



**“NETWORK OF DANUBE WATERWAY ADMINISTRATIONS”**  
South-East European Transnational Cooperation Programme

**STATUS QUO REPORT ON ENC ACTIVITIES**  
**UA - ONMA**

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## LIST OF ABBREVIATIONS

ABBR.	Abbreviation
ECDIS	Electronic Chart Display and Information System
ENC	Electronic Navigational Chart
IENC	Inland Electronic Navigational Chart

## **SCOPE OF DOCUMENT**

Activity 5.2 is related to the harmonisation of activities in the field of Inland ENC production and distribution.

According to description of work SWP 5.2 (Task 5.2.3) every partner shall identify and describe the status quo on ENC activities and what are the problems. The status quo shall at least contain relevant information about:

- IENC coverage of the national stretch (incl. reasons and solution if this is not achieved so far)
- Availability of depth information within the Inland ENCs
- The IENC production process from raw GIS data into IENC objects, involved persons or organisations, used equipment and software tools
- IENC publication process (distribution of updates and new releases)
- Sources (data basis) and accuracy for IENC charts
- Create and maintain IENCs according to the Inland ECDIS Standard
- Cooperations
- Updates, updating circle

## CHAPTER 1 IENC COVERAGE

IENCs is available with Inland ECDIS standard, version 1.02.

**Inland Electronic Navigational Charts (IENCs)** are provided in Danube and Dnipro rivers. The total length of the Ukrainian part of Danube is 170,6 kilometres (0 – 116 km, 44 – 72 miles), the total length of the Ukrainian Dnipro is 981 kilometres.

The coverage of the Ukrainian Inland ENC of Danube is full and about km 650 for the Dnipro. The common border section between Ukraine and Romania is developed and provided in Ukraine as well as in Romania.

The content of the Ukrainian Inland ENCs in accordance Inland ECDIS Standard, Edition 1.02.

All objects regarding the Minimum Contents of Inland ECDIS Standard 1.02 are included:

- Bank of wareway/river bank
- Shoreline construction (e.g. dam, groin)
- Contours of locks and dams
- Boundaries of the navigation channel/fairway (if defined)
- Isolated dangers in the fairway below and above the water level, such as bridges, overhead cables and obstructions
- Shipping police regulations (e.g. buoys, beacons, lights, notice marks)
- Waterway axis with kilometres/hectometres or river mile indications

The UN/ECE classification of the Ukraine Danube is **Vla**. There is a full coverage without any gaps.

Information in Inland ENCs is available at the web-site (<http://www.hydrography.com.ua>). ENCs are not available for free.

Navigational river (pilot) chart of the Danube River on section from Reni to the mouth and Dnipro river is prepared as an edition in chart sheets cutting orthogonal to parallels and meridians as a set of 16 charts bounded in the form of an album.

While using the chart it is necessary to consult guidances, published by SHS:

- „Symbology for Inland Waterways Charts”;
- „Nautical charts Symbols”;
- „Sailing Directions of the Danube River, Kiliyskoye Mouth Delta to Prut River mouth”;
- „Lights and Beacons of the Danube River”.

IENCs of the Dnipro river include:

- navigational river chart of the Kanivs’ke reservoir „From Kyivs’ka hydroelectric power station to Kanivs’ka hydroelectric power station”, scale 1:25 000;
  - navigational river chart of the Nyzhnii Dnipro River „From Kakhovs’ka hydroelectric power station to the mouth”, scale 1:25 000;
  - navigational river chart of the Dniprodzerjins’ke reservoir, scale 1:25 000.
- 
- Approaches channel to the Danube, Bystroye mouth, Black Sea.
  - Ukrainian section of the Danube, river km 0 – 60,0 km
  - Ukrainian section of the Danube km 60,0 – 116,0
  - Ukrainian section of the Danube miles 44 - 72

Charts with detailed information about the infrastructure in ports were developed in cooperation with the port operators, as illustrated in the next figure (e.g. port of Izmail).

Common Ukrainian and Romania part of Danube , Bystroe outlet and about 600 km. of Dniper river, Dniper - Black sea canal under IENC production

There are not any gaps

## Chapter 2 Coverage of depth information

Depths values are based on RNW 96 (low water level according to the recommendations of the Danube Commissions). They represent the situation at the time of measurement. As the riverbed is subjected to ongoing natural changes especially in the free flowing sections of the Danube, liability for the depths values cannot be assumed; depth data are intended for information purposes only.

In Ukraine the following sections are covered with detailed depth information. In total 0 – 116 km, 44 – 72 miles are covered with depth data. This section was measured by our hydrographic department and was integrated into the final Inland ENC.

In the following table there is an overview where detailed depth information along the Ukrainian Danube based on following dates of surveys are provided:

Black Sea, Danube, 0 km	Approachs channel to the mouth Bistre	Annualy, last survey October 2009
0 – 60 km	From mouth to Kilia	June 2009
60 – 116 km	From Kilia to port Izmail	August 2008
44 – 72 miles	From port Izmail to port Reni	August 2007

Ukrainean Dnipro river based on following dates of surveys are provided:

Kanivs'ke reservoir, from Kyivs'ka hydroelectric power station to Kaniv	May – August 2006
Nyzhnii Dnipro River, from Kakhovs'ka hydroelectric power station to the mouth	June – August 2007

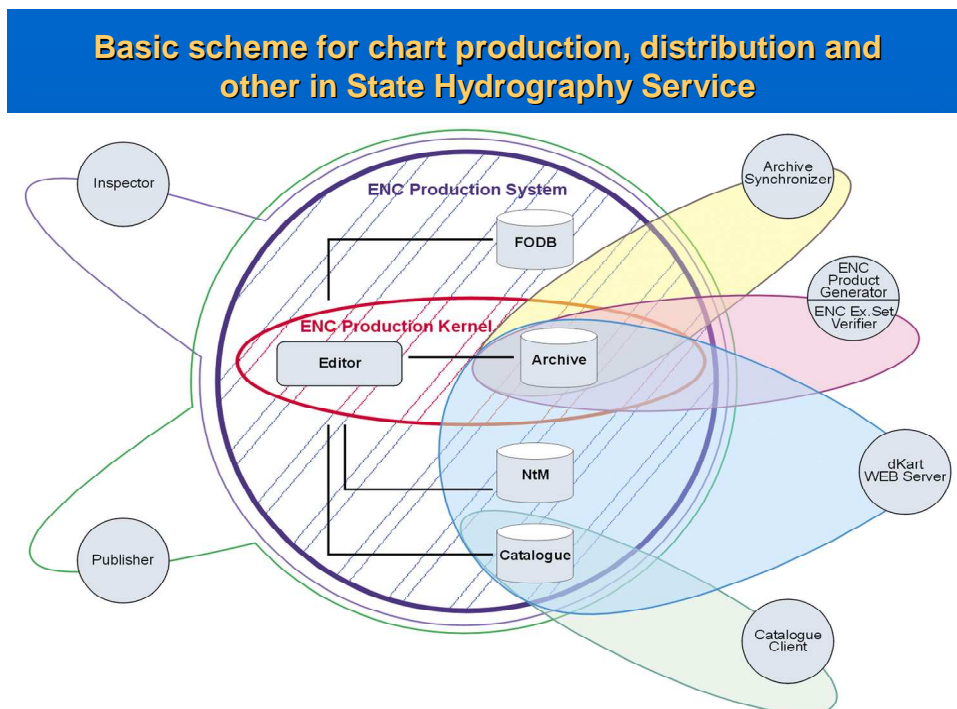
Dniprodzerjins'ke reservoir	June – August 2008
Kremenchugs'ke reservoir	June – September 2009

Bathymetric information in IENC arranged In sepaered layer

### Chapter 3 IENC production process

In Ukraine we are using HYPACK software for geographical data, bathymetric data and Notice marks & buoys production.

The diagram below describes the ENC production process for the Ukrainian part:



In Ukraine there are three groups of data which are processed within the Inland ENC production and maintenance process:

- Geospatial data (Topographical information)

Information obtained from orthophoto images or topography surveying process. The general area data are considering the information about all fixed objects. Based on the hi-resolution geo-referenced terrain images, the digital vectorized dataset can be easily produced by means of ENC tools and used further in ENC production process.

- Bathymetric data (Depth information) – collected by multi-beam and single-beam echo sounders surveying with HYPACK software using.
- The post processing of the surveyed data is checking of possibility mistakes amount of dates.
- Marking system data, including the data related to the fairway, buoys, mooring places, etc.

In post processing of **surveyed soundings** and the conversion into Inland ENCs (S-57 format) the hydrographic department of SHS use the following software:

- Hydrographic software for hydrographic survey HYPACK (HYPACK inc., USA)

The HYPACK SURVEY product is a comprehensive bathymetric data cleaning and validation tool integrated with powerful vector product creation.

- HYPACK OFFICE software

With HYPACK the density and distribution of soundings are controlled, a digital 3D terrain model and depth contours are calculated.

- dKart Office software

For the transformation into WGS 84 and conversion to the final S-57 format the dKart Office is used for S-57 production.

Production of **geographical data** and **notice marks** using the ENC dKart software tools . The cartographic office still preparation the geographical data in Microstation field.

The Inland ENCs produced by the State Hydrographic Service of Ukraine. The basis in this production of charts are images taken of the areas concerned by aerial surveys, surveys or other measurement procedures. For the production of IENCs all objects is available in WGS 84 format.

### **Geographical data (Topographical information)**

Information obtained from orthophoto images (or high-resolution satellite images). The general area data are considering the information about all fixed objects. Based on the hi-resolution geo-referenced terrain images, the digital vectorized dataset of IENC tools and using in IENC production process.

### **Bathymetric data (Depth information)**

The post processing in order to provide actual depth data to fairway users, the following steps are necessary:

- A bathymetric survey has to be carried out. One of the first decisions is whether to use multi-beam or single-beam echosounders for surveying depth information.
- The recorded bathymetric data have to be cleaned and processed due to the high amount of data.
- The surveyed data have to be transformed into the desired projection and exported to the final Inland ENC S-57 format.
- The old depth information is substituted and integrated into the official Inland ENCs with the actual depth data. Objects are formed new, attributes are adapted and the depth areas are cleaned by editing other geometry errors. This process is quite complicated and time consuming. At the end the cell is checked to a quality test and further errors are repaired regarding the Inland ECDIS Standard.

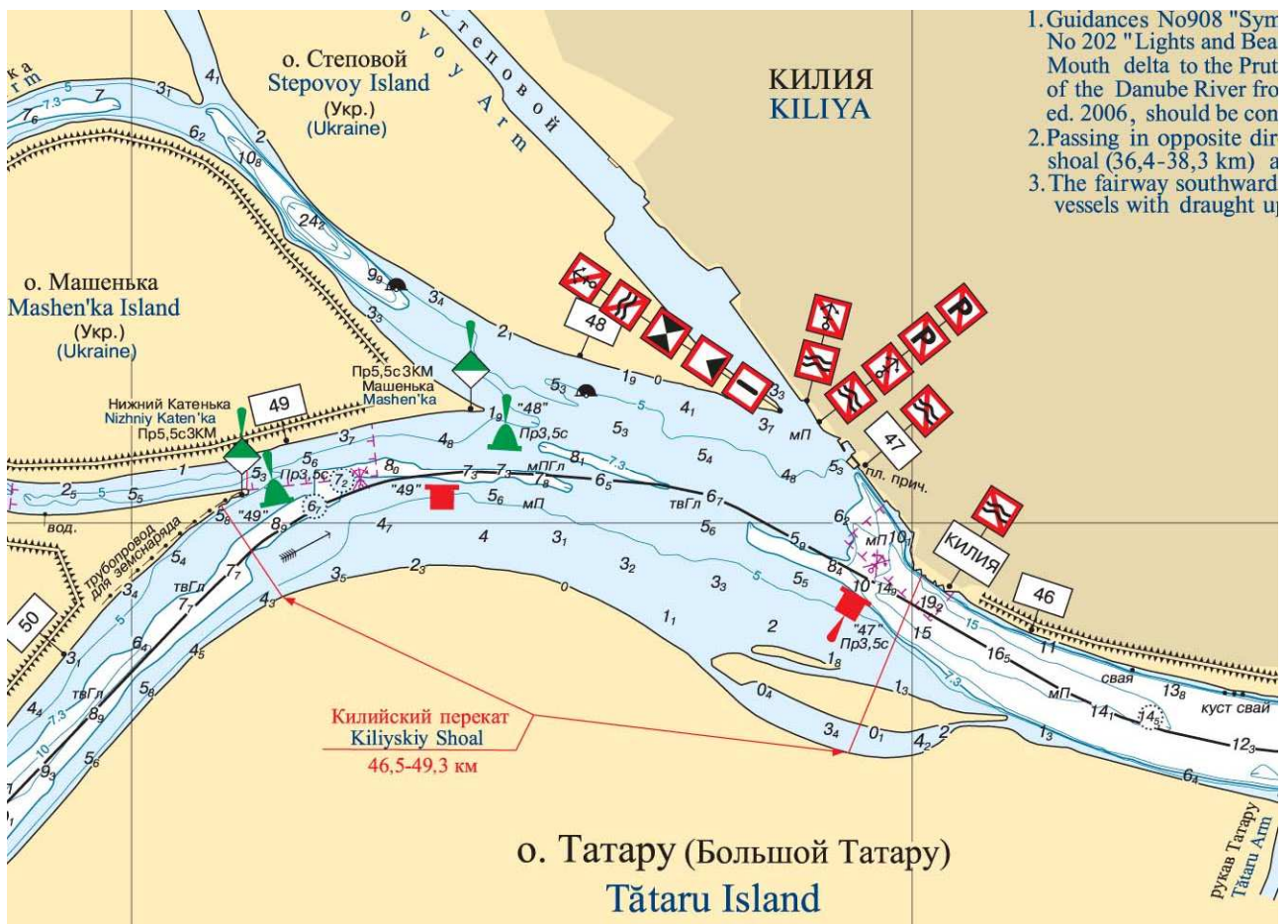
Depth information is extremely important on critical sections, because there the depth is changing rapidly. Therefore it is necessary to update the depth information much more frequently than the rest of the Inland ENC. In Ukraine the depth information for the free-flowing sections in the Inland ENCs must be updated once a year.

For the production of the depth information survey data from hydrographic survey department are needed as sources. With adequate conversion tools the survey source data (depth countours, depth areas) then is converted into the S-57 format regarding the Inland ECDIS Standard.

To reduce the data volume of Inland ENCs the isobaths are reduced. The following contour intervals are produced in Ukraine:

- less than 1m of depth there are no isobaths
- from 3 m and 7 m of depth there are 2 m spacing between isobaths
- more than 7 m of depth there are represented isobaths 10, 15, 20 m.

Below you can see some IENC example.



### **Notice marks**

In Ukraine notice marks is included the data related to the fairway, buoys, mooring places, etc.

Following steps for producing and encode all objects and attributes regarding Inland ECDIS Standard Edition 1.02:

Check the accuracy and encoding consistency with dKart ENC Analyzer.

## **Chapter 4 IENC publication process**

IENCs published in S-57 format

<http://dudg.kiev.ua> Ukraine's charts of Danube and Dniپر rivers, which is produced with Inland ECDIS standard, edition 1.02 distributed by itself (State Hydrography Service) and you can see some simple charts at web site <http://dudg.kiev.ua>, and also through Periskal company including in Tresco viewer software.

In Ukraine Inland Electronic Navigational Charts (Inland ENC) are provided and updated at a regular basis and published in S-57 format.

The publication of new updates for Inland ENC is announced on the Notices to Mariners of Ukraine. Distributors of IENC are such companies as PERISKAL and Jeppesen.

## **Chapter 5 IENC sources and accuracy**

We are using required to accuracy of IENC objects according IHO recommendations S-44.

The charts were produced on the basis of the information available at the time of generation and are updated when new data become available (e.g. on water engineering work carried out in the meantime or changes to the riverbed due to flooding).

The source data for the ENC product are provided out of surveys. The surveying department (hydrographical) are equipped with tools and technologies to assess the sources to meet the minimum requirement for ENC production.

Depths information are based on RNW96 (low water level according to the recommendations of the Danube Commission). SHS continues to carry out hydrographical survey and production IENCs of Dniپر river. Now IENCs coverage of Dniپر is 60%.

Accuracy arrange of IENCs notice marks and topographical information is 1-3 metres and bathymetric information is 1-4 m.

## **Chapter 6 Inland ECDIS Standard**

After Post processing we are doing control checks.

In Ukraine the Inland ENC's are produced according Edition 1.02 of the Inland ECDIS Standard. The Ukrainian Inland ENC's consist of digitised data conforming to the IHO (International Hydrographic Organization) S-57 ENC Product Specification that records all relevant charted features for safe navigation, such as coastlines, bathymetry, buoys, lights, etc.

The Inland ENC's are in accordance with the IHO S-57 standard. This Standard is based on the „IHO Transfer Standard for Digital Hydrographic Data” (Edition 3.1, November 2000), which defines the format for exchanging information, the object catalogue and the product specification. The IHO also published the so-called S-52 standard for standardizing how vessels, bridges, locks, buoys, notice marks, waterway signs, signs and markings and other objects are displayed on the charts.

It is planned to publish updates of the IENC's for each version of the standard as soon as it is official and availability of financial conditions.

## **Chapter 7 Utilisation of location codes and RIS Index**

Just ports, terminals, hectometre marks and moorages are primarily encoded with the 20 digit ISRS Location Code.

For the provision of the Minimum Data (i.e. also the RIS Index) as prescribed in the Annex I of the RIS Directive 2005/44/EC are responsibilities in Ukraine the State Hydrography Service

RIS Index according to the RIS Index Encoding Guide not available on the website of the NTS Expert Group, it is still the testing process

RIS Index provided for Danube and some part of Dnipro

Provide an update of the RIS Index when it's needed.

Software module is not used to extract the ISRS Location Codes from the IENC objects to the RIS Index.

The **RIS Index** is a list of location codes with additional information on the objects and is available at <http://www.delta-pilot.ua> or <http://www.vts.delta-pilot.ua>.

## **Chapter 8 Cooperations**

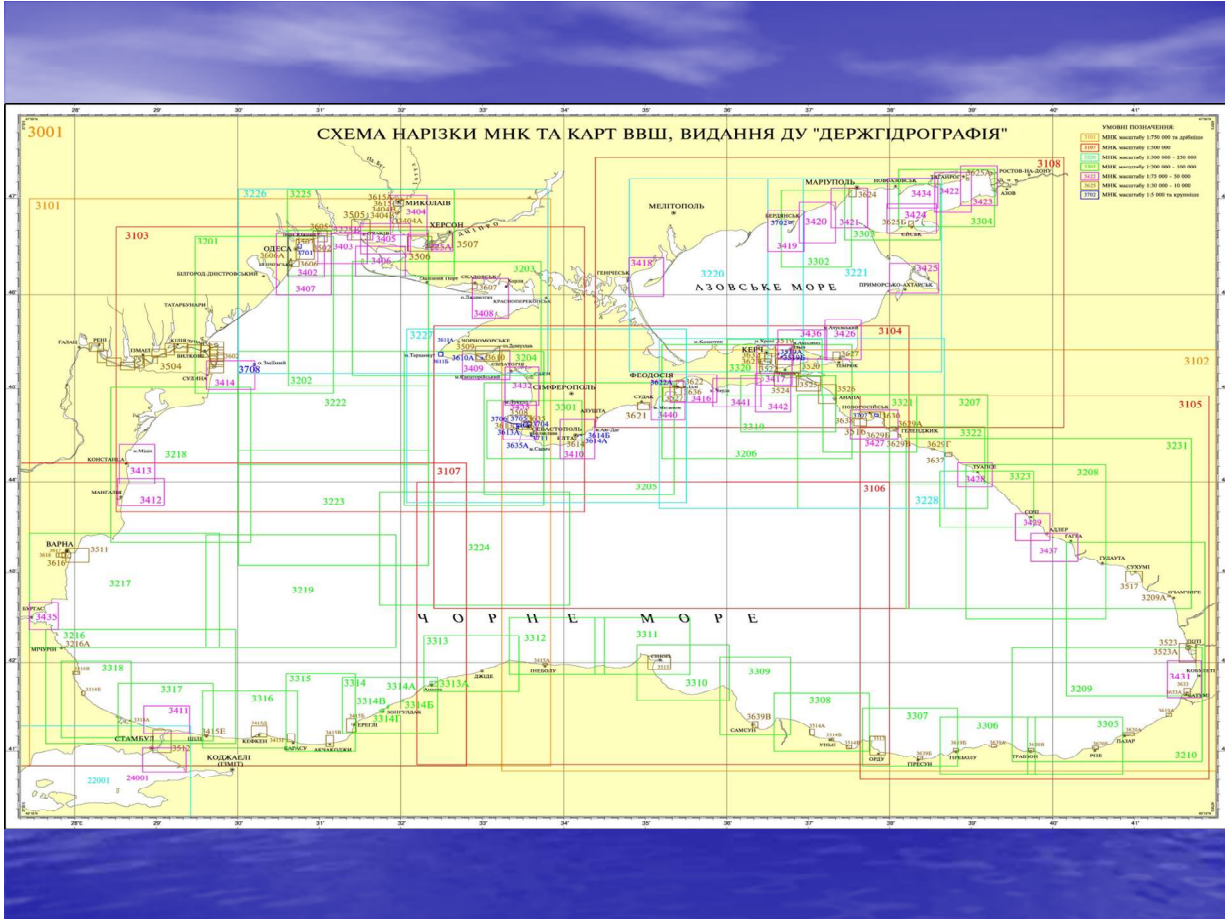
There is no Cooperation with neighbouring countries Ukraine and Romania and an agreement concerning “area of responsibility”.

## **Chapter 9 Chart updates, updating circle**

Inland waterways are dynamic systems. If the depth of a water area changes, if there is a new bridge, or a new transshipment installation then updates are provided and published.

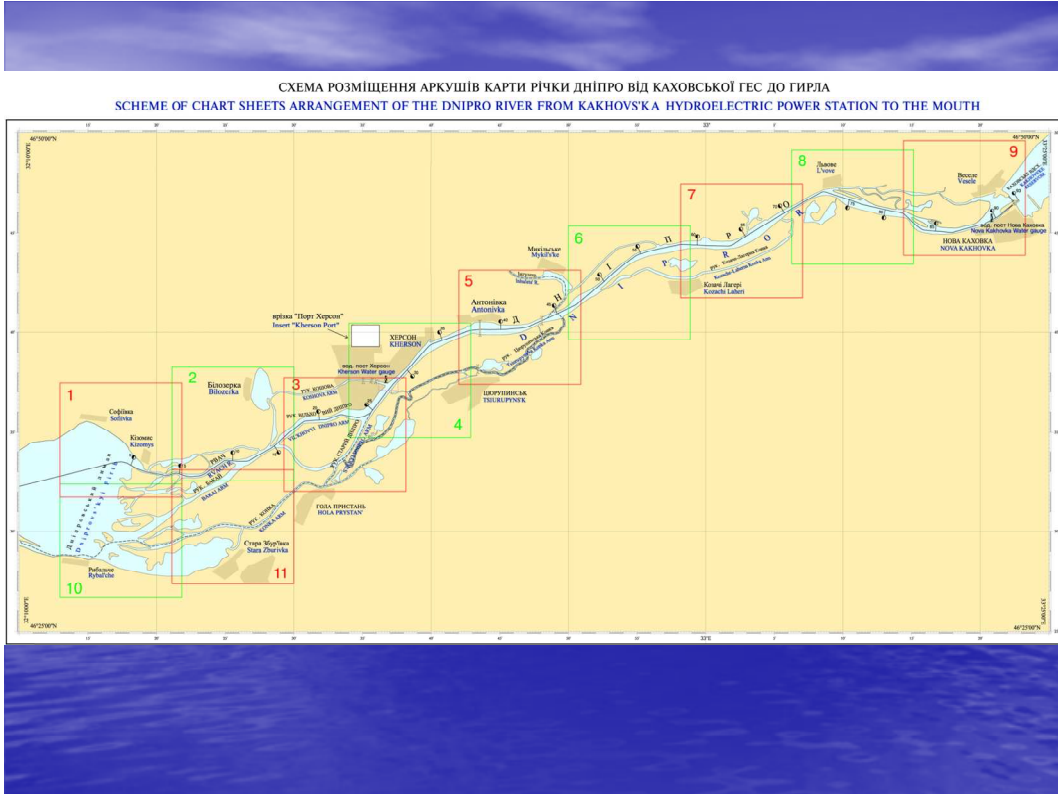
In general, the process starts when the hydrographic department provides a message to update the current edition of an Inland ENC cell. The hydrographic department that produce the geographical information out of surveys is responsible for the accurate and the up-to-date information. Computer software is used to compare the difference between the two versions and then to update the changes.

Below you can see some scheme of ENC production in Ukraine



**Навігаційна річкова карта Канівського водосховища № 3533**  
**Navigational River chart of Kaniv's'ke Reservoir No 3533**





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