

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT MI2010-CS-N

Port of Charlevoix, Michigan

Introduction

NOAA Coastal Mapping Program (CMP) Project MI2010-CS-N provides highly accurate digital shoreline data for key areas of change within the Port of Charlevoix, Michigan. 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

The design of Project MI2010-CS-N was accomplished 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 MI2010-CS-N for details of the chart comparison process.

Field Operations

The field operations consisted of collection of static and kinematic Global Positioning System (GPS) data and Inertial Measurement Unit (IMU) data, and the acquisition of aerial imagery. Digital images utilized for this project were acquired with the NOAA King Air (N68RF) aircraft in October 2020 using an Applanix Digital Sensor System (DSS) dual aerial camera at a nominal altitude of 10,500 feet, resulting in an approximate ground sample distance (GSD) of 0.32 meters for project imagery. Color (RGB) and near infrared (NIR) imagery was acquired in tandem, but only the color images were used.

GPS Data Processing

The GPS/IMU data were processed by RSD personnel to yield precise camera positions in order to provide a control network necessary for aerotriangulation (AT). The kinematic GPS data was processed in November 2020 using Applanix POSPac MMS (ver. 8.4) software, utilizing the IN-Fusion PP-RTX processing mode, which is an implementation of Trimble's *CenterPoint RTX* GNSS correction service. 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.

Aerotriangulation

Routine softcopy AT methods were applied to establish a network of precise camera positions and other control for mapping, and to provide model parameters and orientation elements

required for digital compilation. This work was performed by AB personnel in February 2021 utilizing BAE's SOCET SET (ver. 5.6) software on a Windows-based photogrammetric workstation. The RGB images were measured and adjusted as a single block using the Multi-Sensor Triangulation (MST) module of SOCET SET. Upon successful completion MST provided the standard deviations for each aerotriangulated ground point, which were used to compute a predicted horizontal circular error of 0.45 meters based on a 95% confidence level. An AT Report was written and is on file with other project data within the RSD Electronic Data Library. Positional data is referenced to the North American Datum of 1983 (NAD83).

Compilation

Data compilation was accomplished by a member of AB in March 2021. Digital feature data was compiled from the aerotriangulated RGB imagery using the Feature Extraction software module of SOCET SET. 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. Selected features were further modified with additional descriptive information to refine general classification.

Spatial data accuracies for Project MI2010-CS-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 0.9 meters at the 95% confidence level. This predicted accuracy of compiled well-defined points is derived by doubling the circular error calculated from the AT statistics.

The following table provides information on the images used in the project completion:

Date	Time (UTC)	Roll	Photos	Lake Level*
13-OCT-2020	14:30 – 14:32	20VC44	19192 – 19202	177.3 m
13-OCT-2020	14:38 – 14:41	20VC44	19203 – 19216	177.3 m
13-OCT-2020	14:47 – 14:49	20VC44	19217 – 19228	177.2 m

* Lake water levels are given in meters above IGLD 1985 and are based on verified observations at the Port Inland station in Michigan. The Low Water Datum (LWD) for Lake Michigan is 176.0 meters above IGLD 1985.

Quality Control / Final Review

The final review of the project was completed by senior CMP personnel in March 2021, and included analysis of AT 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 Esri's ArcGIS desktop GIS software (ver. 10.8.1). 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
- Airborne Positioning and Orientation Report (APOR)
- Project database
- Aerotriangulation Report
- Project Completion Report (PCR)
- GC11710 in shapefile format
- CEF in shapefile format

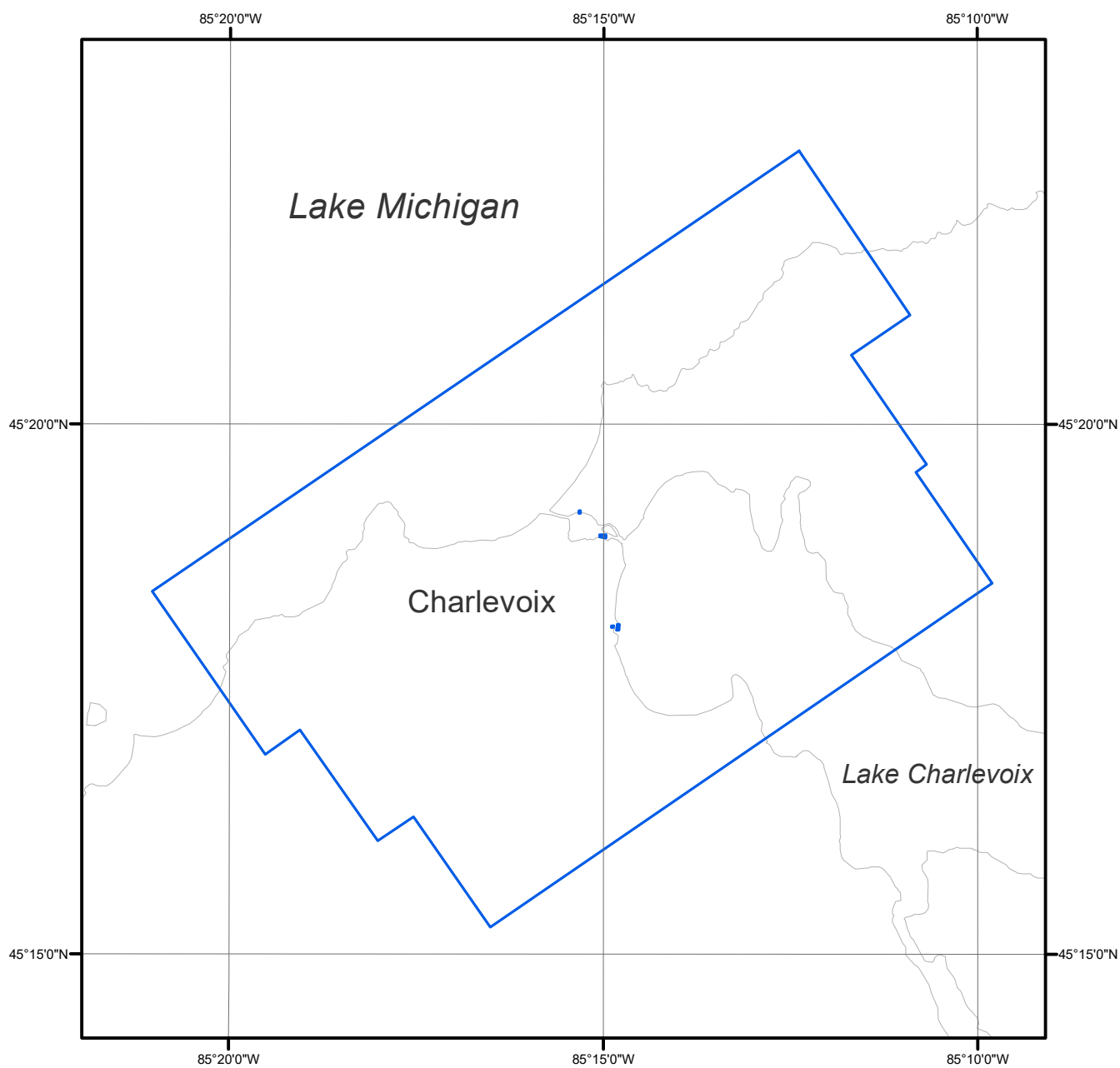
NOAA Shoreline Data Explorer

- GC11710 in shapefile format
- Metadata file for GC11710
- PCR in Adobe PDF format

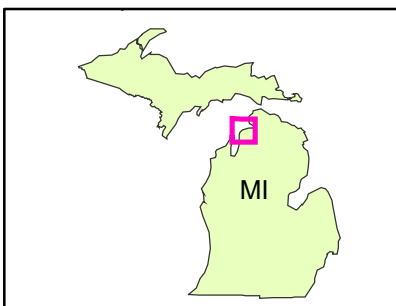
End of Report

PORT OF CHARLEVOIX

MICHIGAN



Overview



MI2010-CS-N

GC11710