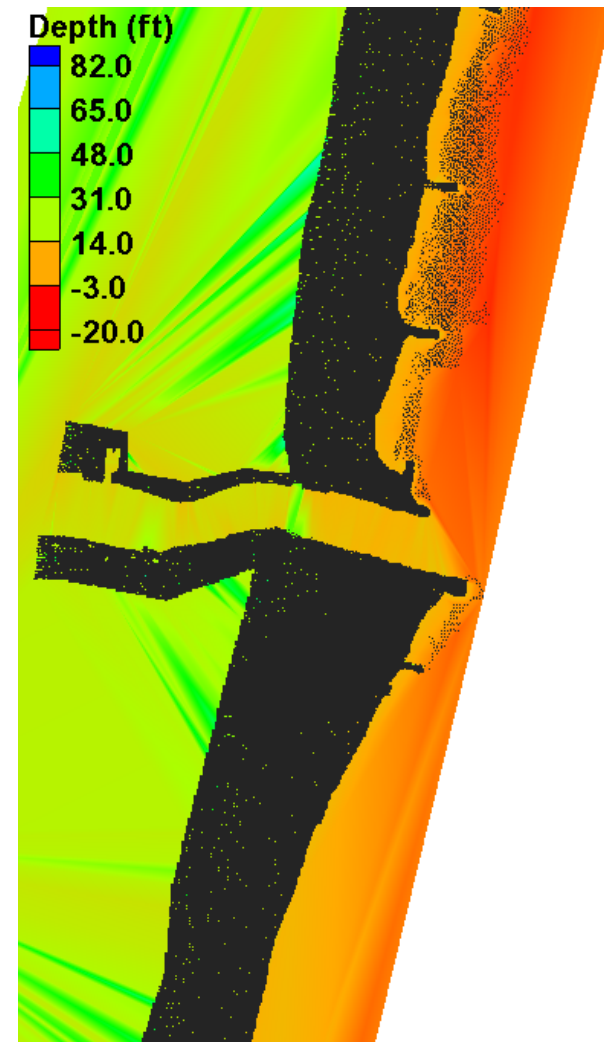
Coastal Relief Model (DTM/DEM)

CIRP

Generate a 3 sec
(pt/3rd second) grid

15
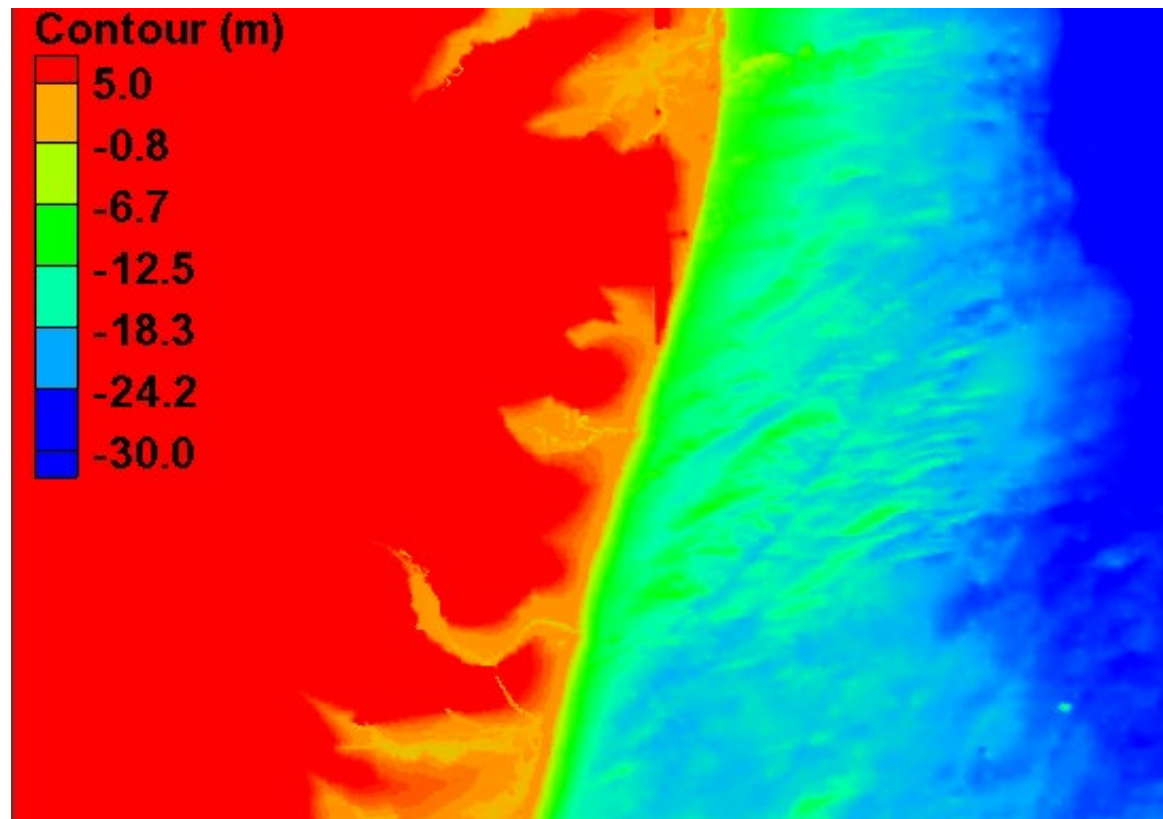
Horizontal Datum:

Geographic NAD83

Vertical Datum:

MSL (m) - Not accurate for shallow bathymetry (used for offshore)

- Convert shoreline shapefile in SMS

Horizontal Datum:

State Plane NAD83 New Jersey 2900 (ft)
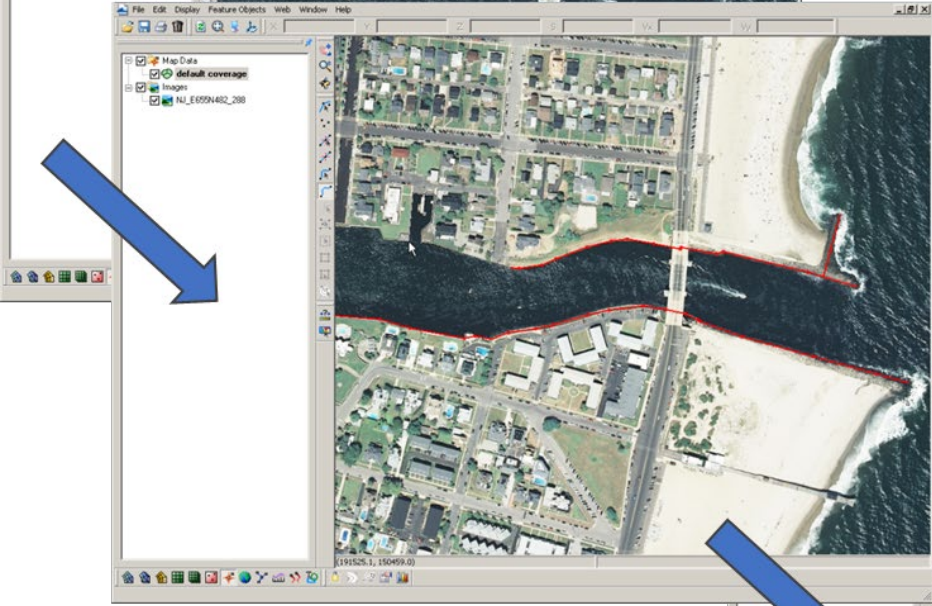
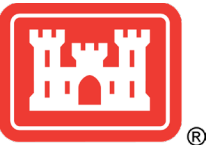- Added extra bay contour (set to 0.75 m above MSL)

Select Default Coverage under Map Data Type → Generic → Mapping/Observation/Shoals
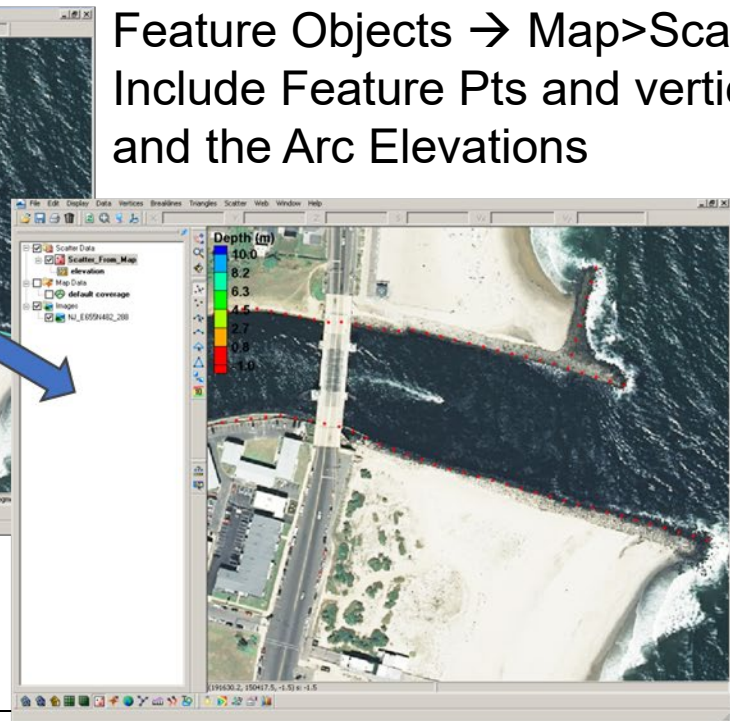
Draw arcs (polylines) feature with [tool icon] tool

Select arcs [tool icon] and convert the z elevation to the desired contour elevation
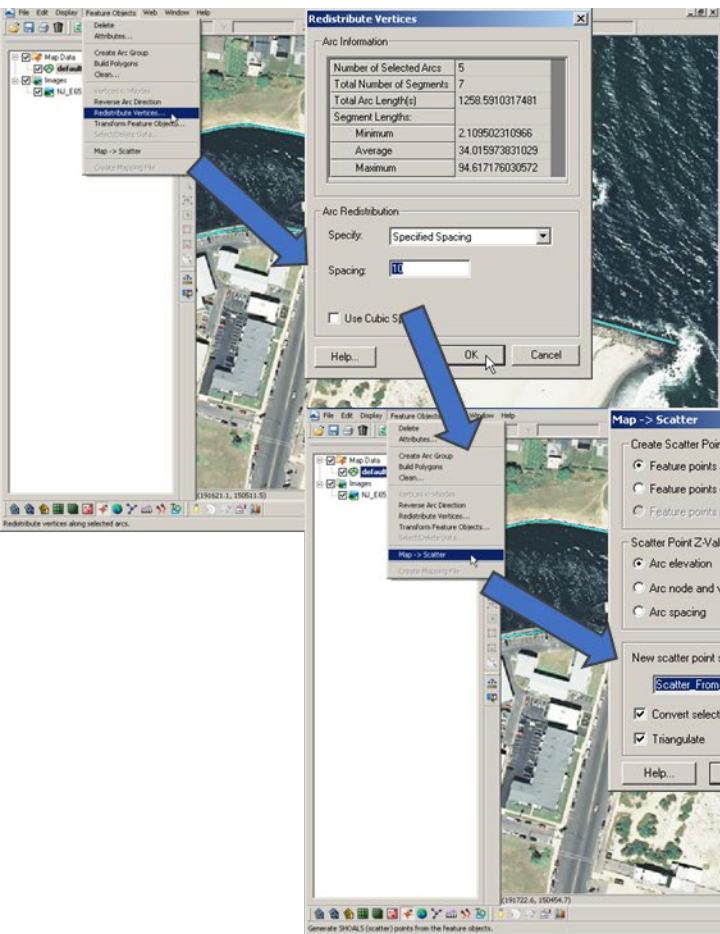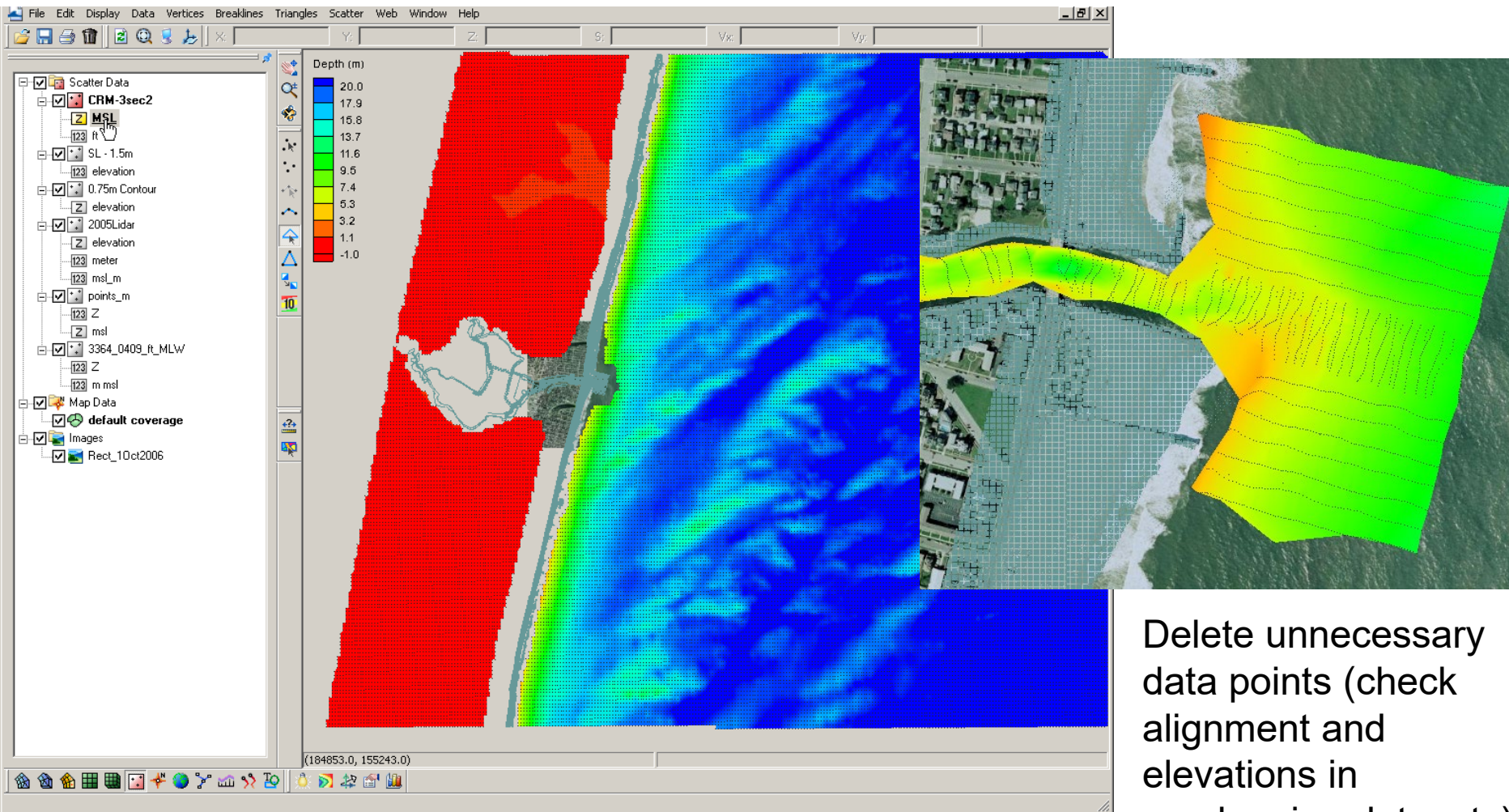
Select arcs to redistribute the spacing of vertices
Feature Objects → Redistribute Vertices
Specify Spacing based on horizontal coordinate system units (metric in this case)
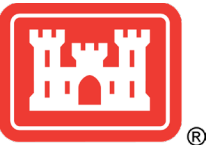
Feature Objects → Map>Scatter
Include Feature Pts and vertices and the Arc Elevations

Delete unnecessary data points (check alignment and elevations in overlapping datasets)

Merging Scattersets

Merging all scattersets will integrate all points. Overlapping areas of scattersets should either be deleted or use a separate method of merging (by prioritizing using triangles).

Select the dataset

Questions?

Mitch Brown
Mitchell.E.Brown@usace.army.mil
601-634-4036