NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT MI1901-CS-N

Ports of St. Clair and Marine City, Michigan

Introduction

NOAA Coastal Mapping Program (CMP) Project MI1901-CS-N provides highly accurate digital shoreline data for key areas of change in the St. Clair River for the Ports of St. Clair and Marine City, Michigan, and vicinity. The Geographic Cell (GC) may be used in support of the NOAA Nautical Charting Program (NCP) as well as geographic information systems (GIS) for a variety of coastal zone management applications.

Project Design

This project was designed and planned by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for timely updates to the NOAA chart suite within key U.S. ports. Project requirements were formulated as a result of analysis conducted within the Coast and Shoreline Change Analysis Program (CSCAP), in which NOAA nautical chart products are compared to contemporary high resolution digital imagery in order to ascertain the need for more current shoreline data. A Chart Evaluation File (CEF) was forwarded to the Applications Branch (AB) of RSD once the change analysis was complete. Refer to the CSCAP memorandum for Project MI1901-CS-N for details of the chart comparison process.

Field Operations

The field operations consisted of the collection of static and kinematic Global Positioning System (GPS) data and Inertial Measurement Unit (IMU) data and the acquisition of aerial imagery. Color (RGB) images utilized for this project were acquired with the NOAA King Air aircraft in July 2019 using an Applanix Digital Sensor System (DSS) dual camera. The imagery was flown at a nominal altitude of 10,500 feet resulting in an approximate ground sample distance (GSD) of 0.32 meters for project imagery. Near-infrared (NIR) images were also acquired, but were not used for this project.

Direct Georeferencing Data Processing

GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (DG) of the imagery. A local GPS base station was established for use as a reference station for kinematic GPS processing operations. The position of the base station was determined using the NGS Online Processing User Service (OPUS), which computed fixed baseline solutions from nearby CORS stations. The airborne kinematic data was processed using Applanix POSPAC MMS (ver. 8.3) software in August 2019. For further information refer to the Airborne Positioning and Orientation Report (APOR) that is on file with other project data within the RSD Electronic Data Library.

The processed GPS/IMU data were used to derive precise exterior orientation (EO) values of the camera centers required for digital feature extraction. The predicted horizontal accuracy of the imagery was determined by propagating sensor EO and image measurement uncertainties through the photogrammetric collinearity equations using an Exterior Orientation Total Propagated Uncertainty (EO-TPU) tool developed by NGS. Using this tool, the predicted horizontal uncertainty at the 95% confidence level was calculated to be 1.0 meters. Previously compiled feature data from several CMP Projects were used to verify the DG data.

Compilation

Data compilation was accomplished by a member of AB in February 2020. Feature data was compiled monoscopically using Esri's ArcGIS desktop GIS software (ver. 10.7.1) using orthoimagery produced from the project images. Feature identification and attribution within the GC were based on analysis of the project imagery and information extracted from NOAA nautical charts and other ancillary sources. Feature attribution was assigned in compliance with the Coastal Cartographic Object Attribute Source Table (C-COAST), which provides the definition and attribution scheme for the full range of cartographic features pertinent to the CMP.

Spatial data accuracies for Project MI1901-CS-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 2.0 meters at the 95% confidence level. This predicted accuracy of compiled well-defined points is derived by doubling the horizontal uncertainty calculated using the EO-TPU tool.

The following table provides information on the imagery used to complete this project:

Date	Time (UTC)	Roll #	Photo #s	Lake Level*
7-23-2019	16:58 – 17:02	19VC35	62-002 / 7340 – 7361	n/a
7-23-2019	17:08 – 17:30	19VC35	62-001 / 7362 – 7386	n/a

* Lake water levels were not applicable to this project.

Quality Control / Final Review

The final review of the project was completed by senior CMP personnel in July 2020, and included analysis of DG results and assessment of the identification and attribution of digital feature data within the GC according to image analysis and criteria defined in C-COAST. The quality control process concluded with an inspection of topological connectivity within the GC using ArcGIS. All project data was evaluated for compliance to CMP requirements.

End Products and Deliverables

The following specifies the location and identification of end products generated during the completion of this project:

Remote Sensing Division Electronic Data Library

- CSCAP evaluation memorandum
- Project database
- Airborne Positioning and Orientation Report (APOR)
- Project Completion Report (PCR)
- GC11587 in shapefile format
- CEF in shapefile format

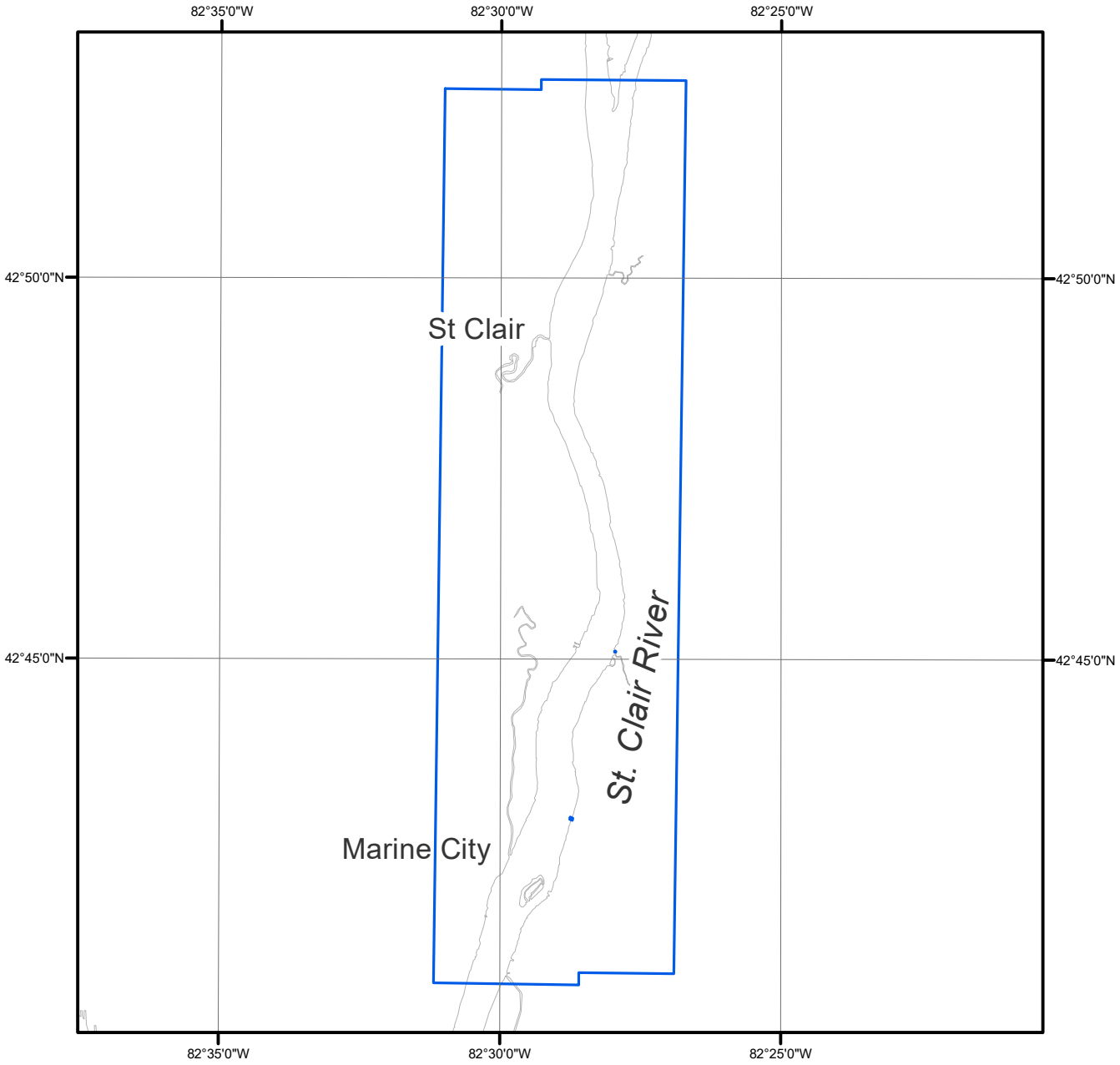
NOAA Shoreline Data Explorer

- GC11587 in shapefile format
- Metadata file for GC11587
- PCR in Adobe PDF format

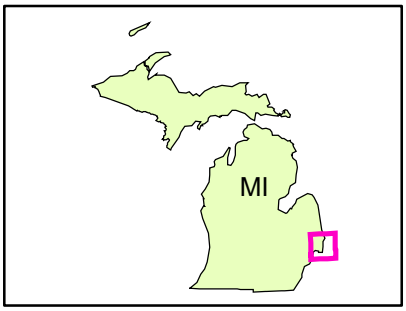
End of Report

PORTS OF ST. CLAIR AND MARINE CITY

MICHIGAN



Overview



MI1901-CS-N

GC11587