

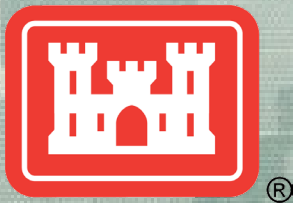
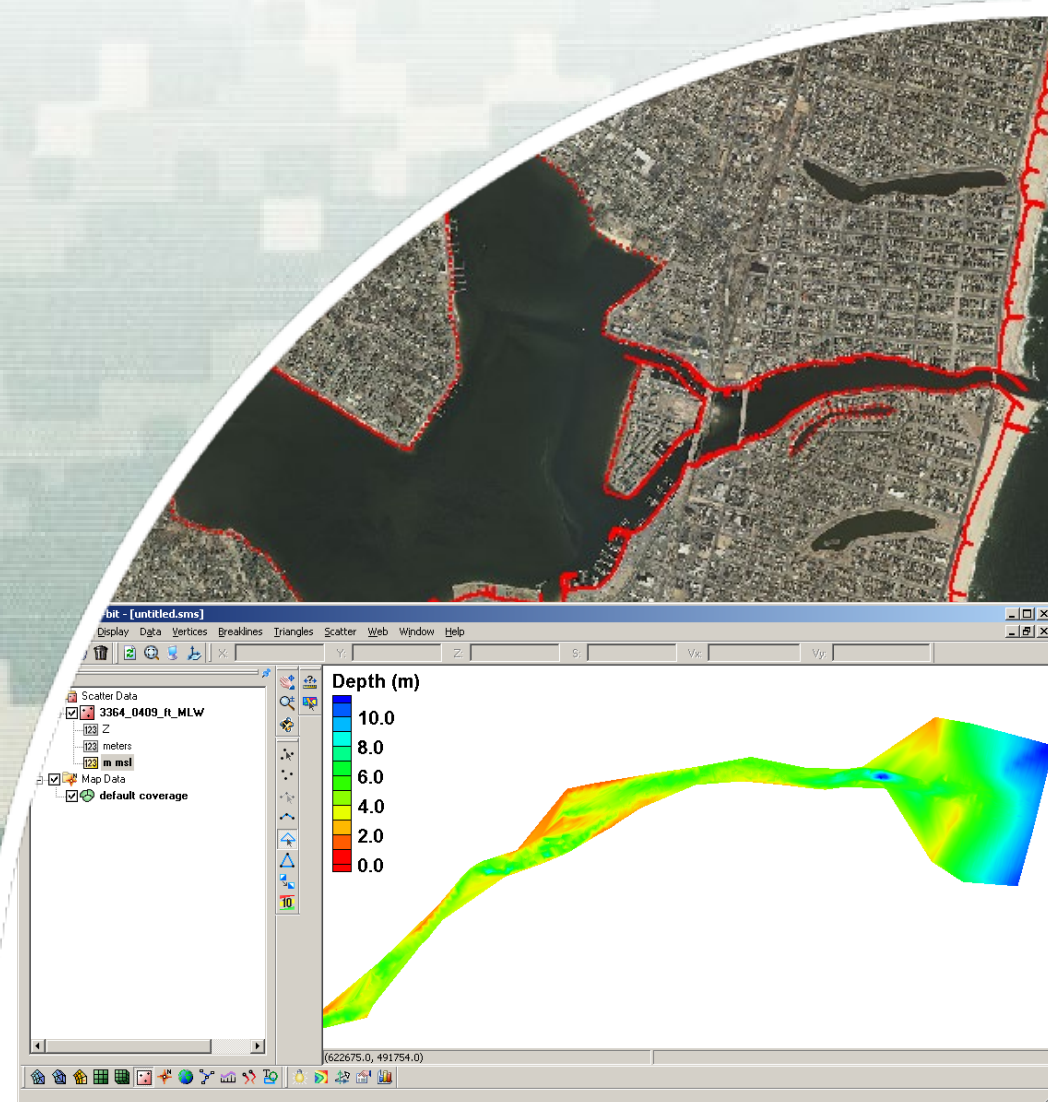
Creating a Bathymetric Database & Datum Conversion



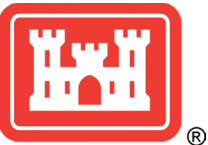
Mitchell Brown

Civil Engineering Technician

Mitchell.E.Brown@usace.army.mil



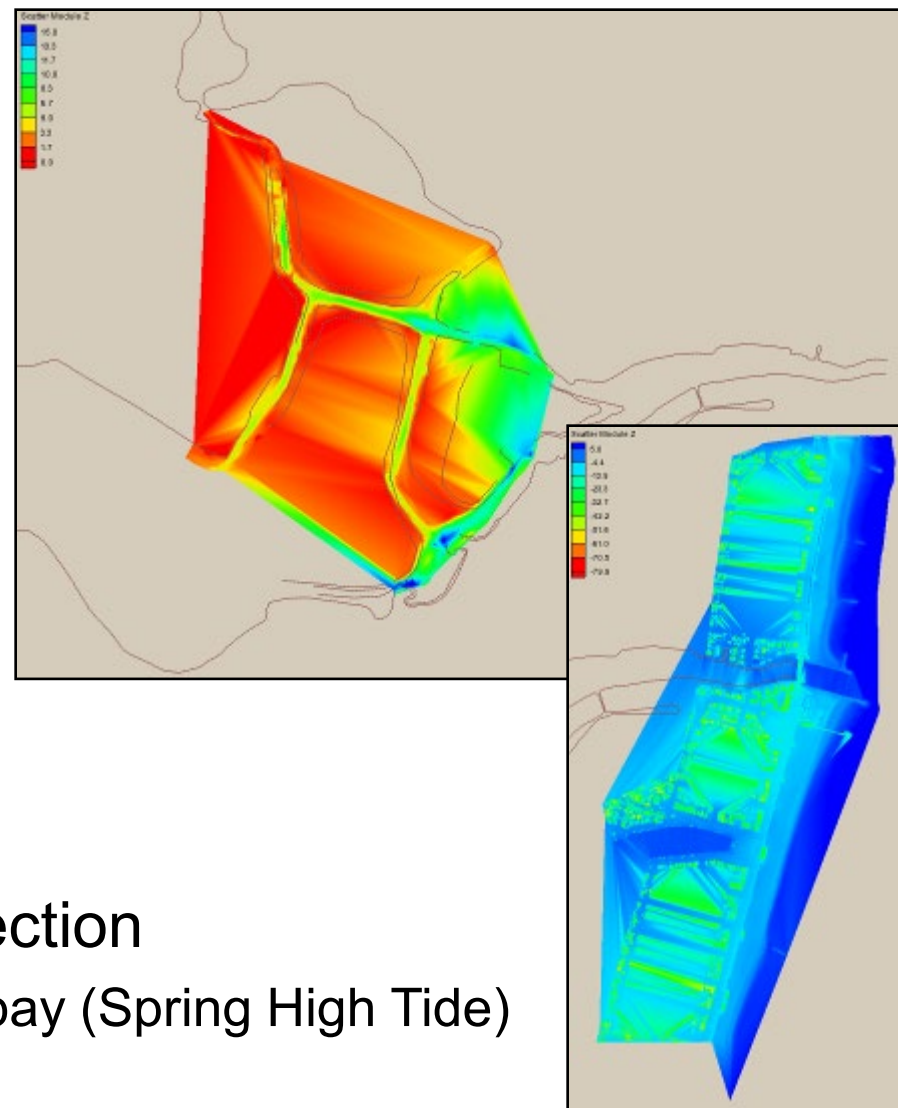
US Army Corps of Engineers
BUILDING STRONG

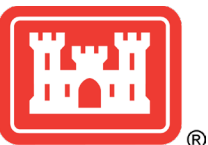


Multiple Bathymetric Datasets



- 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)





Common Spatial Reference Datum & Vertical Datum



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)

Horizontal Projection

- > Continental
- > County Systems
- > Gauss Kruger
- > National Grids
- > Polar
- > State Plane
- > State Systems
- > UTM
- > World
- > World (Sphere-based)

Filter strings:

Add projection from:

Projection name:
NAD_1983_StatePlane_New_Jersey_FIPS_2900

WKT:
PROJCS["NAD_1983_StatePlane_New_Jersey_FIPS_2900",GEOGCS["GCS_North_American_1983",DATUM["D_North_American_1983",SPHEROID["GRS_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],PROJECTION["Transverse_Mercator"],PARAMETER["False_Northing",150000.0],PARAMETER["False_Easting",150000.0],PARAMETER["Central_Meridian",-74.5],PARAMETER["Scale_Factor",0.9999],PARAMETER["Latitude_Of_Origin",38.83333333333333],AUTHORITY["EPSG",32111]]

Horizontal Projection

- > NAD 1983 (2011) (US Feet)
- > NAD 1983 (CORS96) (Meters)
- > NAD 1983 (CORS96) (US Feet)
- ▼ NAD 1983 (Meters)
 - NAD 1983 StatePlane New Jersey FIPS 2900 (Meters)
- ▼ NAD 1983 (US Feet)
 - NAD 1983 StatePlane New Jersey FIPS 2900 (US Feet)
- > NAD 1983 HARN (Meters)
- > NAD 1983 HARN (US Feet)
- > NAD 1983 NSRS2007 (Meters)

Filter strings:

Add projection from:

Projection name:
NAD_1983_StatePlane_New_Jersey_FIPS_2900

WKT:
PROJCS["NAD_1983_StatePlane_New_Jersey_FIPS_2900",GEOGCS["GCS_North_American_1983",DATUM["D_North_American_1983",SPHEROID["GRS_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],PROJECTION["Transverse_Mercator"],PARAMETER["False_Northing",150000.0],PARAMETER["False_Easting",150000.0],PARAMETER["Central_Meridian",-74.5],PARAMETER["Scale_Factor",0.9999],PARAMETER["Latitude_Of_Origin",38.83333333333333],AUTHORITY["EPSG",32111]]

Display Projection

Horizontal

No projection Units:

Global projection

Projection name:
NAD_1983_StatePlane_New_Jersey_FIPS_2900

WKT:
PROJCS["NAD_1983_StatePlane_New_Jersey_FIPS_2900",GEOGCS["GCS_North_American_1983",DATUM["D_North_American_1983",SPHEROID["GRS_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],PROJECTION["Transverse_Mercator"],PARAMETER

Vertical

Datum: Units:

...Need to convert all bathymetric data



Tides and Currents (NOAA)



NOAA TIDES & CURRENTS

PRODUCTS Data, Analyses, and Publications | PROGRAMS Serving the Nation | EDUCATION Tides, Currents, and Products

Home / Products / Datums

Datums - Station Selection

Datum Errors for East Coast | Datum Errors for Gulf Coast | Datum Errors for West Coast

Present Epoch | Superseded Epoch

Sort by Name Station ID

Alabama

8730667	Alabama Point, AL	8731952	BON SECOURS ISLAND, AL
8737138	Chickasaw Creek, AL	8736897	Coast Guard Station, AL
8735180	Dauphin Island, AL	8735391	Dog River Bridge, AL
8731439	Gulf Shores, ICWW, AL	8737373	Lower Bryant Bridge, AL
8737048	Mobile State Docks, AL	8733821	Point Clear, AL
8738043	West Fowl River Bridge, AL		

Alaska

9455120	AGNES COVE, AK	9456901	AGUCHIK ISLAND, AK
9455146	AIALIK SILL, AIALIK BAY, AK	9460150	ATTU, MASSACHUSETTS
9462719	Akun Cove, Akun Island, AK	9462694	Akutan, Alaska
9455606	Anchor Point, Cook Inlet, AK	9451317	Anchor Point, Alaska
9454794	Applegate Island, AK	9461710	Atka, AK
9450906	BECK ISLAND, CLARENCE	9454907	BLACKSTONE ISLAND, AK

Elevations on Station Datum

Station: 8531991, LONG BRANCH, FISHING PIER, NJ T.M.: 75
 Epoch: 1983-2001
 Status: Accepted (Apr 17 2003) Datum: STND
 Units: Meters

Datum	Value	Description
MHHW	7.294	Mean Higher-High Water
MHW	7.189	Mean High Water
MTL	6.519	Mean Tide Level
MSL	6.534	Mean Sea Level
DTL	6.542	Mean Diurnal Tide Level
MLW	5.848	Mean Low Water
MLLW	5.790	Mean Lower-Low Water
NAVD88	6.609	North American Vertical Datum of 1988
STND	0.000	Station Datum
GT	1.504	Great Diurnal Range
MN	1.341	Mean Range of Tide
DHQ	0.105	Mean Diurnal High Water Inequality
DLQ	0.058	Mean Diurnal Low Water Inequality
HWI	12.260	Greenwich High Water Interval (in hours)
LWI	6.040	Greenwich Low Water Interval (in hours)
Max Tide	8.269	Highest Observed Tide
Max Tide Date & Time	01/02/1987 09:12	Highest Observed Tide Date & Time
Min Tide	4.389	Lowest Observed Tide
Min Tide Date & Time	01/10/1978 21:00	Lowest Observed Tide Date & Time
HAT		Highest Astronomical Tide
HAT Date & Time		HAT Date and Time
LAT		Lowest Astronomical Tide

Datums for 8531991, LONG BRANCH, FISHING PIER, NJ

All figures in meters relative to station datum

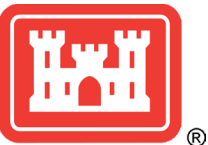
Showing datums for: 8531991 LONG BRANCH, FISHING PIER, NJ

Data Units: Feet Meters

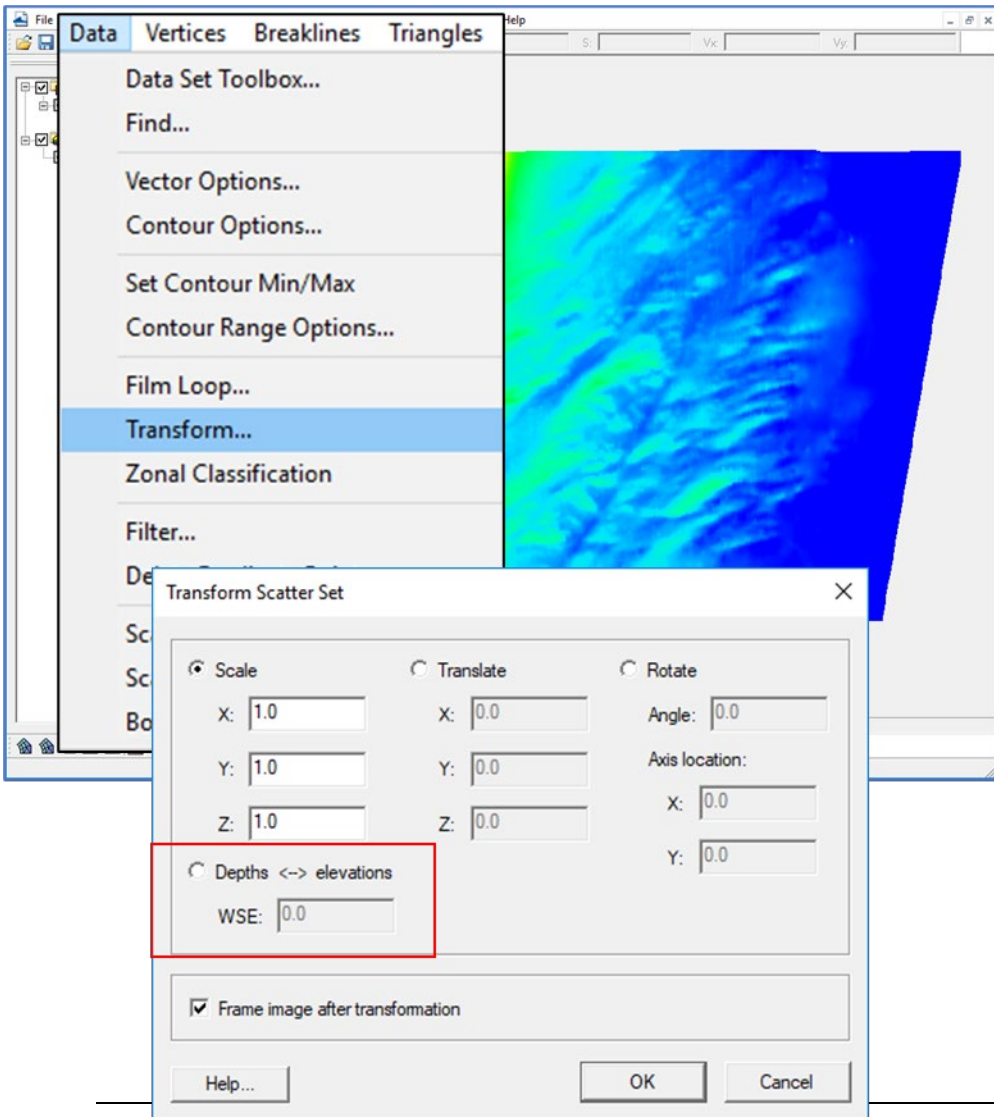
Epoch: Present (1983-2001) Superseded (1960-1978)



- 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



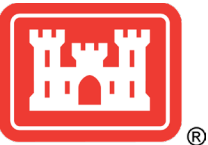
Converting Depths to Elevations (CMS Requirement)



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.

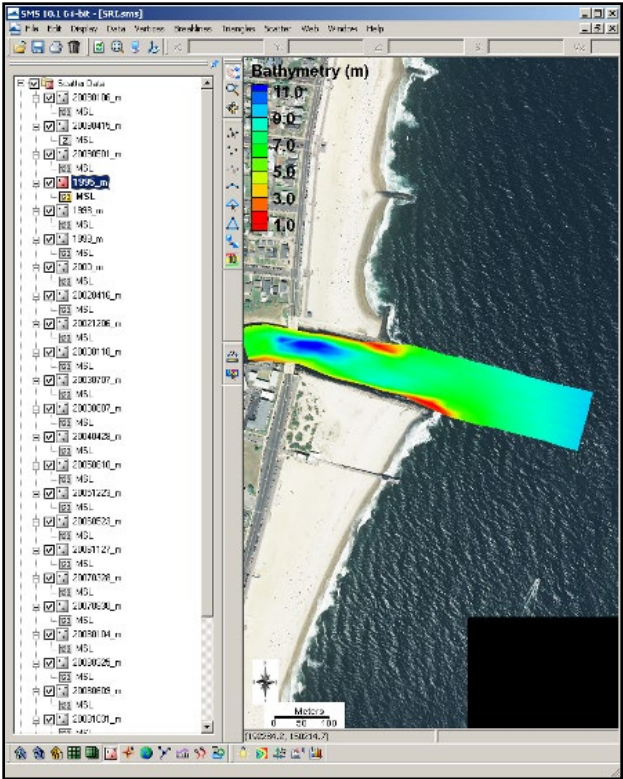


NAN Channel Surveys



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		

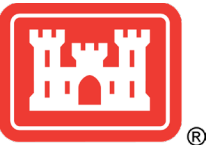


Horizontal Datum:

State Plane NAD27 New Jersey 2900 (ft)

Vertical Datum:

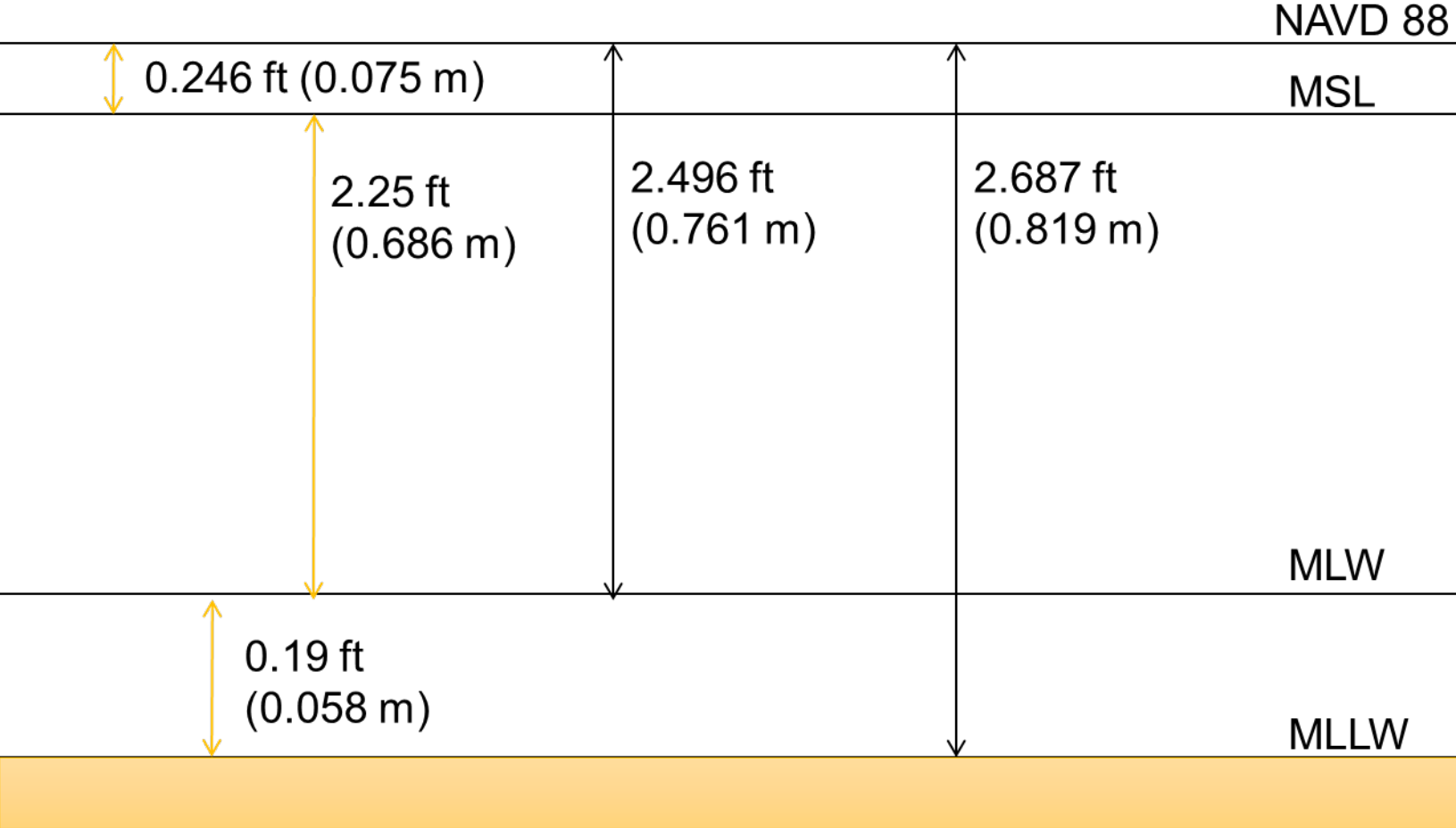
MLW (ft) – COE Datum (not local NOAA benchmark)



Vertical Datum Relationships

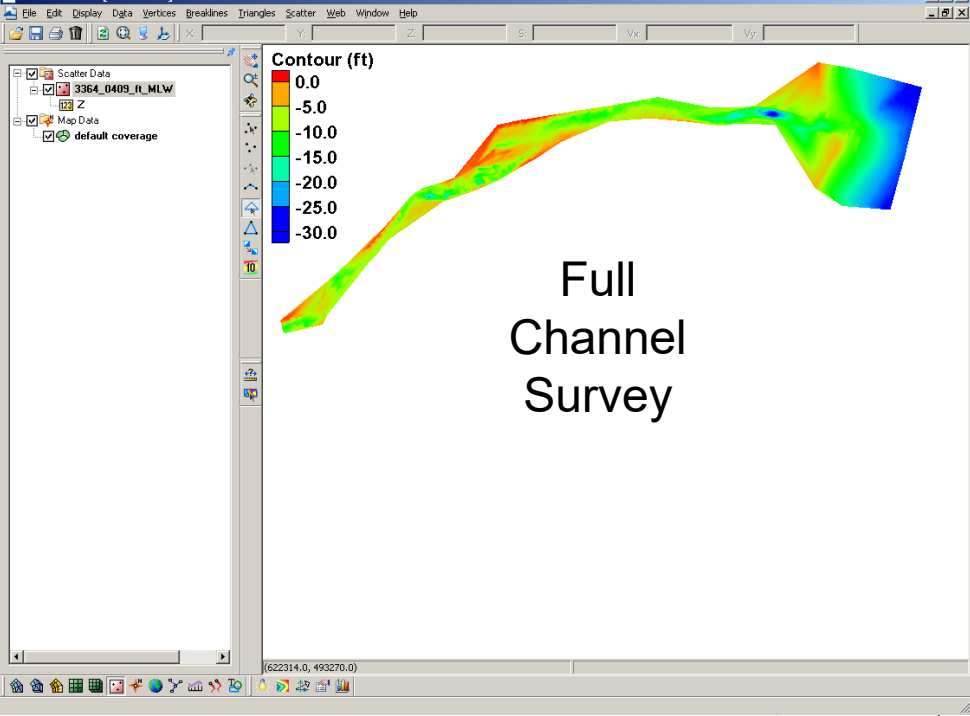


NOAA (Long Branch)

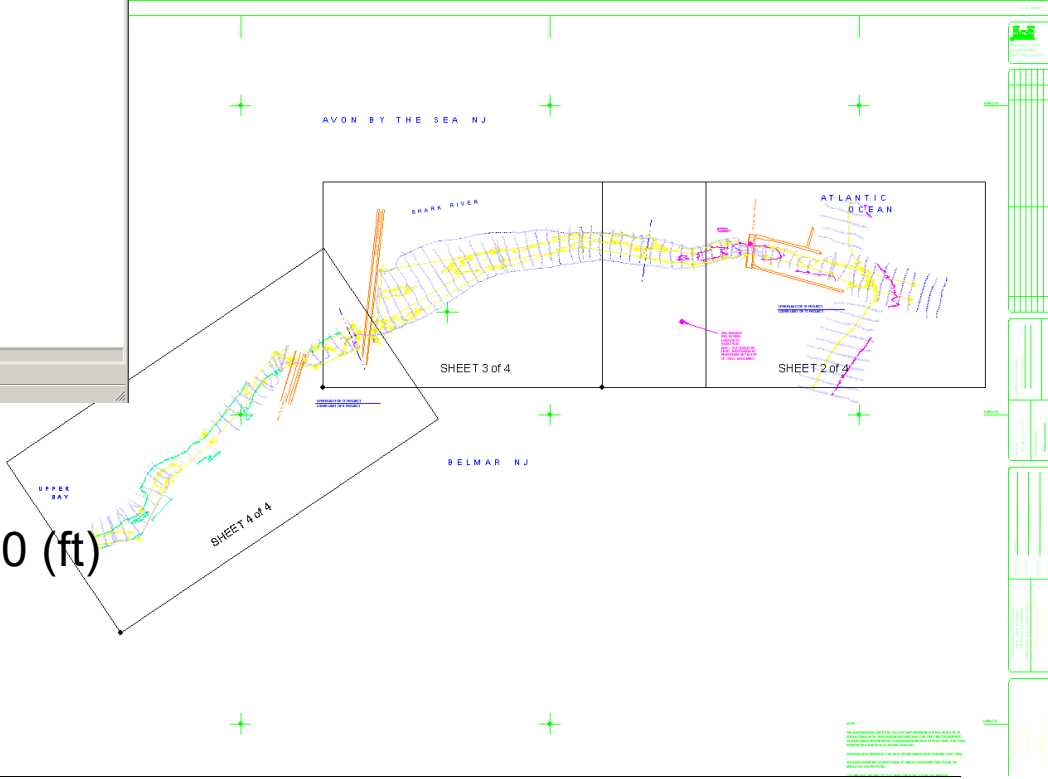




NAN Channel Surveys Extended into Bay



MLW → MSL
2.25 ft (0.686 m)



Horizontal Datum:
State Plane NAD27 New Jersey 2900 (ft)

Vertical Datum:
MLW (ft)



Dataset Toolbox | Data Calculator



Data Set Tool
Find...
Vector Optic
Contour Op
Set Contour
Contour Par
Film Loop...
Transform...
Zonal Classi
Filter...
Delete Dupli
Scatter -> M
Scatter Cont
Boundary ->

Dataset Toolbox

Tools

- [-] Math
 - Compare datasets
 - Data Calculator**
 - Angle convention
- [-] Spatial
 - Smooth datasets
 - Geometry
 - Grid Spacing
- [-] Temporal
 - Sample time steps
 - Merge datasets
- [-] Conversion
 - Scalar to Vector
- [-] Coastal
 - Wave Length and Celerity
 - Gravity Waves
 - Quadratic Friction
 - Mannings N
 - Chezy Friction
 - Directional Roughness
 - Canopy Coefficient
 - Primitive Weighting
- [-] Modification
 - Map activity
 - Filter

Update Available Tools

Help...

Data Calculator

Data Sets

- 3364_0409_ft_MLW
 - d1. Z**
 - d2. x location
 - d3. y location
 - d4. MLW m

Add to Expression Data Set

Time Steps

0 00:00:00

Output dataset name:

SMS 13.1.24 (64-bit) - [Workshop.sms]

Project

- [-] Scatter Data
 - 3364_0409_ft_MLW**
 - Z
 - MLW m
 - MSL m
- [-] Map Data
 - Area Property

Scatter Module MSL m

Color scale: 5.0, 2.22222222222222, -0.05000000000000, -3.33333333333333, -6.11111111111111, -8.88888888888889, -11.6666666666667, -14.4444444444444, -17.2222222222222, -20.0

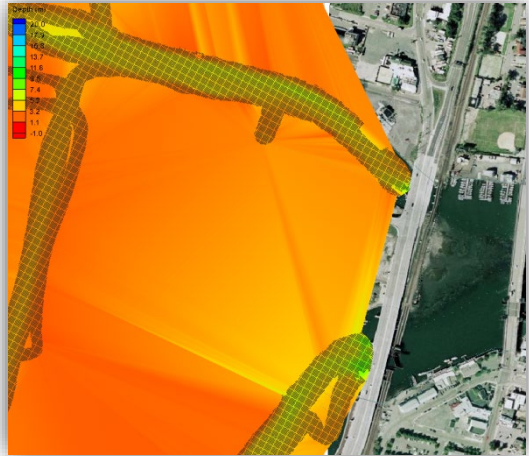
(191139.0, 149257.0)



NJ DEP Channel Surveys



June 2009
Survey



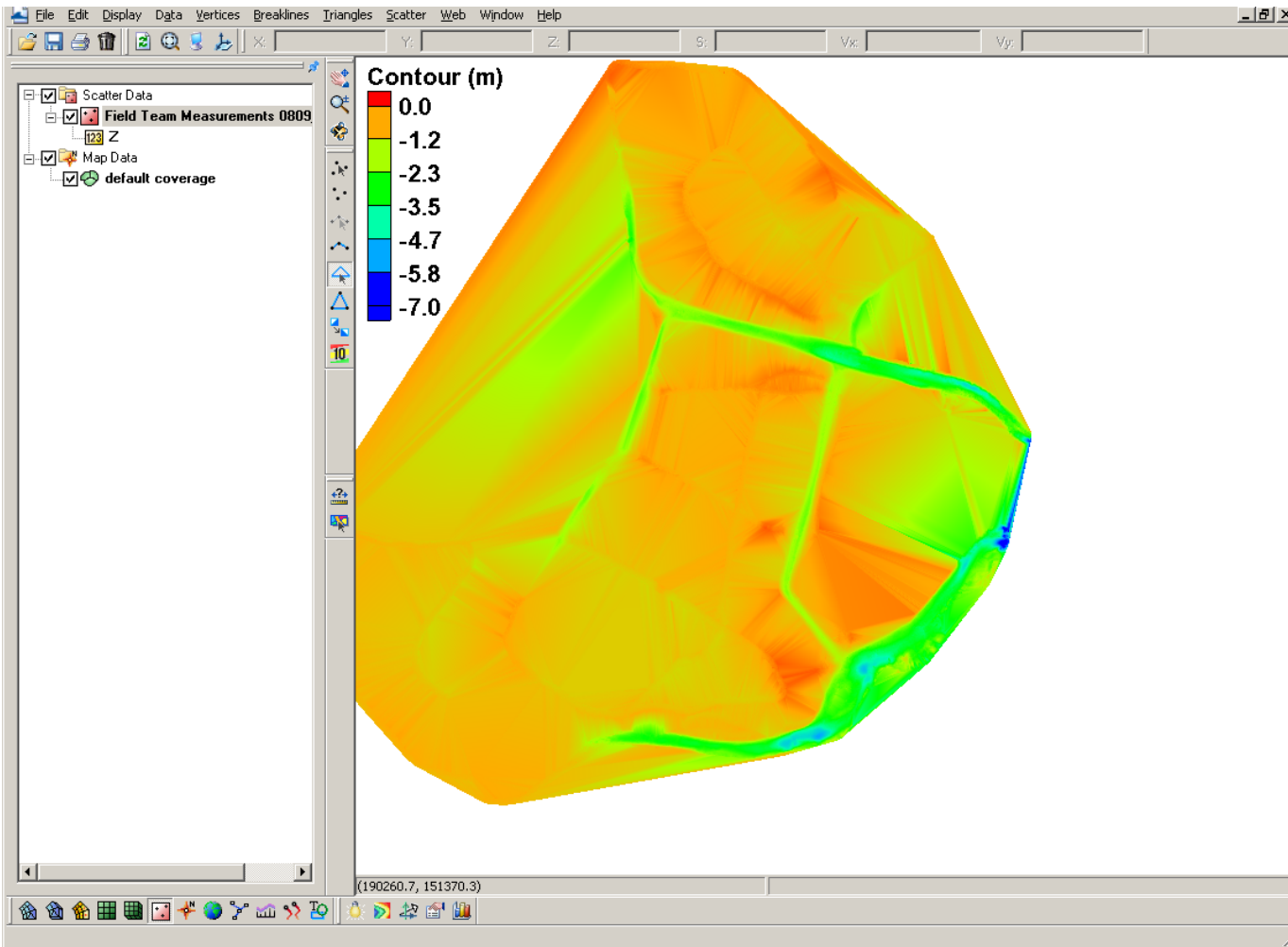
Provided conversion from local datum
to MSL:

MLW → MSL
2.25 ft (0.686 m)

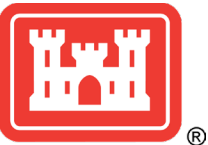
XYZ pulled out of drawing and
changed to ASCII format



Field Data Collection – Multibeam Bay Bathymetry (August 2009)



Horizontal Datum:
State Plane
NAD83 New
Jersey 2900 (m)
Vertical Datum:
NAVD88 (m)



LIDAR



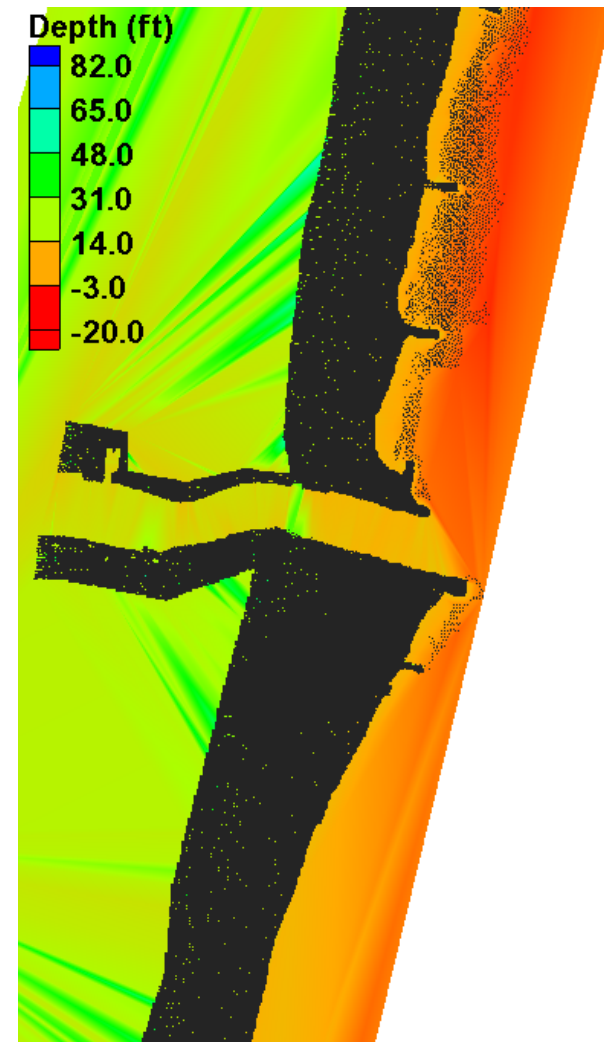
- Files are emailed in separate sections from the NOAA CSC Archive
 - Typically, several to 10s of files that are 5 - 100 mb in size
- Compiling takes time
 - Points have been sampled/filtered and cropped to area of interest

Horizontal Datum:

State Plane NAD83 New Jersey 2900 (ft)

Vertical Datum:

NAVD88 (ft)





®

Coastal Relief Model (DTM/DEM)



Bathymetry & Global Relief | ngdc.noaa.gov

NOAA NATIONAL GEOPHYSICAL DATA CENTER
NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION

NOAA > NESDIS > NGDC > MGGD > Marine Geology & Geophysics > Bathymetry & Relief

All MGG Coastal DEM Portal Fishing Global Lakes Multibeam NDS surveys

Bathymetry & Global Relief

Scientific stewardship, products, and services for ocean depth data and derived digital elevation models

Bathymetry (Ocean Depths)

Bathymetric & Fishing Maps
Great Lakes
IHO Data Center for Digital Bathymetry (IHO DCDB)
International Ocean Mapping Projects
Multibeam Data
NOS Hydrographic Survey Data
Satellite-derived Data
Trackline Data

Combined Bathymetry & Topography

Coastal Relief & Tsunami Inundation
Coastlines & Coastline Extractor
Digital Elevation Model (DEM) Discovery Portal
Global Relief (ETOPO1, ETOPO2, ETOPO5)

Topography (Land Elevations)

All Topography
Global Land 1-km Base Elevation Project (GLOBE)
U.S. State images of 30-second Topographic Data Lidar Archive

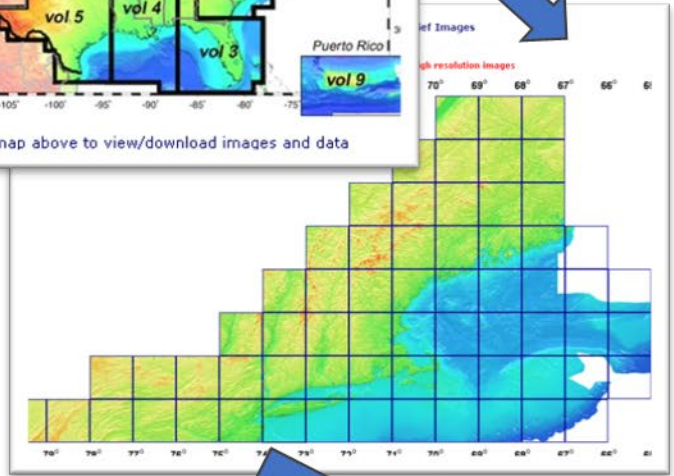
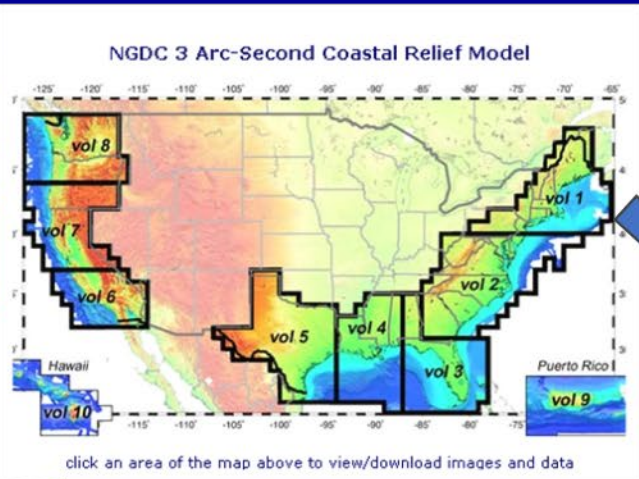
NGDC compiles, archives, and distributes bathymetric data from coastal and open ocean areas, including acting as the long-term archive for NOAA National Ocean Service (NOS) data collected in support of charting and navigation.

NGDC compiles the global ETOPO1 1-minute relief database, coastal relief models for US coastal areas, creates digital elevation models for tsunami inundation research, and stewards gridded topographic data from the GLOBE project.

NGDC participates in numerous international ocean mapping projects, and operates the International Hydrographic Organization (IHO) Data Center for Digital Bathymetry (IHO DCDB) on behalf of the member nations.

NOAA > NESDIS > NGDC > MGGD > Marine Geology & Geophysics Questions: dem.info@noaa.gov

NGDC Home | Contacts | Data | Disclaimers | Education | News | Privacy Policy | Site Map



GEODAS Grid Translator - Design-a-Grid

Grid Database: US Coastline Relief Model

Grid Area in degrees and minutes: Upper Latitude: 30, Lower Latitude: 29, Left Longitude: 122, Right Longitude: 121

Grid Cell Size: 3000

Number of Latitude Cells: 901 Number of Longitude Cells: 901

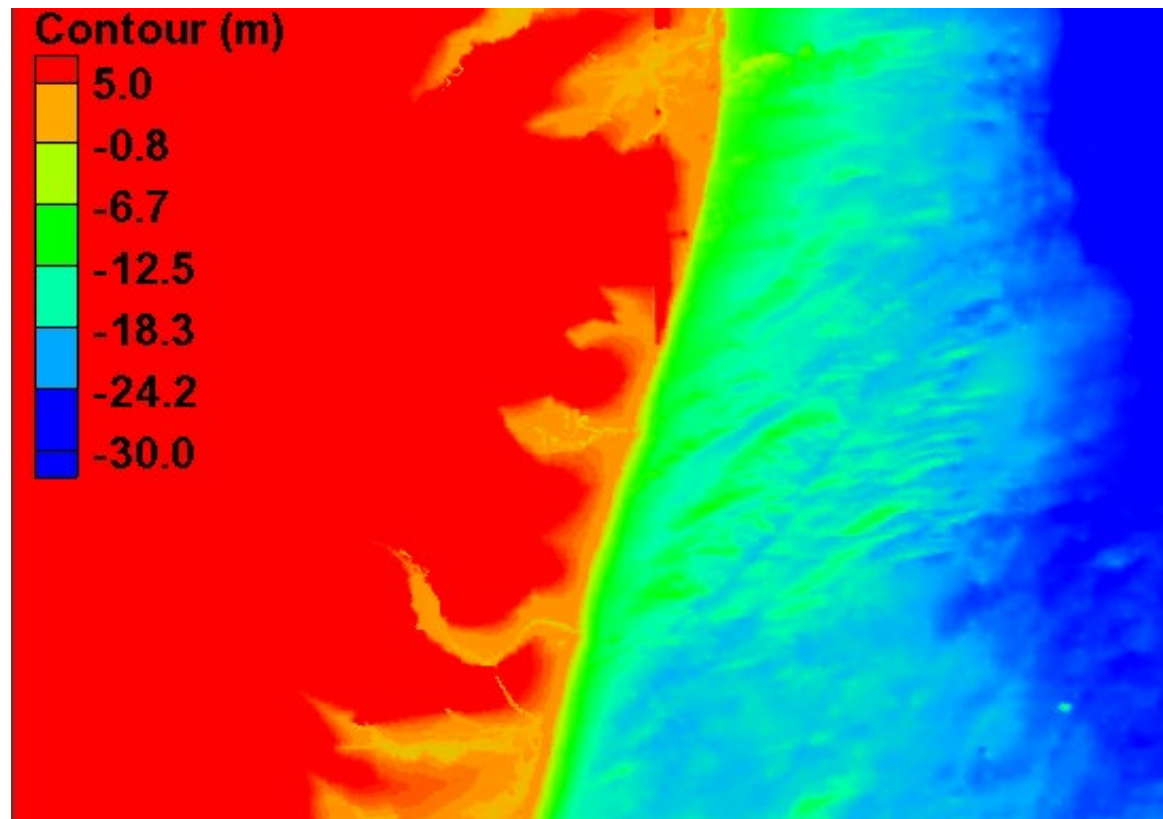
Grid Format: Binary Raster Format, ASCII Raster Format, XYZ (lat,lon,depth)

Output Grid Header: Space, Tab, ASCII (Arc) Header, No Header, Omit Empty Grid Cells

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



Coastal Relief Model



Horizontal Datum:

Geographic NAD83

Vertical Datum:

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



Extra Bathymetry



- 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)



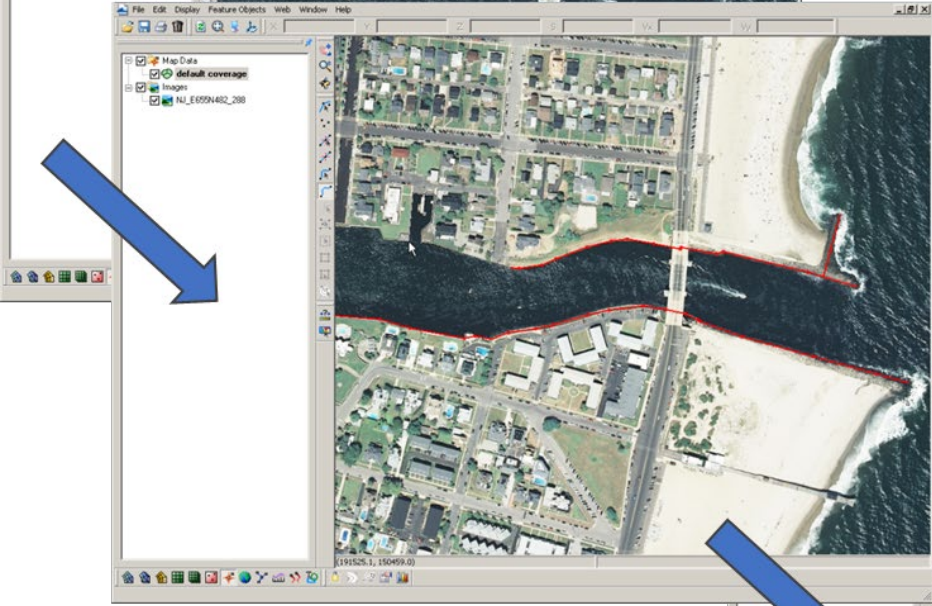


Create a Contour Polyline in the Map Module

CIRP




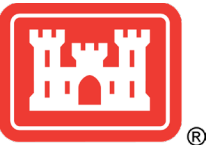
Select Default Coverage under Map Data Type → Generic → Mapping/Observation/Shoals



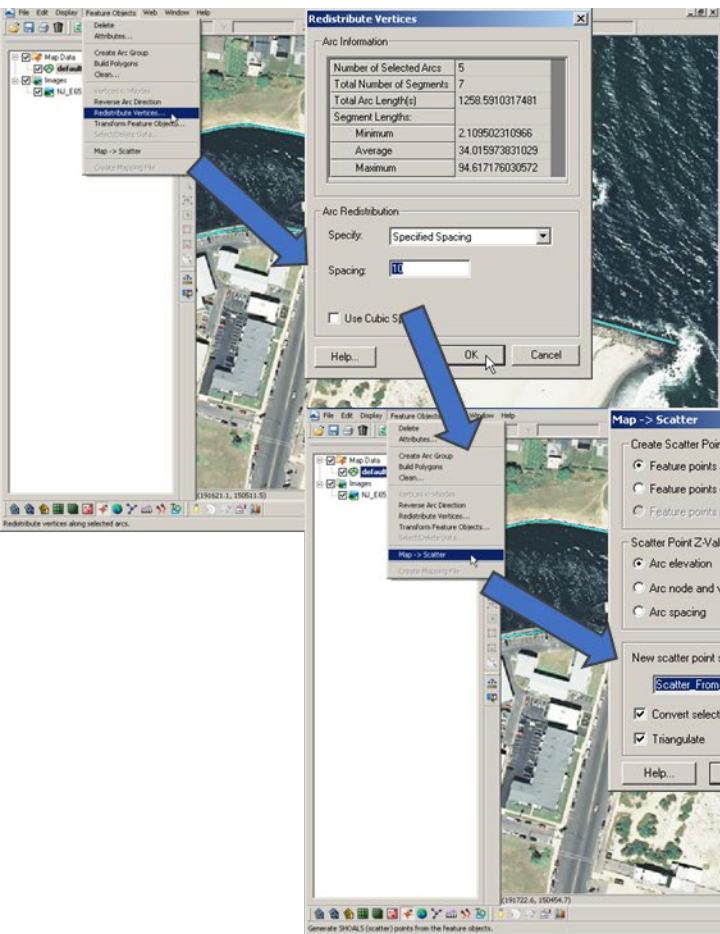
Draw arcs (polylines) feature with  tool



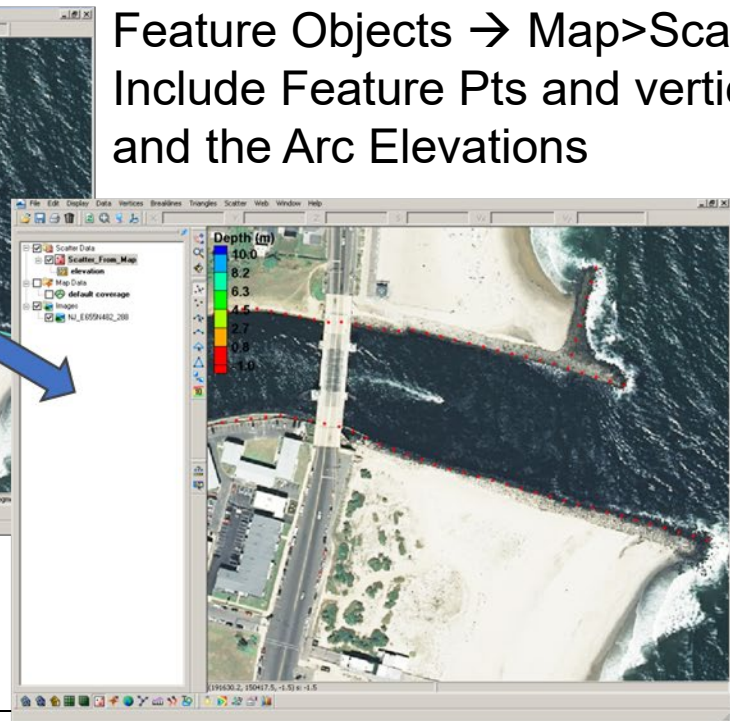
Select arcs  and convert the z elevation to the desired contour elevation



Create Scatterset Points from Map Data



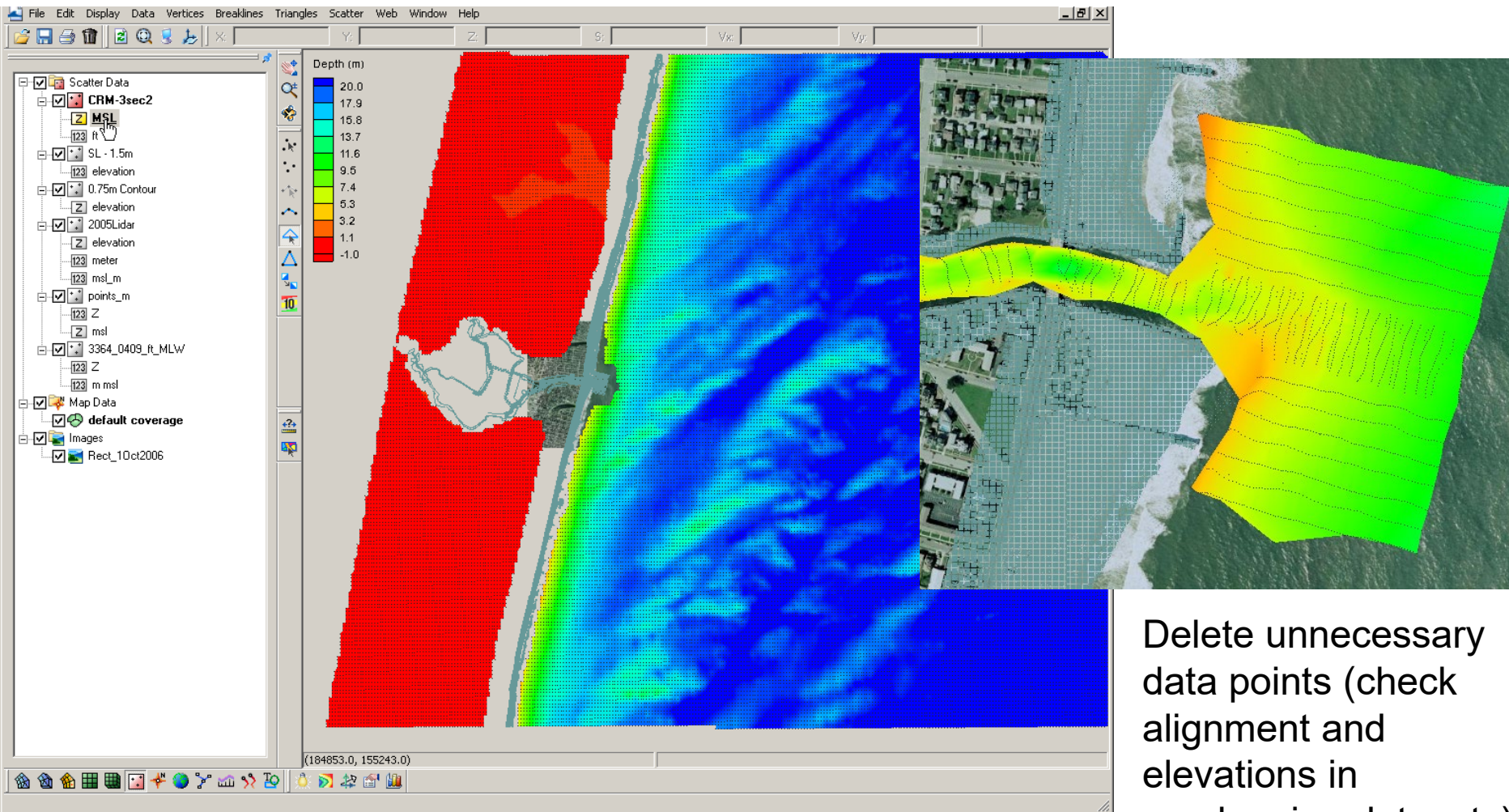
Select arcs to redistribute the spacing of vertices
Feature Objects → Redistribute Vertices
Specify Spacing based on horizontal coordinate system units (metric in this case)

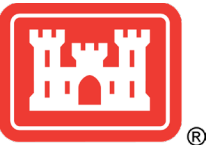


Feature Objects → Map>Scatter
Include Feature Pts and vertices and the Arc Elevations



All Files Referenced to Same Horizontal and Vertical Datum





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 scatter sets to merge

Priority	Scatterset	Merge	Dataset
1	CRM-3sec2	<input checked="" type="checkbox"/>	MSL
2	SL - 1.5m	<input checked="" type="checkbox"/>	elevation
3	0.75m Contour	<input checked="" type="checkbox"/>	elevation
4	2005Lidar	<input checked="" type="checkbox"/>	m sl_m
5	points_m	<input checked="" type="checkbox"/>	m sl
6	3364_0409_ft_MLW	<input checked="" type="checkbox"/>	m msl

Merged scatter set options

Name:

Delete original scatter sets

Overlapping region options

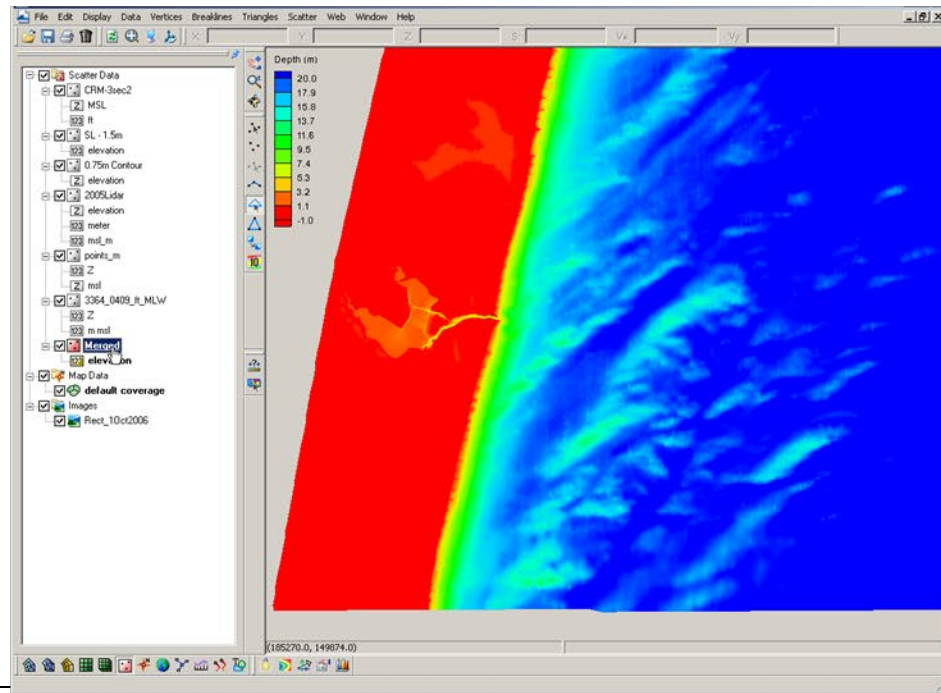
Merge all scatter points

Delete lower priority scatter points

Maintain triangulation

Buttons: Select All, Deselect All, Move up, Move down, Help..., OK, Cancel

Select the dataset





Questions?

Mitch Brown

Mitchell.E.Brown@usace.army.mil

601-634-4036