Schedule A – Annex 2

REQUEST FOR HYDROGRAPHIC PRODUCTS, DATA OR EXPERTISE

1. Hydrographic Products or Expertise being requested:

This Schedule ("Annex 2") summarizes and records how Canada and the United States of America have agreed to produce Electronic Navigational Charts (ENCs) in overlapping areas of transboundary waters.

As the United States and Canada rescheme their ENC product schemes onto a grid, the rules for determining cell coverage must be revisited. Annex 2 supersedes any prior Schedules describing transboundary ENC cuts in specific transboundary regions, to include 2011-1, 2012-1, 2012-4, 2013-1 and 2014-1 (all of which have expired).

This Schedule documents updated methods for cutting transboundary ENC cells, in what circumstances each method is used, and when special considerations for each circumstance are required (see Appendix A, attached to this Schedule). An ENC cut is defined as a modification to the data coverage on an ENC to prevent overlapping data on adjacent products.

2. Purpose of Request:

This Schedule is to be considered together and as part of the 2023 U.S.-Canadian Hydrographic Commission (USCHC) Memorandum of Understanding (MOU) between the Office of Coast Survey, National Ocean Service, National Oceanic and Atmospheric Administration (OCS) and His Majesty the King of Right in Canada as Represented by the Minister of Fisheries and Oceans on Behalf of the Canadian Hydrographic Service (CHS) (reference NOS MOA-2023-088/12745).

Detailed documentation of individual ENC cuts between the two Participants is stored on the "USCHC Transboundary Web App" web application hosted by OCS. The web application is located at the following fixed URL:
https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=3d56cca277334bb18d918e4292bd3313

3. Starting Date and Duration of Project:

This Schedule will be effective as of the date of last signature and will remain in effect until termination or expiration of this Schedule or MOU 2023-088/12745.

4. Deliverables (reports, etc.):

The Participants will report on implementation and status of this Schedule at the USCHC annual meetings, as needed.

5. Financial Arrangements (which agency is paying for travel, training, shipping, etc.):

For this project, there will be no transfer of funds between the Participants.

6. Points of Contact:

OCS Primary: Christie Ence, christie.ence@noaa.gov
OCS Secondary: Allison Wittrock, allison.wittrock@noaa.gov

CHS Primary: Laura Colombe, laura.colombe@dfo-mpo.gc.ca
CHS Secondary: Mina Foroutan, mina.foroutan@dfo-mpo.gc.ca

7. Additional Information:

The MOU is not intended by the Participants to be a legally binding "international agreement" as defined by the *Case-Zablocki Act* in the case of NOAA. The intent is solely to foster cooperation on activities of mutual interest.

Signatures and dates:

RDML Benjamin K. Evans
Director and U.S. National Hydrographer
Office of Coast Survey
National Ocean Service
National Oceanic and
Atmospheric Administration
U.S. Department of Commerce

Manon Larocque
Hydrographer General of Canada and
Director General
Canadian Hydrographic Service
Department of Fisheries and Oceans

APPENDIX A

TABLE OF CONTENTS

TRANSBOUNDARY ENC CUT SCENARIOS

Introduction

As the United States and Canada rescheme their Electronic Navigational Chart (ENC) product schemes onto a grid, establishing the rules for determining cell coverage must be revisited. The prior Schedule As (to include 2011-1, 2012-1, 2012-4, 2013-1 and 2014-1) describing transboundary ENC cuts in specific transboundary regions are all expired.

This Appendix A to Schedule A, Annex 2, documents the methods for cutting transboundary ENC cells, in what circumstances each method is used, and special considerations for each scenario are required. Individual ENC cell cuts with supporting decision documents are stored in the "USCHC Transboundary ENC Web App" at https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=3d56cca277334bb18d918e4292bd3313.

Methods

According to the Worldwide ENC Database (WEND) Principles (IHO Resolution 1/1997 as amended), ENC cells should avoid overlapping coverage within the same usage band to prevent data rendering issues. It is each Producer Member State's responsibility to ensure its products are seamless, without gaps and overlaps. Adjacent Producer States are directed to resolve overlap issues within the region.

There are two primary methods for cutting transboundary ENC cells: 1) Single-Agency and 2) Category of Coverage (CATCOV). A third Hybrid solution is used in situations where the area transitions between methods or when the two primary methods cannot be used (i.e., in areas where there is a disputed international boundary).

1) Single-Agency Method

The Single-Agency method relies on one Member State to maintain shore-to-shore coverage of narrow or complex waterways near the international boundary (*Figure 1*). ENC cells using this method apply an S-57 Coverage object (M_COVR) with a Category of Coverage (CATCOV) set to "coverage available" throughout the entire rectangular extent. Single-Agency cells are intended to provide the mariner uninterrupted coverage with only one data provider, particularly in areas where the boundary bisects the waterway. Typically, the Single-Agency solution is used on the largest scale usage bands (i.e., Berthing and Harbour) but can be extended to Approach scale products if necessary. For areas using the Single-Agency method, the US and Canada have developed data-sharing methods from the non-producing agency.

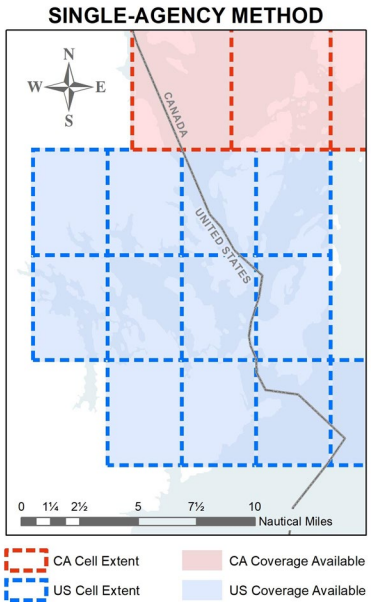

Figure 1. Harbour use cells at Maine/New Brunswick

2) Category of Coverage (CATCOV) Method

The CATCOV method uses the international boundary to split each ENC cell into two S-57 M_COVR features (*Figure 2*). The cell area within each Member State's waters is encoded as "coverage available," while the remainder of the cell beyond the boundary is encoded as "no coverage available." This method favors smaller-scale usage bands (i.e., Approach, Coastal, General, and Overview) and eliminates the need to transfer source data along the entire boundary. OCS and CHS have agreed to use Version 1.3 of the "Digital Boundary" provided by the International Boundary Commission (IBC) to cut their cells to prevent gaps or overlaps. The "Digital Boundary" shapefile is provided by the IBC at https://www.internationalboundarycommission.org/en/maps-coordinates/coordinates.php.

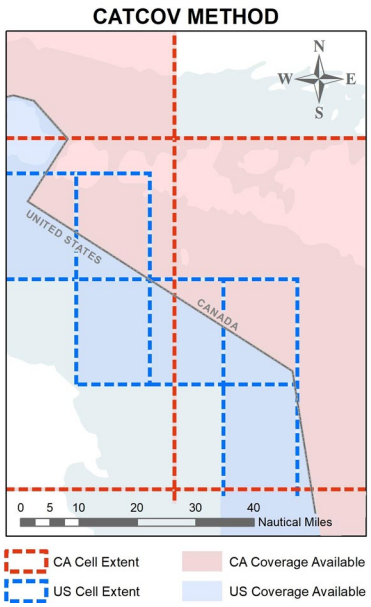

Figure 2. Approach use cells in Lake Huron.

3) Hybrid Method

For various reasons, ENC cuts cannot be made at the rectangular cell edge or the international boundary. When transitioning between different aforementioned methods, the product's usability and the mariner's safety are paramount. This may lead to unique solutions to dissect the cell coverage in the least complicated way possible (*Figure 3a*). Disputed boundaries also require creative approaches to cutting ENC cells (*Figure 3b*). The final scenario requiring a hybrid method is when adjustments are made to the CATCOV solution to prevent slivers, which occur when the international boundary clips a rectangular cell so small it is of little value (*Figure 3c*).

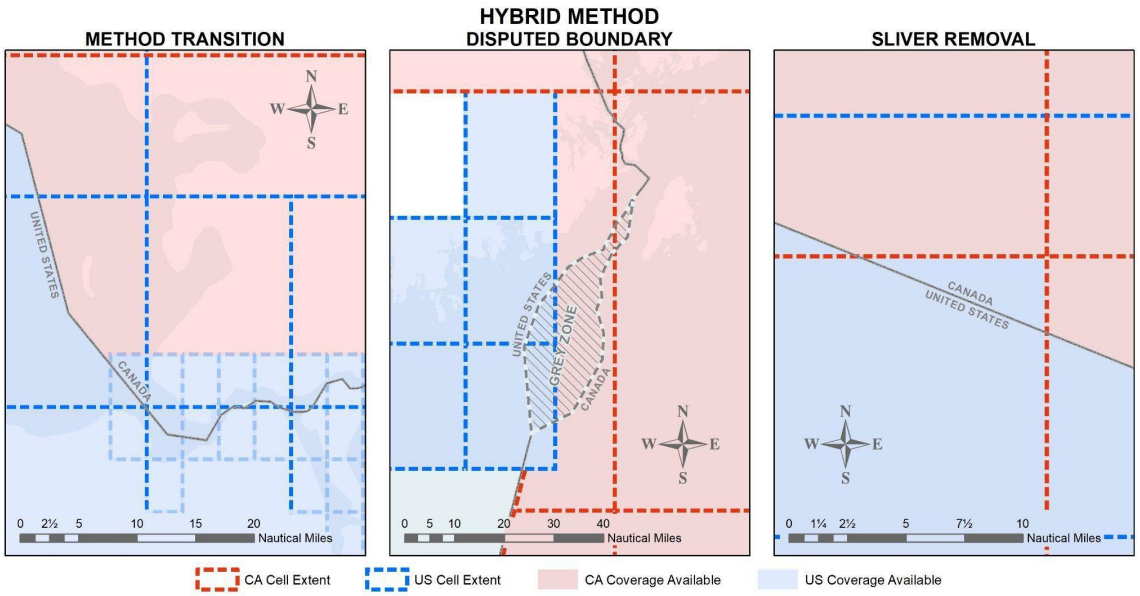

Figure 3. Scenarios where a Hybrid method would be used. From left to right: a) Method Transition between Single-Agency to CATCOV methods in southeast Lake Superior approaching St Marys River. b) Disputed Boundary cuts in Grand Manan Channel. c) Sliver Removal in Lake Superior.

International Boundary Encoding on Transboundary Charts

Each Member State will use the IBC "Digital Boundary" Version 1.3 to depict the International Boundary between the United States and Canada on all transboundary ENCs.

1) Internal Waters Transboundary Charts

The S-57 Use of the Object Catalogue for ENC (S-57 Appendix B.1 Annex A, ED 4.1.0), Section 11.2.1, states that national territories are encoded as Administration Area (Named) (ADMARE) Geo objects with the Jurisdiction (JRSDTN) encoded as "national." The Nationality (NATION) is encoded with the official name of the Member State that holds jurisdiction. According to S-52 and S-101 Portrayal rules, the jurisdiction boundary (*Figure 4*) is symbolized as a dominant grey "T-shaped" line, with down-strokes pointing inwards, entitled "LC(ADMARE01)."

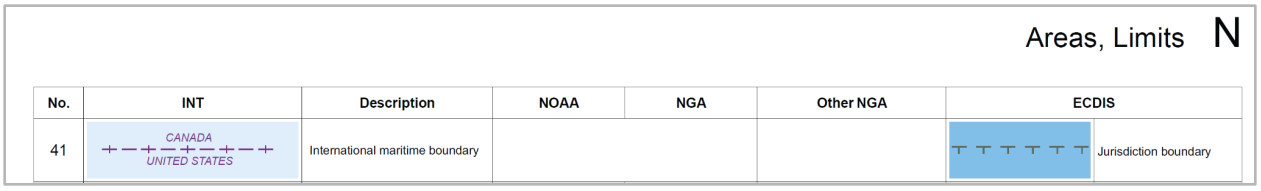

Figure 4. Excerpt from U.S. Chart No. 1, ED 13 depicting the symbology used for jurisdictional boundaries (N 41).

On Single-Agency transboundary cells, the responsible Member State will add two Administration Area (Named) (ADMARE) features to cells crossing the International Boundary. The two ADMAREs will connect at IBC "Digital Boundary" geometry and extend to cover the extent of each Member State's jurisdiction on the cell (*Figure 6a*).

To ensure the international boundary is portrayed on all CATCOV transboundary cells, each Member State will encode an ADMARE feature with the JRSDTN encoded as "national" and the NATION encoded as the applicable Member State. The ADMARE geometry will coincide with each cell's "coverage available" M_COVR geometry (*Figure 6b*).

Cells are cut using a hybrid of the two primary methods where there is a disputed boundary. All hybrid cells will depict both Member States' jurisdictions, similar to Single-Agency cells. The two ADMAREs will connect at IBC "Digital Boundary" geometry and then follow the outer edges of the disputed boundary area. The disputed boundary area is encoded as a Caution Area (CTNARE) with the text, "This area is disputed by United States and Canada." in the Information (INFORM) field and "Cette zone est l'objet d'un désaccord entre les États-Unis et le Canada." in Information in National Language (NINFOM).

2) Coastal Transboundary Charts

In coastal regions, ENCs depict maritime zones recognized under international law. These zones include the twelve-nautical mile Territorial Sea (TESARE), the twenty-four-nautical mile Contiguous Zone (CONZNE), and the two-hundred-nautical mile Exclusive Economic Zone (EXEZNE). The United States also charts the Three Nautical Mile Line, which marks the seaward limit of territorial waters in some domestic U.S. laws. The seaward extent of the Three Nautical Mile Line and Territorial Sea are encoded as skinny ADMARE areas on U.S. charts. According to S-52 and S-101 Portrayal rules, the aforementioned maritime zone limits (*Figure 5*) are symbolized as faint grey dashed lines entitled "LS(DASH,2,CHGRF)."

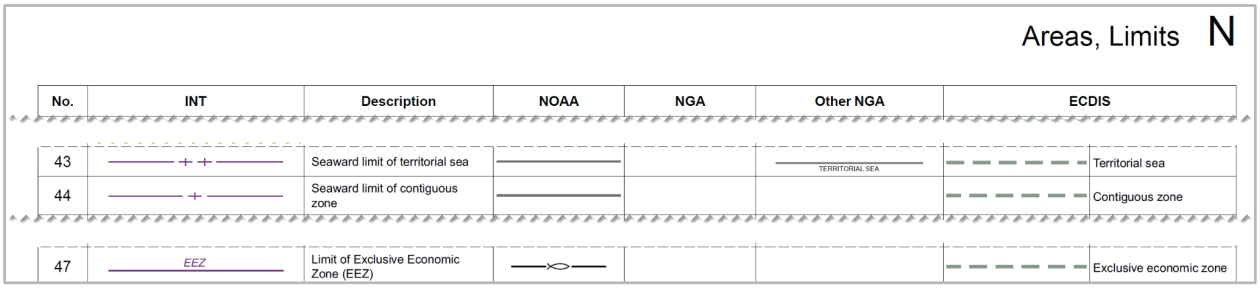

Figure 5. Excerpt from U.S. Chart No. 1, ED 13 depicting the symbology used for Territorial Seas (N 43), Contiguous Zones (N 44), and Exclusive Economic Zones (N 47).

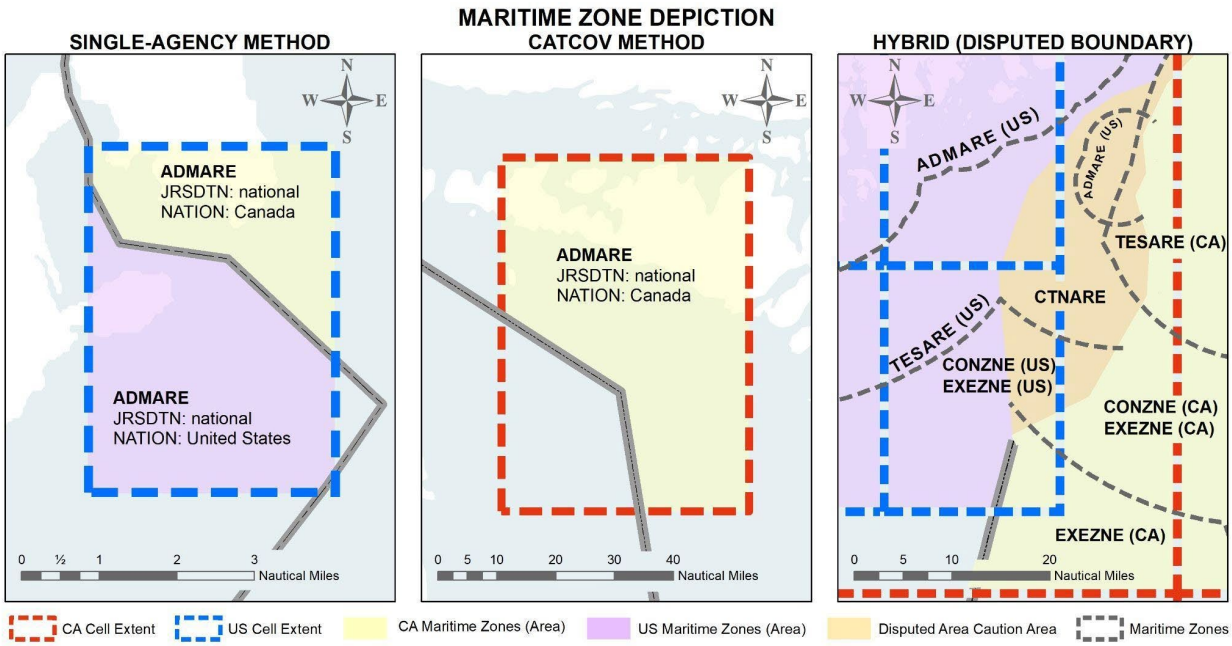

Figure 6. Examples of different methods of charting maritime zones. From left to right: a) Single-Agency cell with an ADMARE for each Member State. b) CATCOV cell with ADMARE for the producing Member State only. c) Hybrid method in an area with a disputed boundary.

Where there is a disputed boundary, all cells may depict both Member States' maritime zones, if known. Any charted ADMAREs, TESAREs, CONZNEs, and EXEZNEs shall be charted as the relevant source documents depict them for each Member State (*Figure 6c*). The disputed boundary area is encoded as a Caution Area (CTNARE) with the text, "This area is disputed by United States and Canada." in the Information (INFORM) field and "Cette zone est l'objet d'un désaccord entre les États-Unis et le Canada." in Information in National Language (NINFOM).

Datum Encoding on Transboundary Charts

A datum is a reference point, line, or surface used in surveying and mapping. Per ENC cartographic framework rules (S-57 Appendix B.1 Annex A, ED 4.1.0), Section 2.1.1, the World Geodetic System 1984 (WGS 84) horizontal datum is mandatory on all electronic charts. However, the United States and Canada differ on their preferred vertical datums.

1) Sounding Datums

A Sounding Datum is a "tidal datum to which soundings and drying heights on a chart are referred. It is usually taken to correspond to a low water stage of the tide..." (S-32, IHO Hydrographic Dictionary, 2023).

The United States uses Mean Lower Low Water (MLLW) on cells in areas depicting tidal waters, whereas Canadian cells use Lower Low Water Large Tide (LLWLT). In the Great Lakes and other transboundary inland waters, both Member States use Chart Datum/Low Water Datum referenced to International Great Lakes Datum 1985 (IGLD 85).

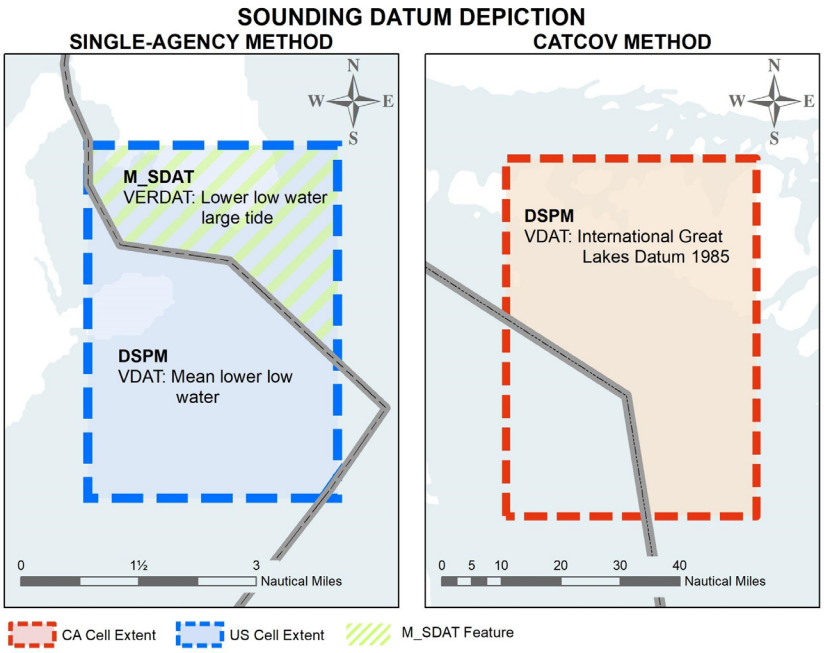

Figure 7. Sounding Datum encoding on transboundary charts. From left to right. a) Sounding Datum encoding on a Harbour scale Single-Agency cell in tidal areas. b) Sounding Datum encoding on an Approach scale CATCOV cell in the Great Lakes.

On Single-Agency and Hybrid method cells, the producing Member State shall populate the cell's Data Set Parameter (DSPM) Sounding Datum (SDAT) field as the nation's preferred sounding datum and create a Sounding Datum (M_SDAT) metadata feature extending from the international boundary into the other Member State's waters with the other Member State's

preferred sounding datum (*Figure 7a*). Only the DSPM needs to be populated on CATCOV method cells (*Figure 7b)*.

2) Vertical Datums

A vertical datum is "Any level surface (e.g., Mean Sea Level) taken as a surface of reference from which to reckon elevations. Also called datum level, reference level, reference plane, levelling datum, datum for heights." (S-32, IHO Hydrographic Dictionary, 2023).

The United States uses Mean High Water (MHW) on cells in areas depicting tidal waters, whereas Canadian cells use Higher High Water Large Tide (HHWLT). In the Great Lakes and other transboundary inland waters, both Member States use Chart Datum/Low Water Datum referenced to International Great Lakes Datum 1985 (IGLD 85).

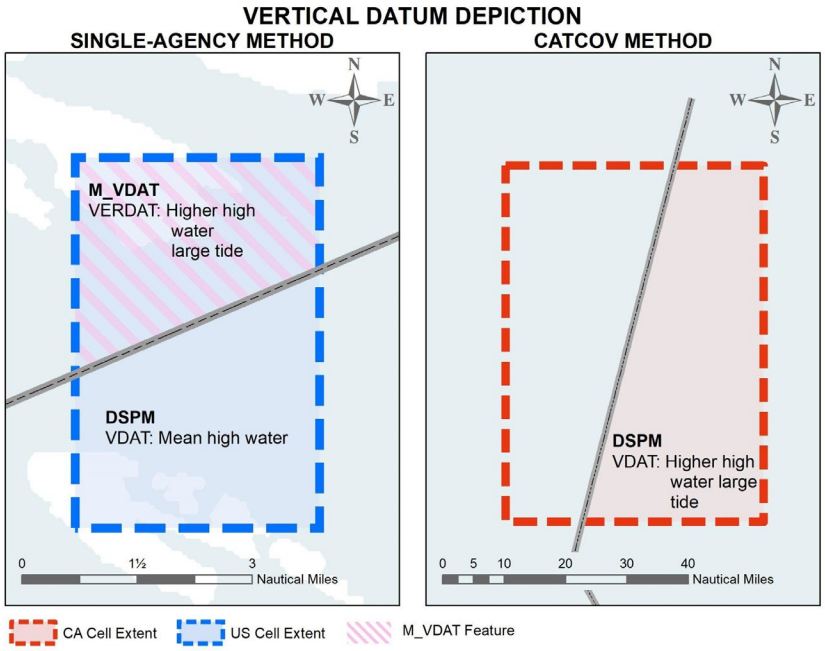

Figure 8. Vertical Datum encoding on transboundary charts. From left to right. a) Vertical Datum encoding on a Harbour scale Single-Agency cell in a tidal area. b) Vertical Datum encoding on an Approach scale CATCOV cell in a tidal area.

On Single-Agency and Hybrid method cells, the producing Member State shall populate the cell's Data Set Parameter (DSPM) Vertical Datum (VDAT) field as the nation's preferred sounding datum and create a Vertical Datum of Data (M_VDAT) metadata feature extending from the international boundary into the other Member State's waters (*Figure 8a*). Only the DSPM needs to be populated on CATCOV method cells (*Figure 8b*).

Standard Notes for Transboundary Charts

Since Canada and the United States have different rules and regulations regarding copyright and intellectual property, specific notes need to be placed on ENCs that are in this region. In addition, since the cuts are determined in the interest of the mariner, rather than based on geo-political boundaries, the United States and Canada agree on a common note that will inform the mariner that they may be travelling in a region with a disputed boundary.

1) Copyright Note

Any US Single-Agency or Hybrid method intersecting the international boundary shall include the following notes in the general Nautical Publication Information (M_NPUB) Text Description (TXTDSC) text file:

```
COPYRIGHT
No copyright is claimed by the United States Government under Title 17 U.S.C.
Therefore, no license is required from the U.S. Office of Coast Survey to
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```

Any Canadian Single-Agency or Hybrid method intersecting the international boundary shall include the following notes in the general Nautical Publication Information (M_NPUB) Text Description (TXTDSC) text file(s):

```
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Any Canadian cell using the CATCOV method intersecting the international boundary shall include the following note in the general Nautical Publication Information (M_NPUB) Text Description (TXTDSC) text file(s):

```
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hydrographique du Canada (www.charts.gc.ca).
```

2) Disputed Boundaries Note

Any US or Canadian transboundary cell that depicts a disputed boundary CTNARE feature shall include the following note in the general Nautical Publication Information (M_NPUB) Text Description (TXTDSC) text file:

```
MARITIME BOUNDARY
Any international maritime boundary shown in the disputed area is without
prejudice to the legal position of the United States or Canada.

L'indication de toute frontière maritime internationale dans la zone contestée est
sans préjudice à la position juridique des États-Unis ou du Canada.
```

Communications Framework

The Office of Coast Survey (OCS) and the Canadian Hydrographic Service (CHS) are in the process of harmonizing their Electronic Navigational Charts (ENCs), in the transboundary waters between Canada and United States to comply with the worldwide ENC Database (WEND) principles of the International Hydrographic Organization (IHO).

1) USCHC Transboundary Web App

The USCHC Transboundary Web App is an Esri-driven web application designed to capture interagency ENC coverage decisions along the US-Canada international boundary and provide a

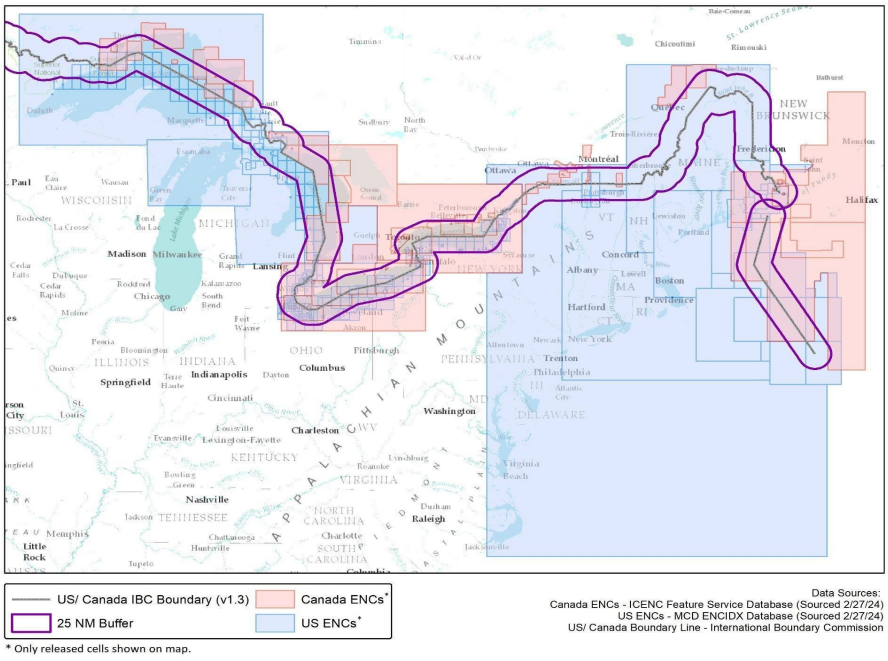

Figure 9. Source dataset that drives the USCHC Transboundary App showing the 25-nautical mile buffer and all currently published charts available.

common workspace to discuss transboundary cell issues. OCS hosts the site and has made the application available externally. The link to the web application is https://noaa.maps.arcgis.com/

apps/webappviewer/index.html?id=3d56cca277334bb18d918e4292bd3313, which will remain static.

The web application includes transboundary ENC cell extents intersecting within a 25-nautical mile buffer to the international boundary, as shown by IBC "Digital Boundary" Version 1.3. The map includes legacy non-gridded and new gridded cells for the United States and Canada (*Figure 9*).

The cell shapes use polygon geometry. Proposed cells are depicted as full rectangles, and released cells are shown using the "coverage available" M_COVR shape.

Cells from the United States are shown in blue, Canadian cells are shown in red, proposed cells are shown with a hollow fill, and released cells are shown with a transparent fill.

Each ENC cell feature has a series of attributes associated with it: Cell Name, Scale, Scale Band, National Responsibility, Schema, Cell Title, Status, Region, In Work, Transboundary Method, Decision, and Notes (*Table 1*).

Field Attribute	**Description**	**Data Type**	**Allowed Values**
Cell Name	8-character Cell Designation	Free-Form Text	
Scale	Product Compilation Scale	Free-Form Text	
Scale Band	S-57 Usage Band Code	Short Integer	1, 2, 3, 4, 5, 6
National Responsibility	Producing Member State	Coded Domain Text	US, Canada
Schema	Description of Cell Types	Coded Domain Text	Gridded, Non-Gridded
Cell Title	Product Title	Free-Form Text	
Status	Product Status	Coded Domain Text	Proposed, Released
Region	Geographic Region	Coded Domain Text	Atlantic, Inland Lakes, Pacific, Arctic
In Work	Product Completion Status	Coded Domain Text	In Work, <NULL>
Transboundary Method	ENC Cut Method	Coded Domain Text	Single-Agency, CATCOV, Hybrid
Decision	Decision Document URL	Free-Form Text	
Notes	Relevant Decision Information	Free-Form Text	

Table 1. Attributes and allowable encoding values for the USCHC Transboundary Web App.

ENC Users:

There is no "typical" ENC user who will be affected by the change. Since the users differ in their reliance on the ENCs, in their methods for acquiring ENCs, and in their sources of ENC information, OCS and CHS will coordinate distinct communication efforts targeted to specific user groups.

The user groups include:

- British Columbia ferry pilots
- British Columbia pilots
- Commercial fishermen
- Commercial mariners and pilots
- ENC distributors, Canadian Digital Dealers, and Value Added Resellers
- End users of ENCs registered with CHS
- Lakes Pilots Association
- Recreational boaters
- Shipping agents
- University - National Oceanographic Laboratory System (UNOLS) research vessels
- US and Canadian Navy
- US Coast Guard, Canadian Coast Guard

3) Press Releases

Press releases shall be sent to the following:

Recreational boater contacts:

- Canadian Power and Sail Squadrons - https://www.cps-ecp.ca/
- CMMA - https://cmma.org/
- Council of British Columbia Yacht Clubs - https://cbcyachtclubs.org/wp/
- Down East – Maine - https://acadiamagic.com/index.html
- Great Lakes/Seaway Review - https://seawayreview.com/
- Huron Mountain Club - https://huronmountainclub.org/
- NewsWaves - https://www.takemefishing.org/corporate/
- Northwest Marine Trade Association - https://nmta.net/
- Northwest Yachting Magazine - https://www.nwyachting.com/
- Pacific Yachting Magazine - https://www.pacificyachting.com/
- Powerboat Magazine - https://www.powerboating.com/
- Professional Boatbuilder – Maine - https://www.proboat.com/
- Quoddy Tides – Eastport, Maine - https://quoddytides.com/
- Sailing World - https://www.sailingworld.com/
- SailingScuttlebutt - https://www.sailingscuttlebutt.com/
- Sea Magazine - https://www.seamagazine.com/
- Shepler's Marine Service - https://www.sheplersferry.com/marine-service/
- Skipper's Choice Marine Supply - https://www.southbaymarina.com/
- True North Books
- US Power Boat Squadron Magazine: The Ensign - https://theensign.org/
- Wharfside
- Wolf's Marine - https://www.wolfsmarine.com/
- Wooden Boat Magazine – Maine - https://www.woodenboat.com/
- Yacht Works - https://www.yachtworks.com/

Commercial mariners/pilots contacts:

- American Shipper - https://www.freightwaves.com/american-shipper

- Association of British Columbia Marine Industries - https://www.abcmi.ca/cpages/home
- Atlantic Pilotage Authority - https://www.atlanticpilotage.com/
- Boating Industry Canada - https://boatingindustry.ca/
- Black Ball Ferry Line - https://www.cohoferry.com/
- British Columbia Coast Pilots - https://www.bccoastpilots.com/
- British Columbia Ferry Services - https://www.bcferries.com/
- British Columbia Shipping News Magazine - https://www.bcshippingnews.com/
- Canada Sailing Community - https://www.canadiansailings.ca/
- Canadian Merchant Service Officers Guild - https://www.cmsg-gmmc.ca/index.php/en/
- Canadian Ship-owner Association - https://www.shipout.ca/profile/156
- CHA Lighthouse Magazine - https://hydrography.ca/2197-2/
- Chase, Leavitt & Company - Portland, ME - https://chaseleavitt.com/
- Master Mariners of Canada - https://www.mastermariners.ca/
- Cruising World Magazine - https://www.cruisingworld.com/
- Durocher Marine, Division of Kokosing Construction Company https://dredgingcontractors.org/durocher-marine/
- Explorer's Guide Maritime Training - https://explorersguidellc.com/
- Grand Manan Coastal Transport - https://grandmanan.coastaltransport.ca/landing.php
- Great Lakes Pilot Authority - https://www.glpa-apgl.com/
- Harbour Authority Association of British Columbia - https://haa.bc.ca/
- Hydro International - https://www.hydro-int.com/en
- Lake Carriers' Association - https://lcaships.com/
- Lower Lakes Towing - https://www.randlog.com/llt/
- Maine Department of Marine Resources, Marine Patrol - https://www.maine.gov/dmr/marine-patrol
- Marine Log - https://www.marinelog.com/
- MarineLink - https://www.marinelink.com/
- Maritime Executive - https://www.maritime-executive.com/
- Maritime Magazine - https://maritimemag.com/en/magazine-en/
- McKeil Marine - https://mckeil.com/
- Ocean Industries British Columbia
- Pacific Maritime Magazine - https://pacmar.com/
- Penobscot Bay & River Pilots Association - https://www.penbaypilots.com/
- Quoddy Pilots – Eastport, Maine
- Sea Technology - https://sea-technology.com/
- Seafarers' International Union of Canada - https://seafarers.ca/
- Seaspan Coastal Intermodal - https://www.seaspan.com/seaspan-ferries/
- Shipping Federation of Canada - https://shipfed.ca/
- St. Lawrence Seaway Management Corporation - https://greatlakes-seaway.com/en/
- State of Maine Harbor Masters Association - https://www.maineharbormasters.org/
- Washington Public Ports Association - https://www.washingtonports.org/
- Washington State Department of Transportation - https://wsdot.wa.gov/
- Western Mariner - https://www.westernmariner.com/

Commercial fishing industry contacts:

- Bay of Fundy Inshore Fishermen's Association - https://fisherynation.com/

- Fundy North Fishermen's Association - https://www.fundynorth.org/
- Grand Manan Fishermen's Association - http://www.gmfa.nb.ca/
- Pacific Coast Federation of Fishermen's Associations - https://pcffa.org/
- Pacific Fishing - https://www.pacificfishing.com/

Regional ENC Coordinating Centers:

- IC-ENC - https://www.ic-enc.org/
- Primar - https://www.primar.org/#/

Port authorities:

- Bayside Port Corporation - https://portofbayside.ca/
- Eastport Port Authority - https://www.portofeastport.org/
- Hamilton Port Authority - https://www.hopaports.ca/
- Maine Port Authority - https://www.maineports.com/
- Thunder Bay Port Authority - https://www.portthunderbay.ca/
- St. John Port Authority - https://sjpa-apsj.com/
- Toronto Port Authority - https://www.portstoronto.com/home.aspx
- Windsor Port Authority - https://portwindsor.com/

Other authorities:

- Canadian Coast Guard - https://www.ccg-gcc.gc.ca/index-eng.html
- Great Lakes Commission - https://www.glc.org/
- Royal Canadian Navy - https://www.canada.ca/en/navy.html
- Transport Canada - Marine Safety - https://tc.canada.ca/en/marine-transportation/marine-safety-canada
- US Coast Guard - https://www.gocoastguard.com/
- US Navy - https://www.navy.com/

4) Blog posts

- gCaptain - https://gcaptain.com/
- Great Lakes Scuttlebutt - https://www.greatlakesscuttlebutt.com/
- SailingScuttlebutt - https://www.sailingscuttlebutt.com/
- Starpath School of Navigation Newsletter: Sightings - https://www.starpath.com/cgi-bin/newsletter/newsletter.pl?num=current