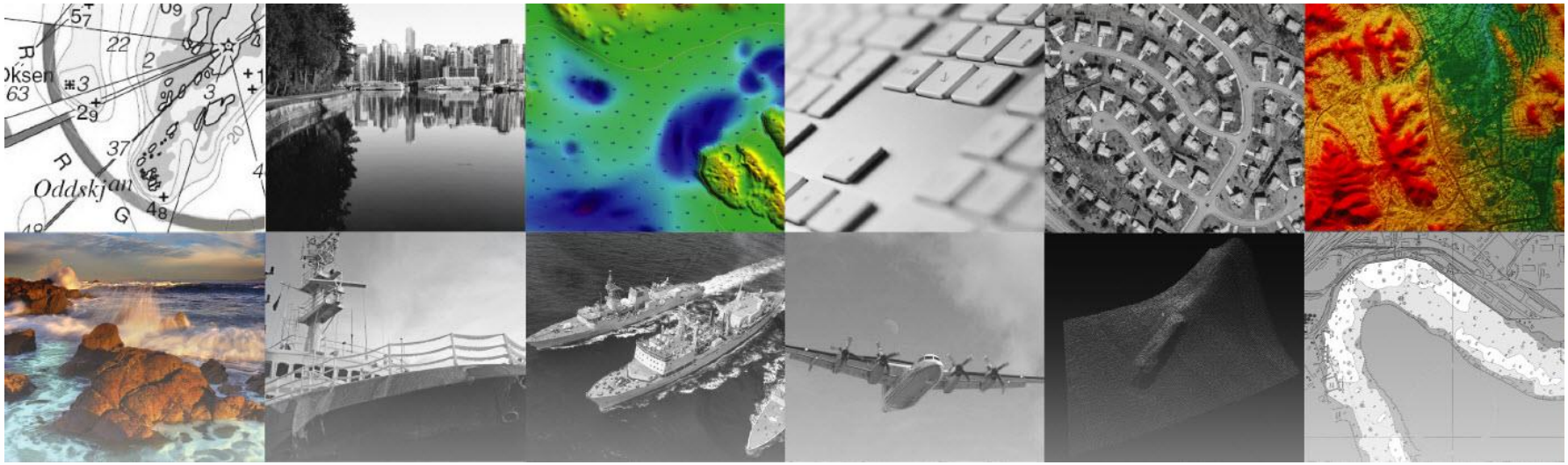
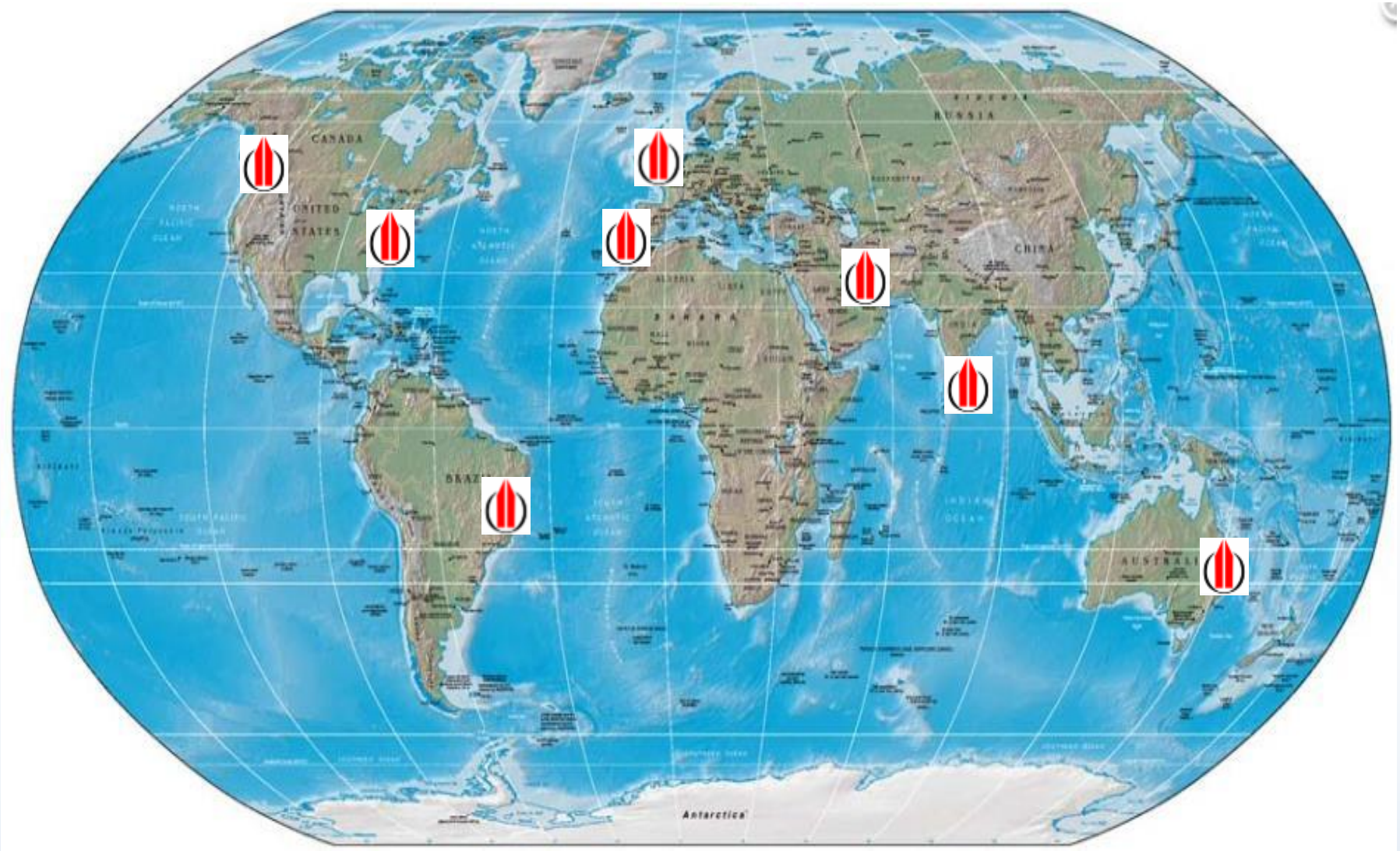
IIC TECHNOLOGIES



Inland Electronic Nautical Charts

IIC Technologies



Content

IIC TECHNOLOGIES

- Specific characteristics of Waterways
- Major diferences between ENCs and IENCs
  - Various users
  - Different usages, scales and chart scheeming
- Inland ENC Harmonization Group
- Compilation using IENC Encoding Guide
- IIC Technologies and IENCs study and production

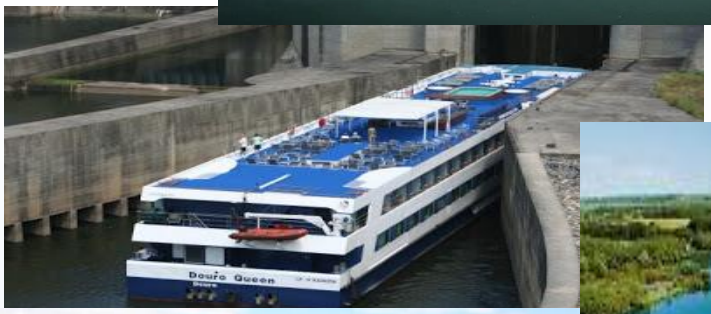
Specific characteristics of Waterways

IIC TECHNOLOGIES

- Vessels using waterways are both inland and maritime
- Inland waterways navigation is regulated by national or regional institutions
- National and regional symbology applied for specific signals, signs and marking

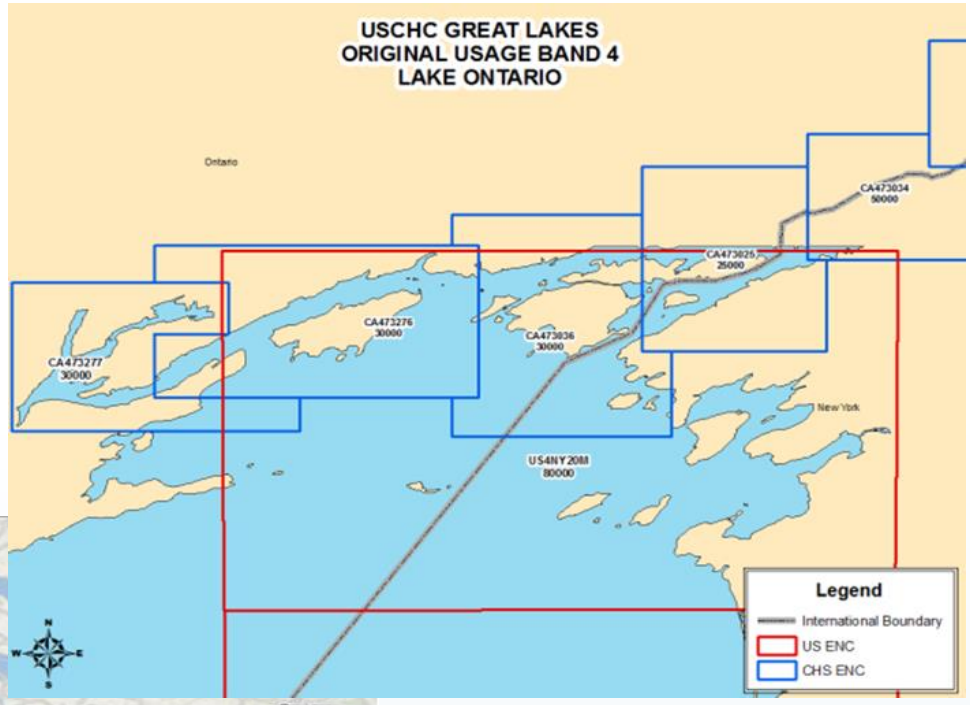
ENCs Vs IENCs – Users

- Maritime navigation vessels
- Inland navigation vessels
- Cargo ships
- Leisure crafts
- Small cruisers

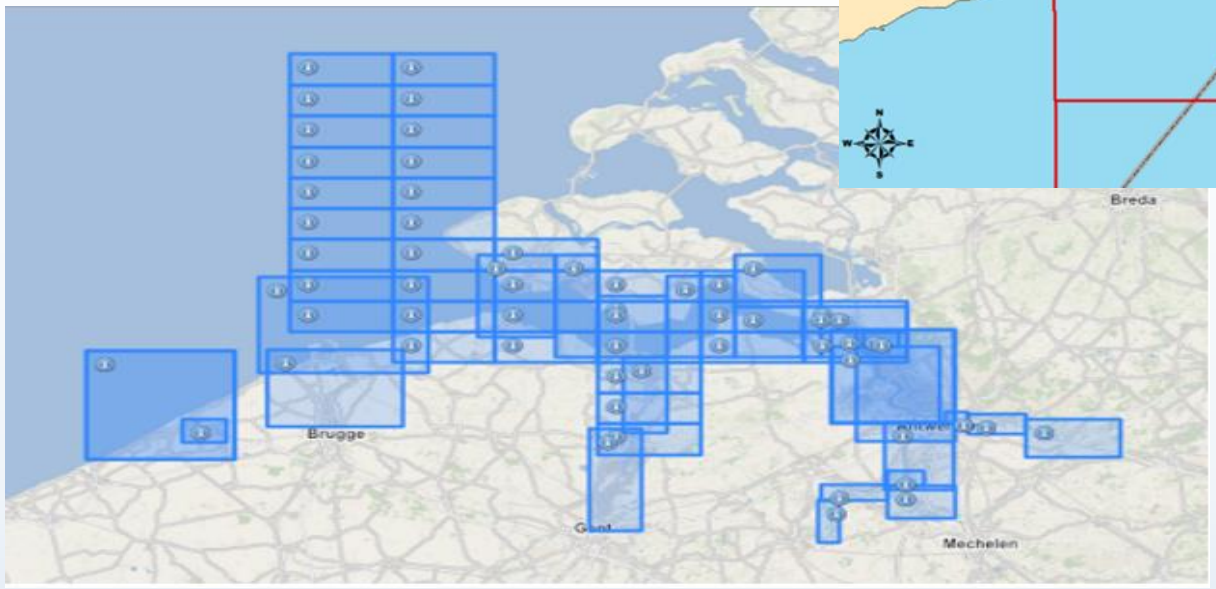


ENCs Vs IENCs – Usages and Scale

- Different usages
  - 7 – River
  - 8 – River Harbour
  - 9 – River Berthing



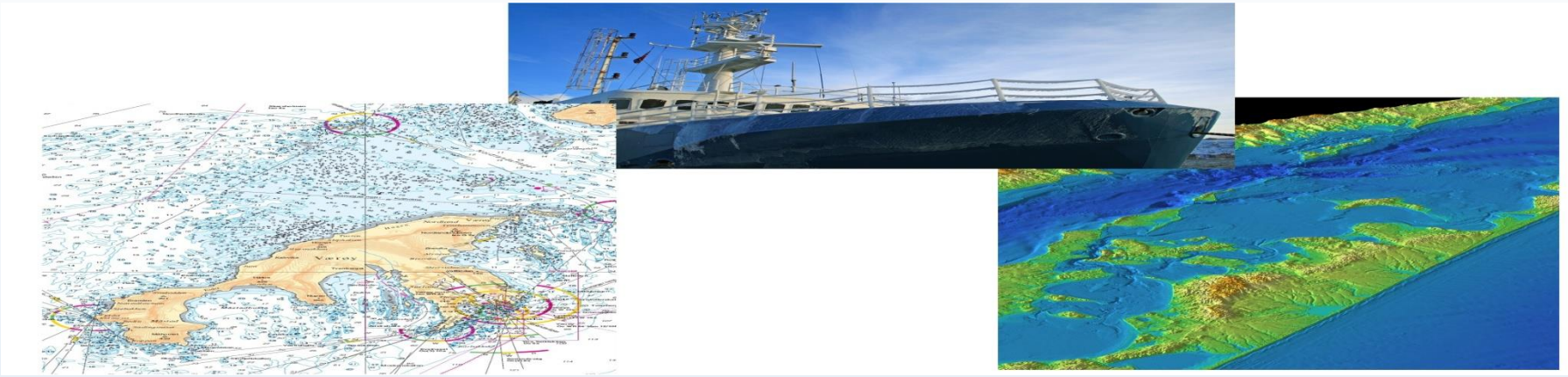
- Larger scale charts



ENCs Vs IENCs – Dynamic Enviorment

IIC TECHNOLOGIES

- Dynamic environment
  - Fluvial currents produce faster erosion, sediment movement and considerable depth variations
  - Metheriological and climatological factors are also determinant
  - Constantly mutating dynamic environment requires great effort from authorities to ensure safe navigation routes



Inland ENC Harmonization Group

IIC TECHNOLOGIES

- 2003 – Establishment of IEHG
- 2009 – Recognition by IHO as a Non Governmental International Organization (NGIO)
- Main object to develop and maintain standardized product specification for Inland ENCs
  - Feature Catalogue
  - Encoding Guide
- IEHG “advises and provides input” regarding IENC technical standards development, implementation and maintenance

ENCs Vs IENCs – Compilation

IIC TECHNOLOGIES

- Detailed Encoding Guide for Inland ENCs
  - IENC exclusive acronyms identified by lower case letters
  - Additional features, attributes and enumerations to complement and adequate S-57 objects
- Specific encoding is needed in key objects
  - Metadata
  - Bridges and Overhead Obstructions
  - Damns
  - Buoys, Beacons, Daymarks, Notice Marks
  - Etc.
- S-401 product will allow homogenization, replacing lower case elements by HYDRO elements

IENC Encoding Guide – Navigation Aids

IIC TECHNOLOGIES

Diagram for Brazilian national inland waterway regulations – side independent

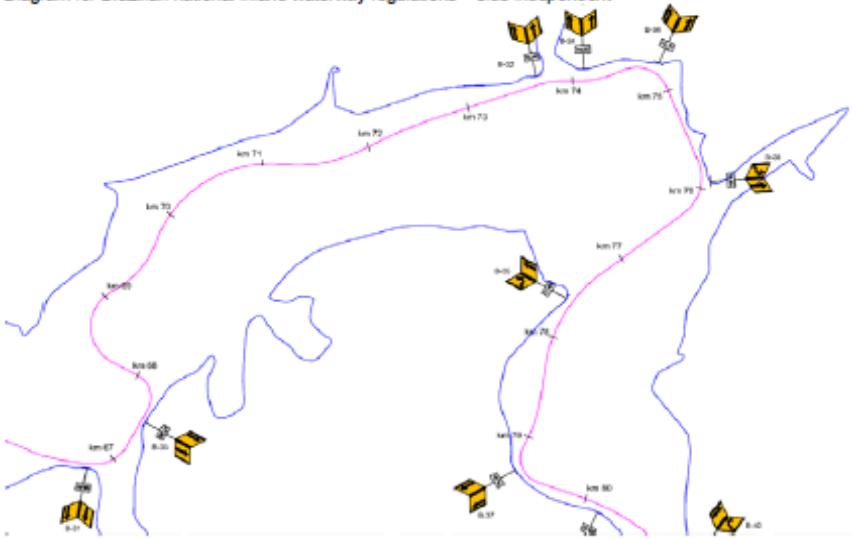
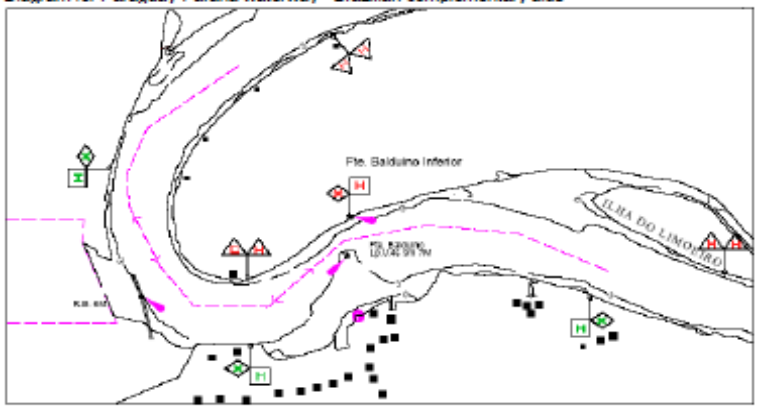


Diagram for Paraguay-Parana waterway - Brazilian complementary aids



Real World

Chart Symbol

IENC Symbolization

Real World (Brazil - one side system)

Real World (Paraguay-Parana (Brazilian))

E) For CEVNI: The distance of impact (downstream or upstream, 'disipd' or 'disipu') can be defined by the distance between two notice marks, by a number, which is shown on the top board or by a number, which is shown on an triangular additional mark.

F) For CEVNI: The minimum distance of impact from the notice mark rectangular to the bank (disbk1) can be defined by:

1. the number on a sign C.5 (distance of the waterway from the bank),

2. the first number on a sign E.5.2 (berthing permitted between two distances).

G) For CEVNI: The maximum distance of impact from the notice mark rectangular to the bank (disbk2) can be defined by:

3. the number on a sign A.5.1 (berthing prohibited within the breadth indicated),

4. the number on a sign E.5.1 (berthing permitted within the distance indicated),

5. the second number on a sign E.5.2 (berthing permitted between two distances).

H) For CEVNI: Rectangular boards on top of the main sign ('addmrk' = 1) are showing the distance at which the regulation applies or the special feature indicated by the notice mark is to be found.

Rectangular boards at the bottom of the main sign ('addmrk' = 2) are showing explanations or additional information.

Triangular pointers at the side of the main sign ('addmrk' = 3 or 4) are showing the direction of the section to which the notice mark applies.

Triangular pointers at the bottom ('addmrk' = 5) are showing the distance from the shore, within which the regulation applies.

The attribute 'addmrk' is only defining the position and shape of the additional mark. The content is given by other attributes ('disipd', 'disipu', 'disbk1', 'disbk2', INFORM, NINFOM)

I) For CEVNI: If the system of

(O) INFORM = (text of additional marks in English)

(O) NINFOM = (Refer to Section B, General Guidance)

(O) CONDTN = [1 (under construction), 2 (ruined), 3 (under reclamation), 5 (planned construction)]

(M) SCAMIN = [EU: 22000; US: 60000; BR: 50000]

(C) SORDAT = [YYYYMMDD]

(C) SORIND = (Refer to Section B, General Guidance)

IENC Compilation – Bridges

D Cultural Features

D.5 Bridges

IHO Definition: **BRIDGE**. A structure erected over a depression or an obstacle such as a body of water, railroad, etc... to provide a roadway for vehicles, pedestrians or to carry utility services. (IHO Dictionary, S-32, 5th Edition, 544)

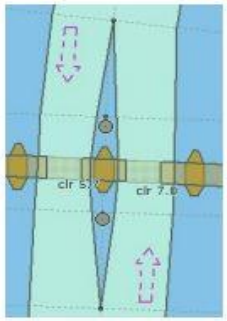
Graphic	S-57 Geo Object	S-57 Attribute	Allowable Encoding Value	Attrib. Type
 Fixed Bridge *Photograph, courtesy of the Pacific Hydrographic Branch*  Fixed Bridge *Photograph, courtesy of the Pacific Hydrographic Branch*	BRIDGE (P, L, A)	CATBRG (M)	1 : fixed bridge 2 : opening bridge 3 : swing bridge 4 : lifting bridge 5 : bascule bridge 6 : pontoon bridge 7 : draw bridge 8 : transporter bridge 9 : footbridge 10 : viaduct 11 : aqueduct 12 : suspension bridge	E
		CONDTN	1 : under construction 2 : ruined 3 : under reclamation 4 : wingless 5 : planned construction	E
		COLOUR	1 : white 2 : black 3 : red 4 : green 5 : blue 6 : yellow 7 : grey 8 : brown 9 : amber 10 : violet 11 : orange 12 : magenta 13 : pink	L
		COLPAT	1 : horizontal stripes 2 : vertical stripes	L

G - Ports, Waterways

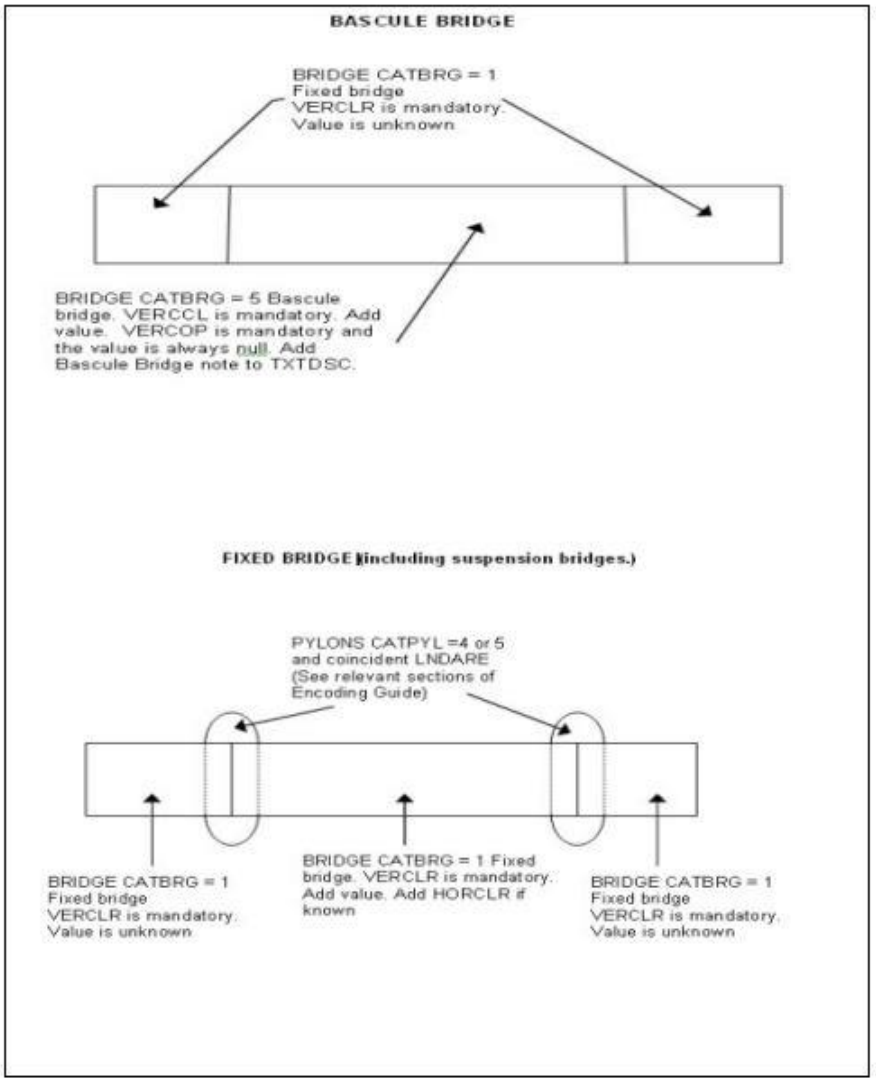
G.1 Bridges, Tunnels, Overhead Obstructions

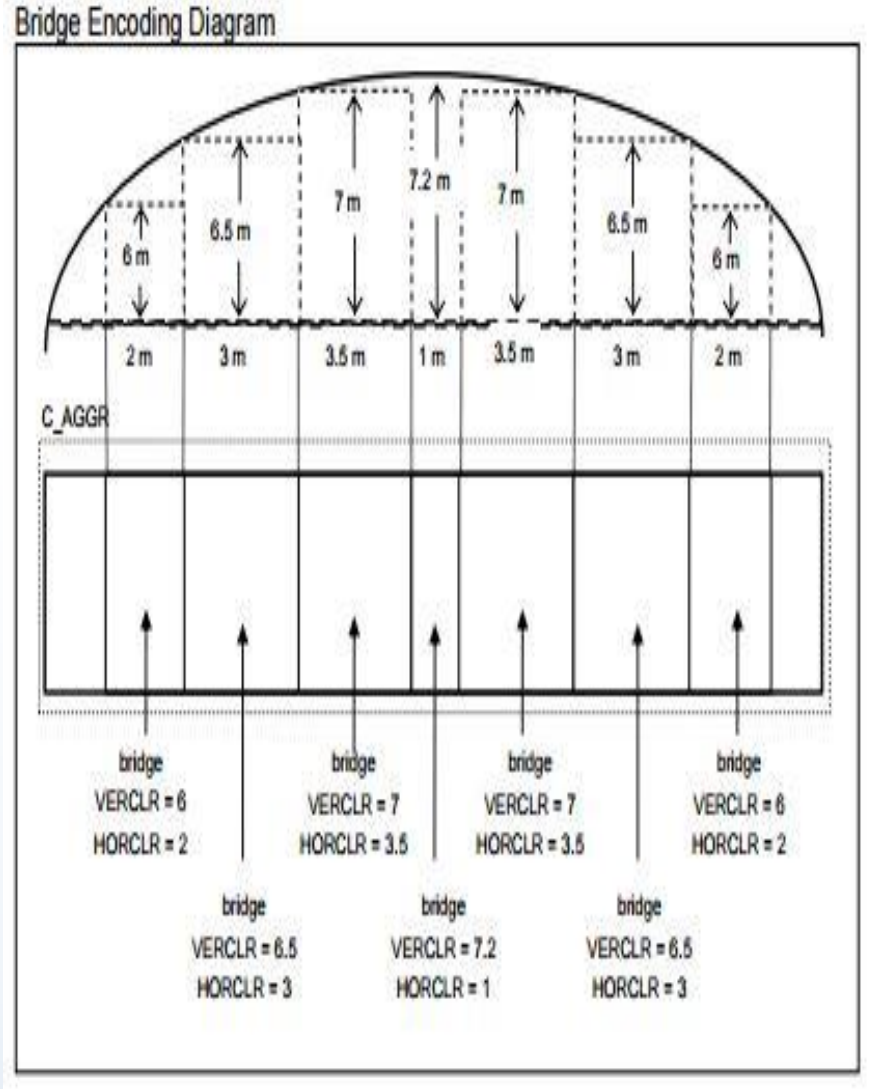
G.1.2 Bridges with Bridge Arches (M)

A Bridge which has bridge arches rather than straight construction.

Graphics	Encoding Instructions	Object Encoding
Real World  *IENC Symbolization* 	A) Pylons shall be encoded as PYLONS (refer to G.1.10 – Pylons, Piers and Bridge, Cable, Pipeline Support) B) The following instructions are only necessary if the available space according to the beam and air-draft of the vessel shall be indicated. This is only possible if the arch of the bridge can be separated into different single pieces with known vertical clearances or if the arc is mathematically known. -Create several bridge objects with CATBRG = 13 (bridge arch) for one bridge arch. -The number of the bridge objects depends on the resolution of the different vertical clearances which shall be provided. The width of the element with the biggest vertical clearance should not be less than the typical width of vessels (12m for European waterways). -The areas must not overlap. -All of the bridge object of one arch which are situated within the allowed passage must be aggregated by a c_brga object. C) Create separate bridge respectively c_brga objects for spans over navigable channel when attributes of navigable spans are different (e.g. vertical clearance, horizontal clearance). D) Bridge approaches (over the bankline) should be encoded. E) Use PICREP if available. F) Roads and railways on bridges shall not be encoded. G) Place LIGHTS on navigable span and piers bounding navigable span. H) All objects of a bridge which belong to one bridge must be combined to	**Object Encoding** **Object Class** = bridge(A) (M) CATBRG = [1 (fixed bridge), 13 (bridge arch)] (C) HORCLR = [xx.x] (metres), e.g., 34.2 (C) VERCLR = [xx.xx] (metres), e.g., 13.27 (C) verdat = [12 (Mean lower low water), 31 (Local low water reference level), 32 (Local high water reference level), 33 (Local mean water reference level), 34 (Equivalent height of water (German GIW)), 35 (Highest Shipping Height of Water (German HSW)), 36 (Reference low water level according to Danube Commission), 37 (Highest shipping height of water according to Danube Commission), 38 (Dutch river low water reference level (OLR)), 39 (Russian project water level), 40 (Russian normal backwater level), 41 (Ohio River Datum), 42 (Approximate LAT), 43 (Dutch High Water Reference Level (MHW)), 44 (Tweede Algemene Waterpassing)] (C) PICREP = (Refer to Section B, General Guidance) (C) unlocd = [ISRS code] (M) wtwdis = [xxxx.xxx] (units defined in hunits), e.g., 2451.732 (M) hunits = [3 (kilometres), 4 (hectometres), 5 (statute miles), 6 (nautical miles)] (C) OBJNAM = (Refer to letter I) (C) NOBJNM = (Refer to Section B, General Guidance) (O) CONDTN = [1 (under construction), 2 (ruined), 3 (under reclamation), 5 (planned construction)] (C) refgag = (Refer to letter P) (M) SCAMIN = [EU: 90000; US: 300000] (C) SORDAT = [YYYYMMDD] (C) SORIND = (Refer to Section B, General Guidance) **Object Encoding**

IENC Compilation – Bridges





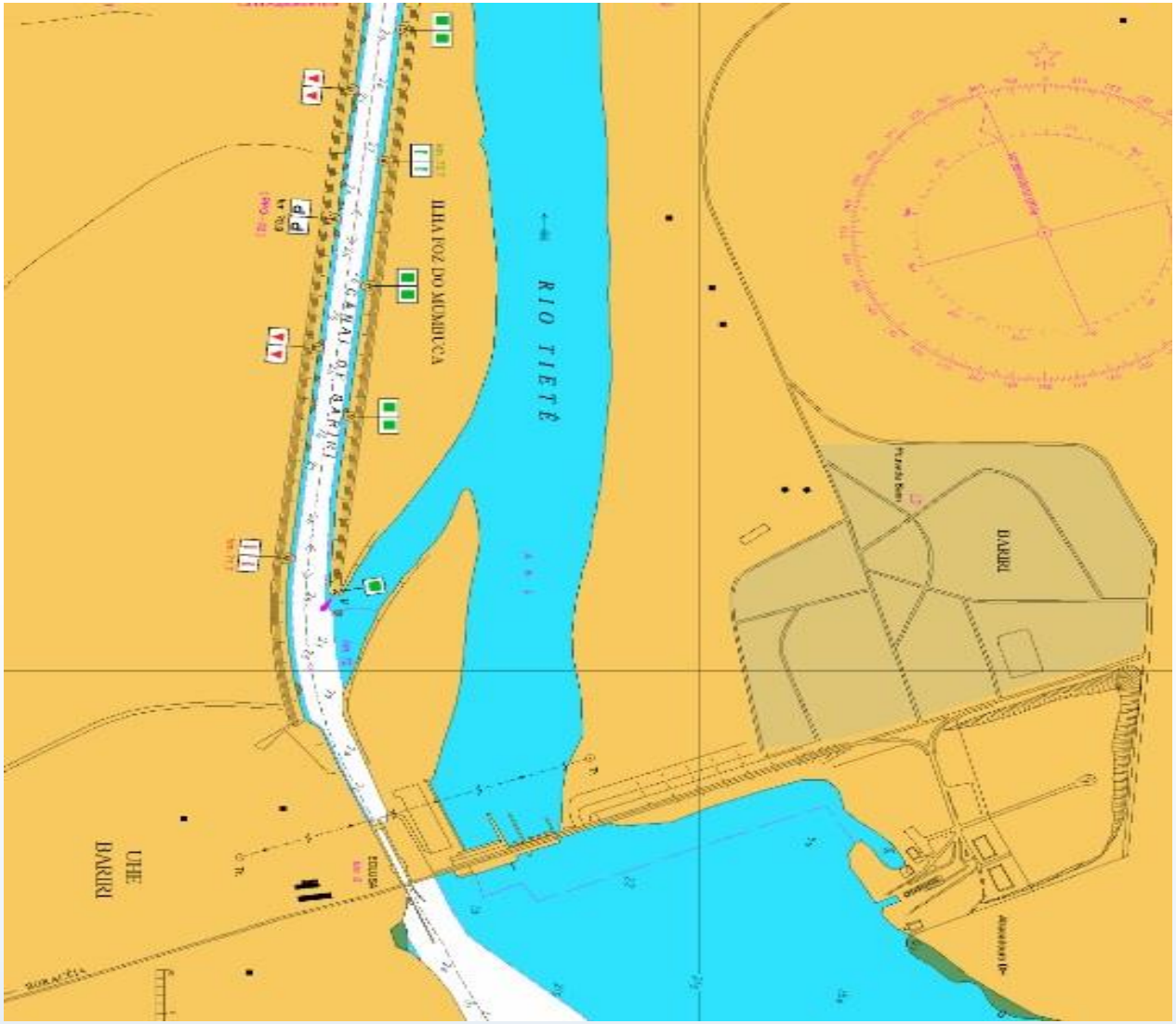
IENC Compilation

IIC TECHNOLOGIES

- Areal image of the Bariri Damn on the Tietê River

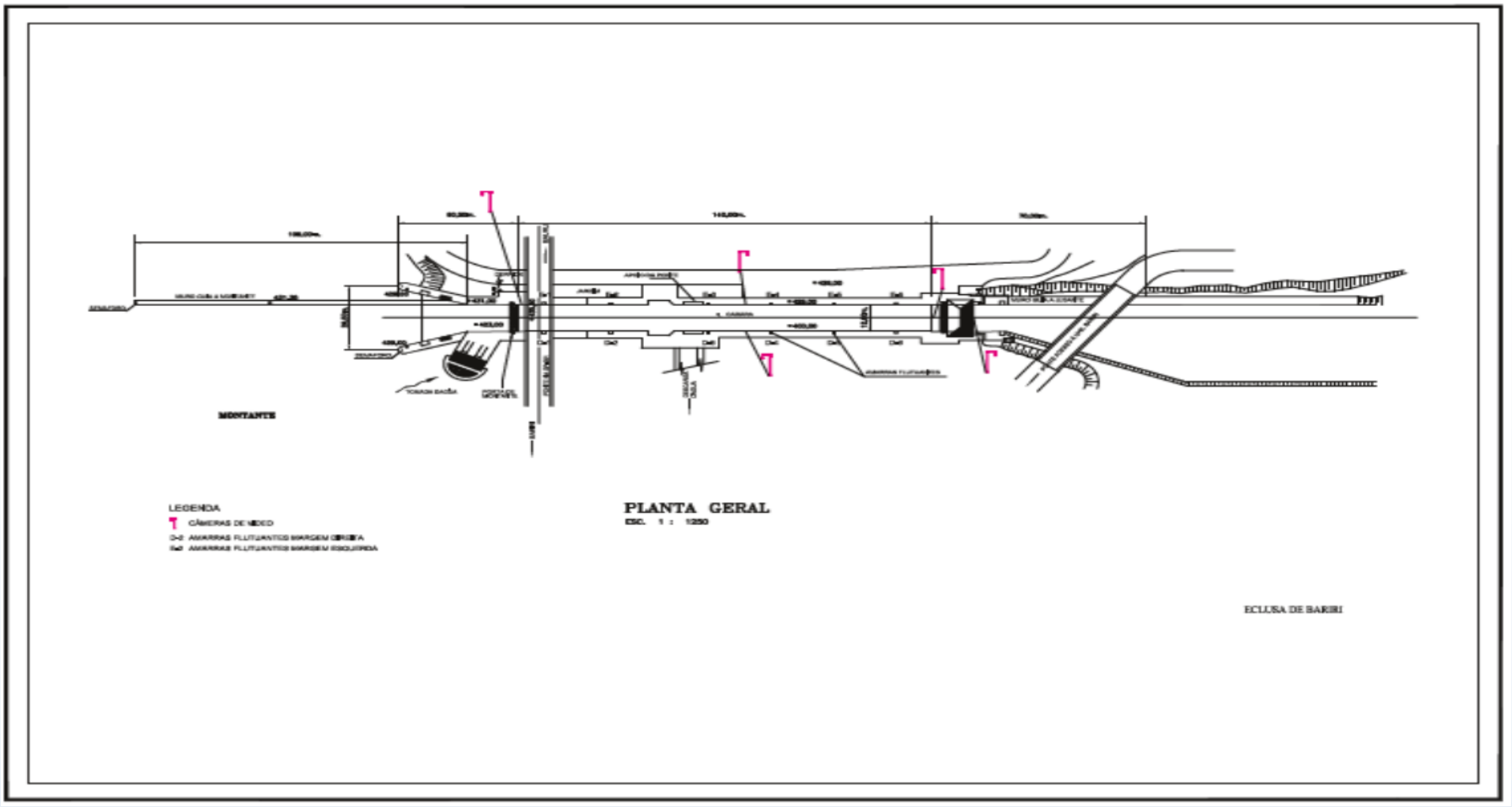
IENC Compilation

- Bariri Damn on the Tietê River as presented on Paper Chart



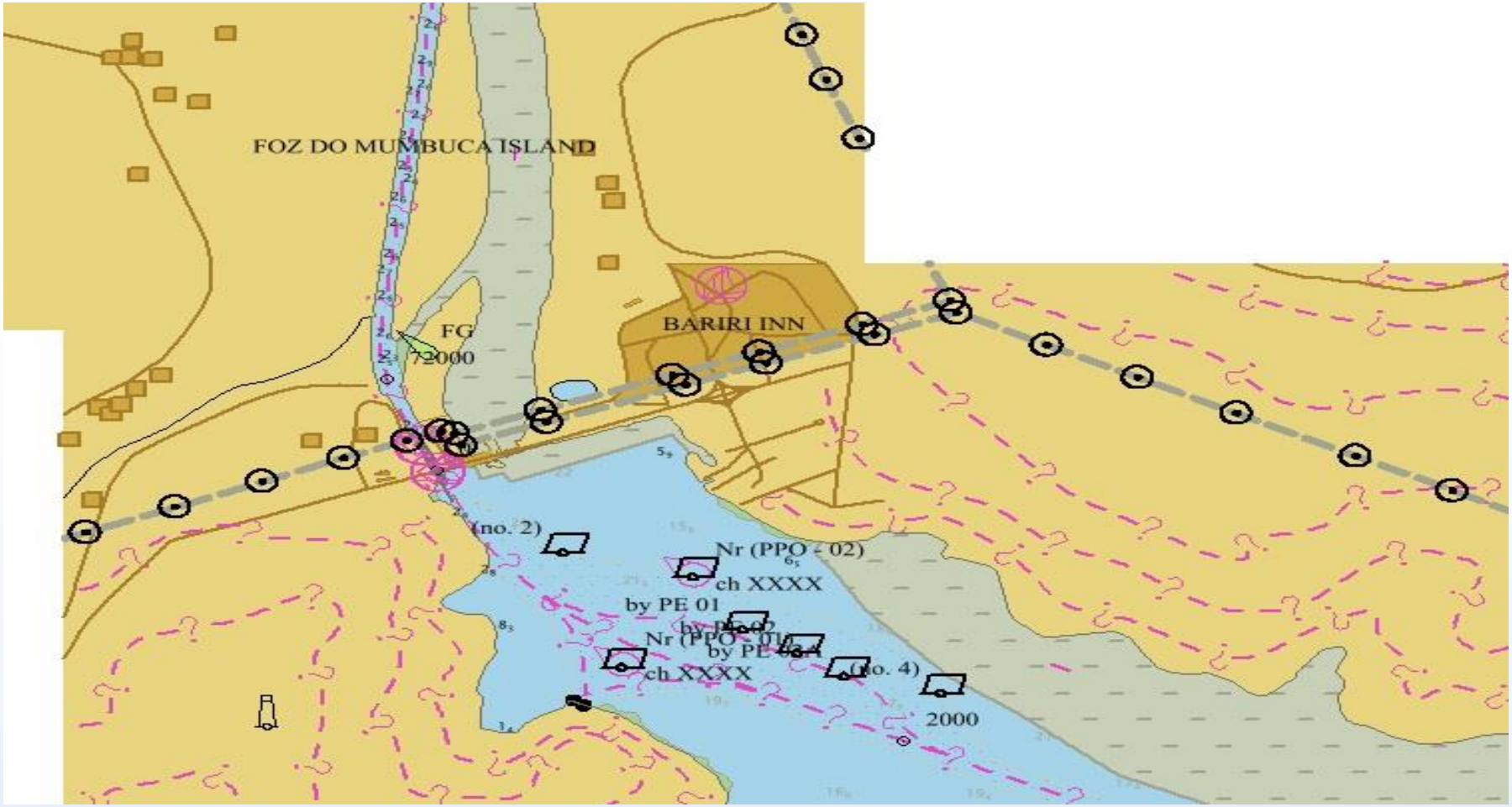
IENC Compilation

- Detailed image of the Bariri Damn on the Tietê River



IENC Compilation

- Bariri Damn on the Tietê River encoded as per IENC



IENC Compilation

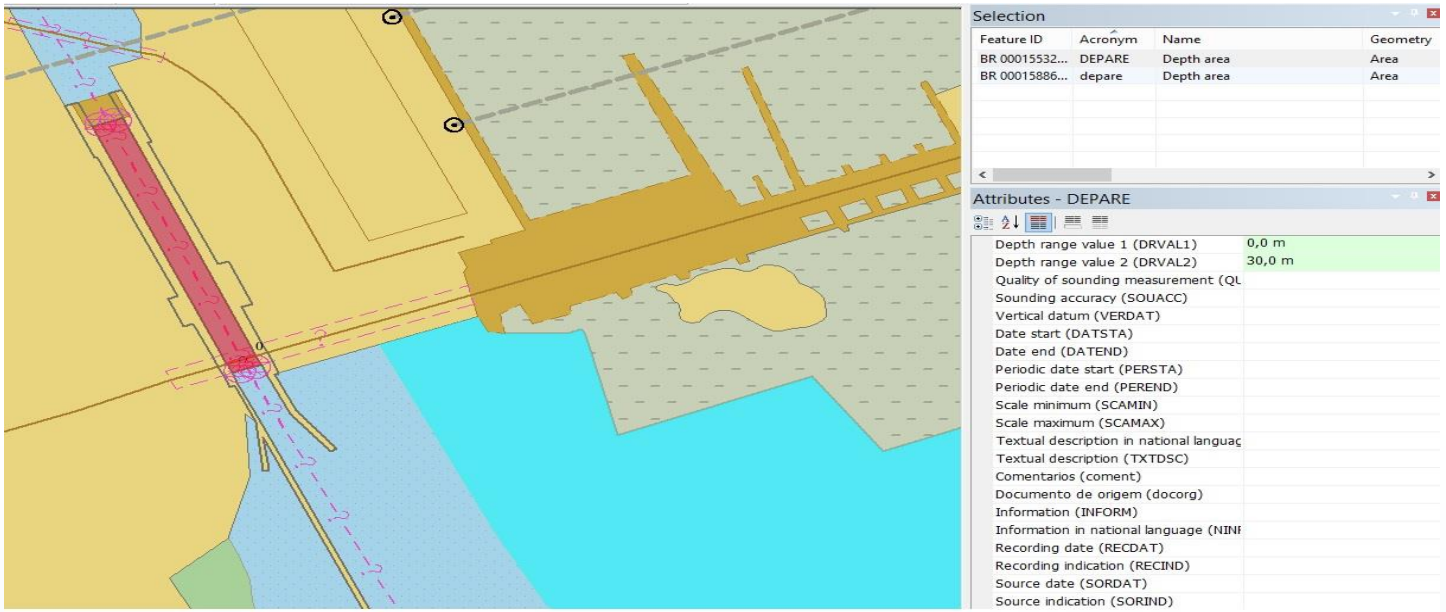
- List of the objects encoded for the Bariri Damn area

Selection

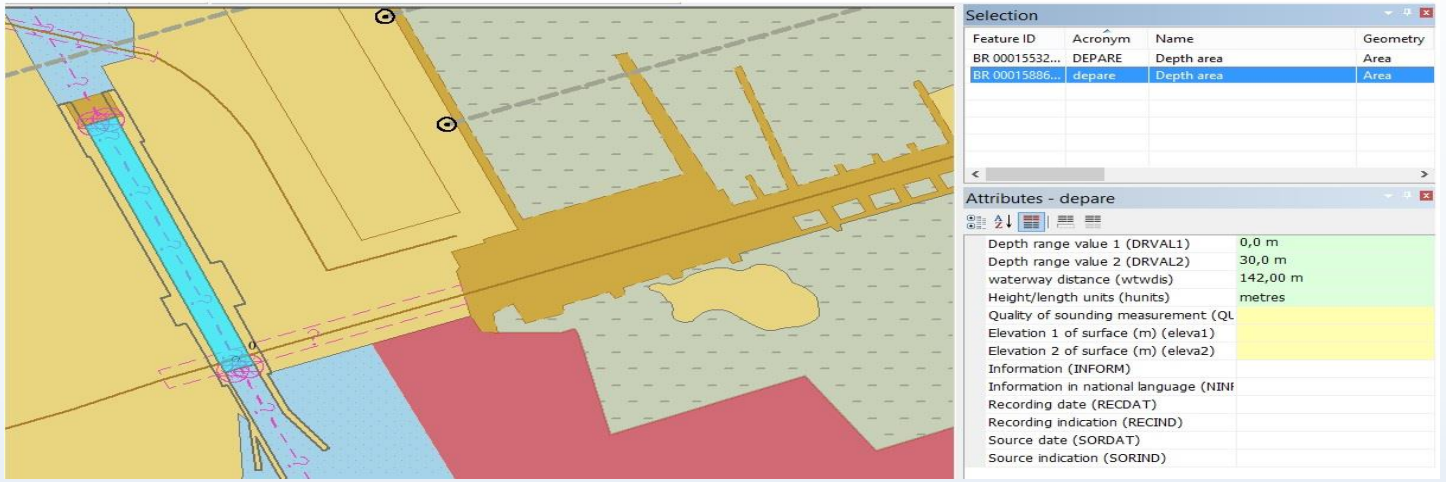
Feature ID	Acronym	Name	Geometry
BR 00015545...	BRIDGE	Bridge	Area
BR 00015885...	BRIDGE	Bridge	Area
BR 00008826...	BUISGL	Building, single	Area
BR 00015885...	DAMCON	Dam	Area
BR 00015885...	DRGARE	Dredged area	Area
BR 00008838...	PYLONS	Pylon/bridge support	Point
BR 00008844...	PYLONS	Pylon/bridge support	Point
BR 00008844...	ROADWY	Road	Line
BR 00015885...	ROADWY	Road	Line
BR 00015521...	cblohd	Cable, overhead	Line
BR 00015521...	cblohd	Cable, overhead	Line
BR 00015521...	cblohd	Cable, overhead	Line
BR 00015886...	depare	Depth area	Area
BR 00015885...	gatcon	Gate	Line
BR 00015885...	lokbsn	Lock basin	Area
BR 00015892...	m_nsys	Navigational system of marks	Area
BR 00015885...	slcons	Shoreline Construction	Area
BR 00015885...	slcons	Shoreline Construction	Area

IENC Compilation

- Encoding DEPARE

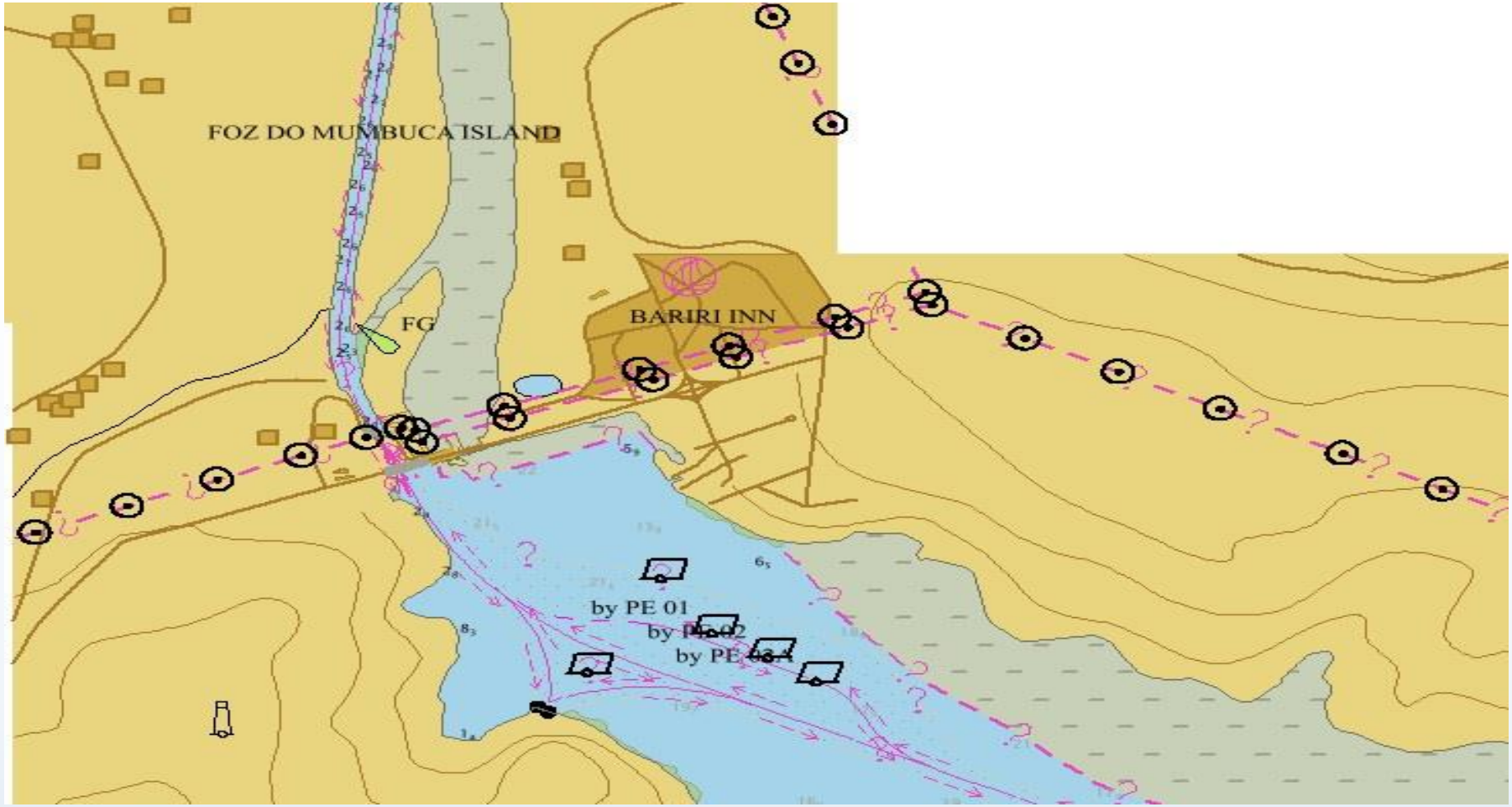


- Encoding dpare



IENC Compilation

- Bariri Damn on the Tietê displayed on an ECDIS (S-52)



IIC Technologies and IENCs

- Support to **DHN Brazil**
  - 151 Paraguay River Paper Charts
  - Paper Charts of the Trombetas River
  - Update of the source for all the 675 Km of Tocantins River
  - Creation and population of 16 IENC cells
  - Capacity building through “tailor fit” training courses and side by side production assistance

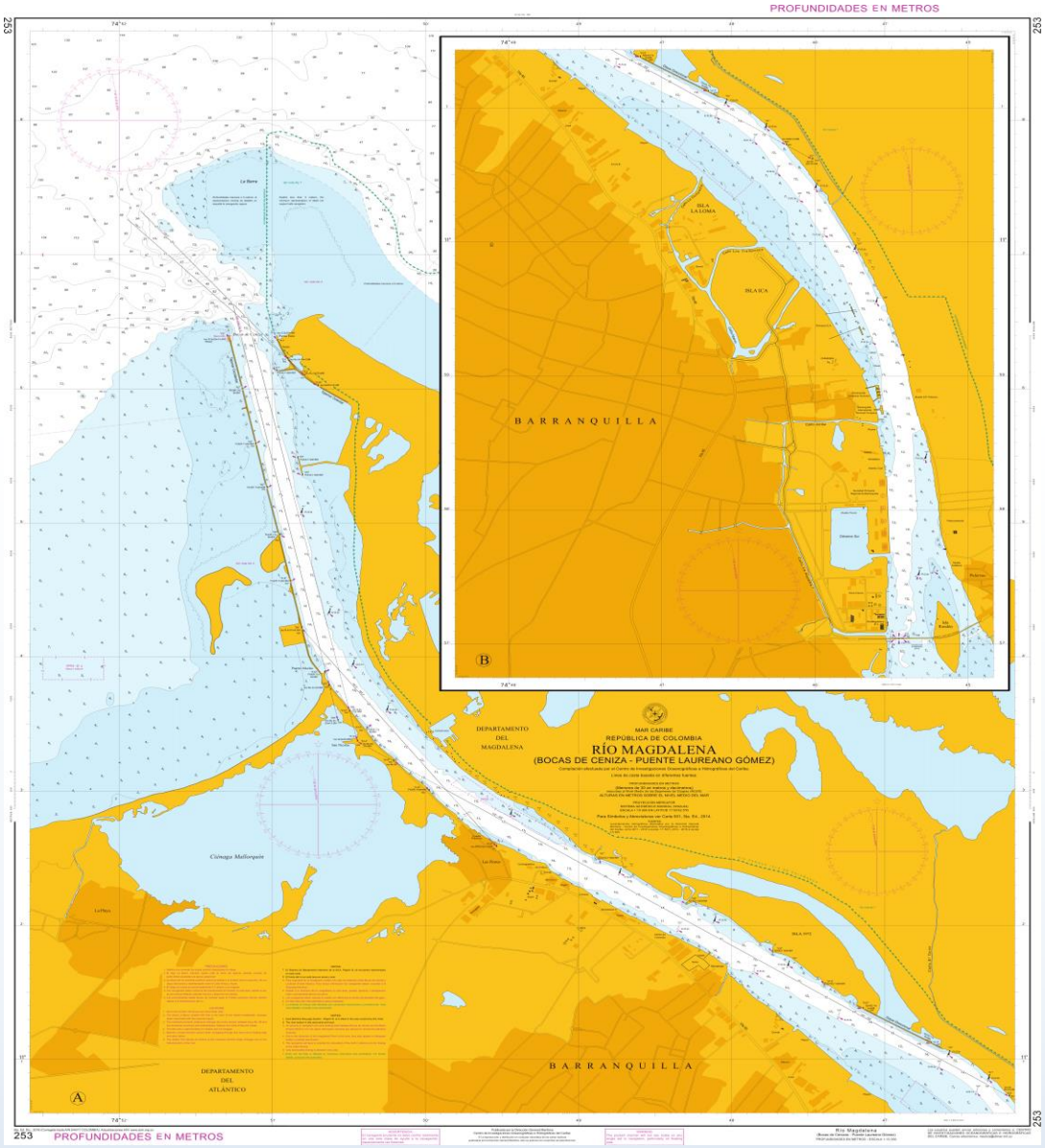
IIC Technologies and IENCs

- Support to the **USACE Programme**
  - Production of IENCs for over 10.000 Km of waterways
  - Monthly maintenance of 61 IENCs coordinated by 11 districts
  - Continuous automatic updating of the Mississippi River

- 2015/2016
  - Production of standardized charts of Arkansas and Atchafalaya River

IIC Technologies and IENCs

- Experience in the Magdalena River, Colombia
- Sources
  - Paper Chart
  - Aerial imagery
  - Bathymetry
- Goal was to produce an IENC

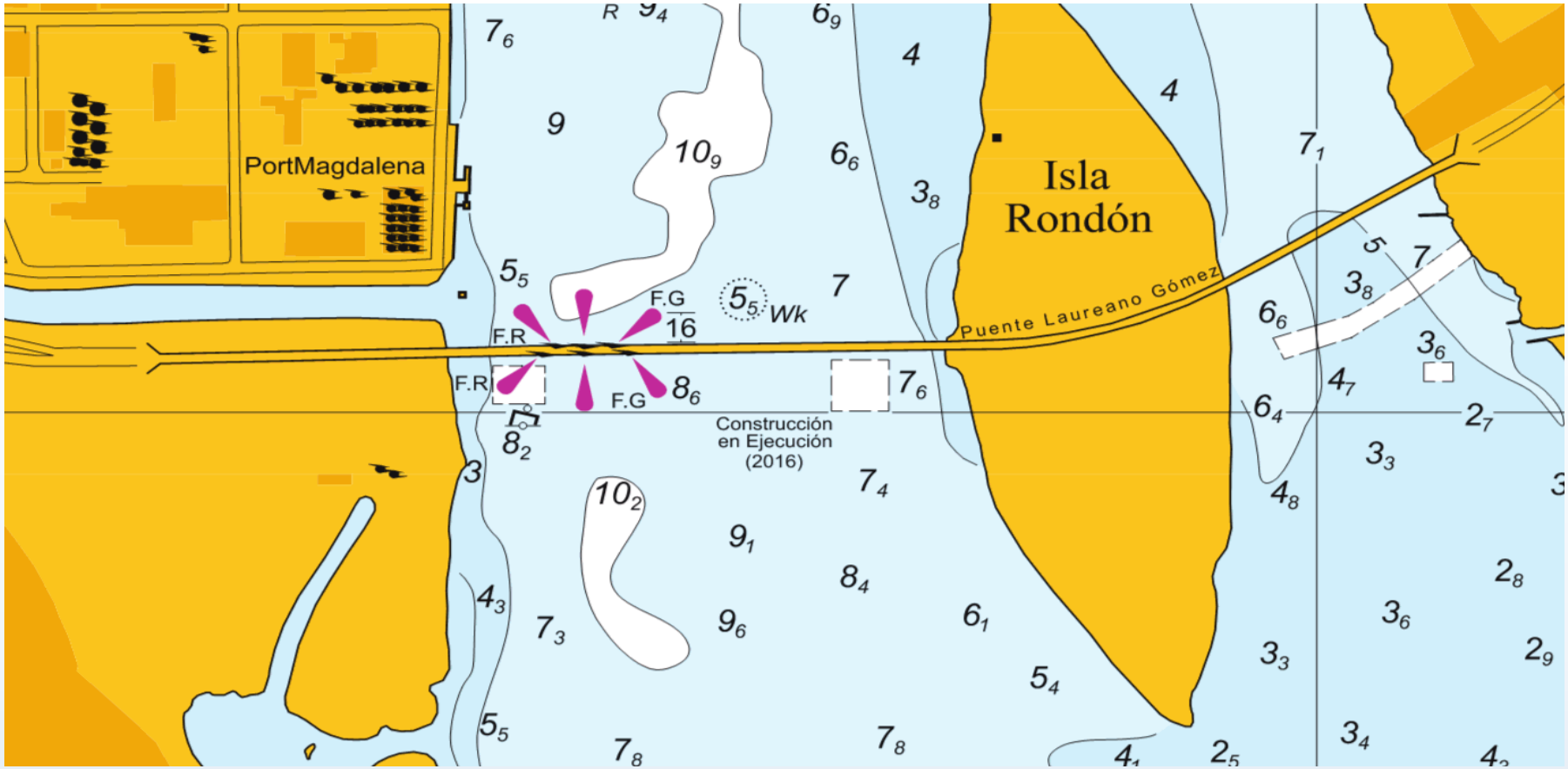


IIC Technologies and IENCs

- Image of the first study of the area at an early stage of compilation

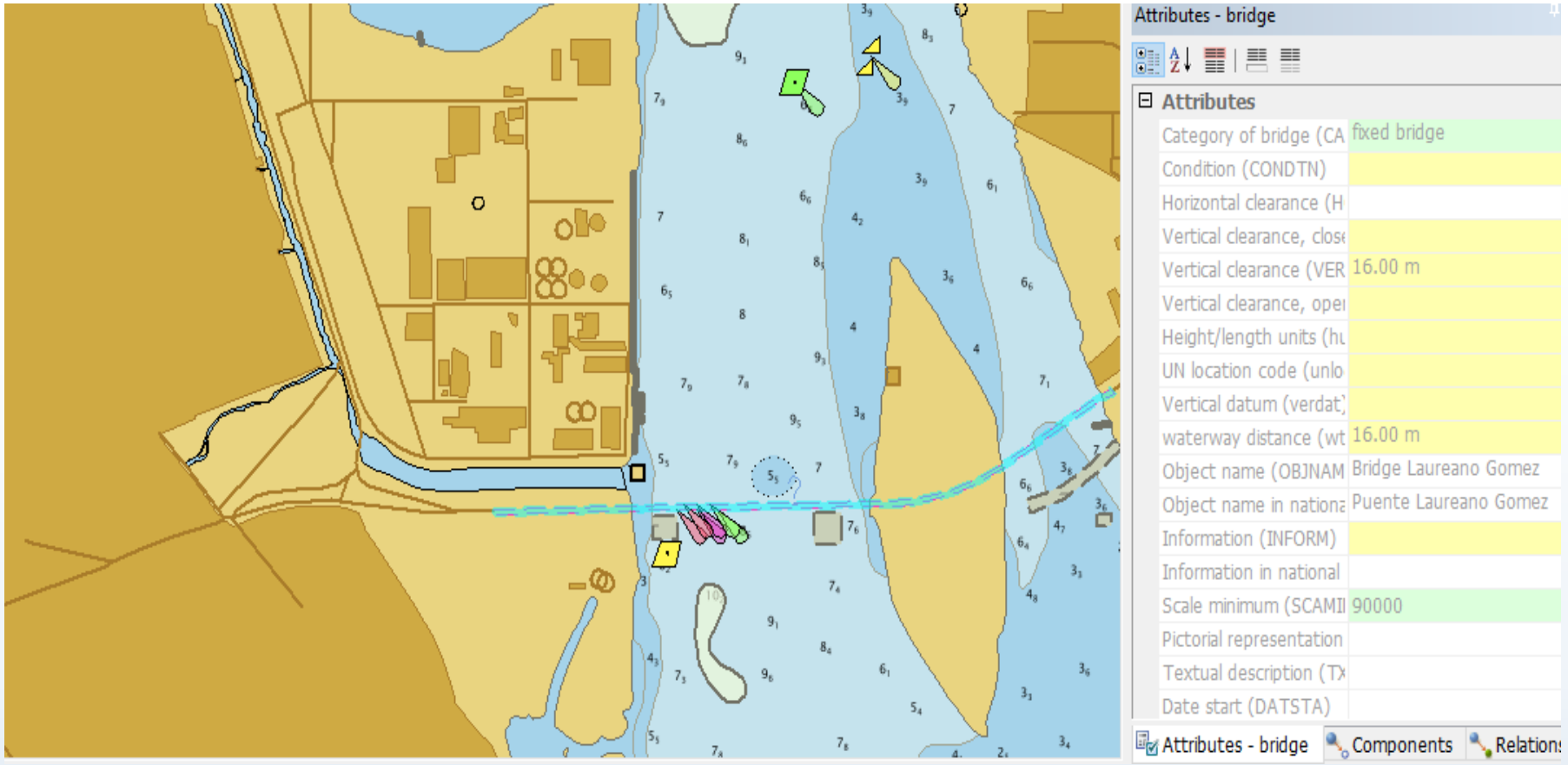
IIC Technologies and IENCs

- The Laureano Gómez Bridge as represented on Paper Chart



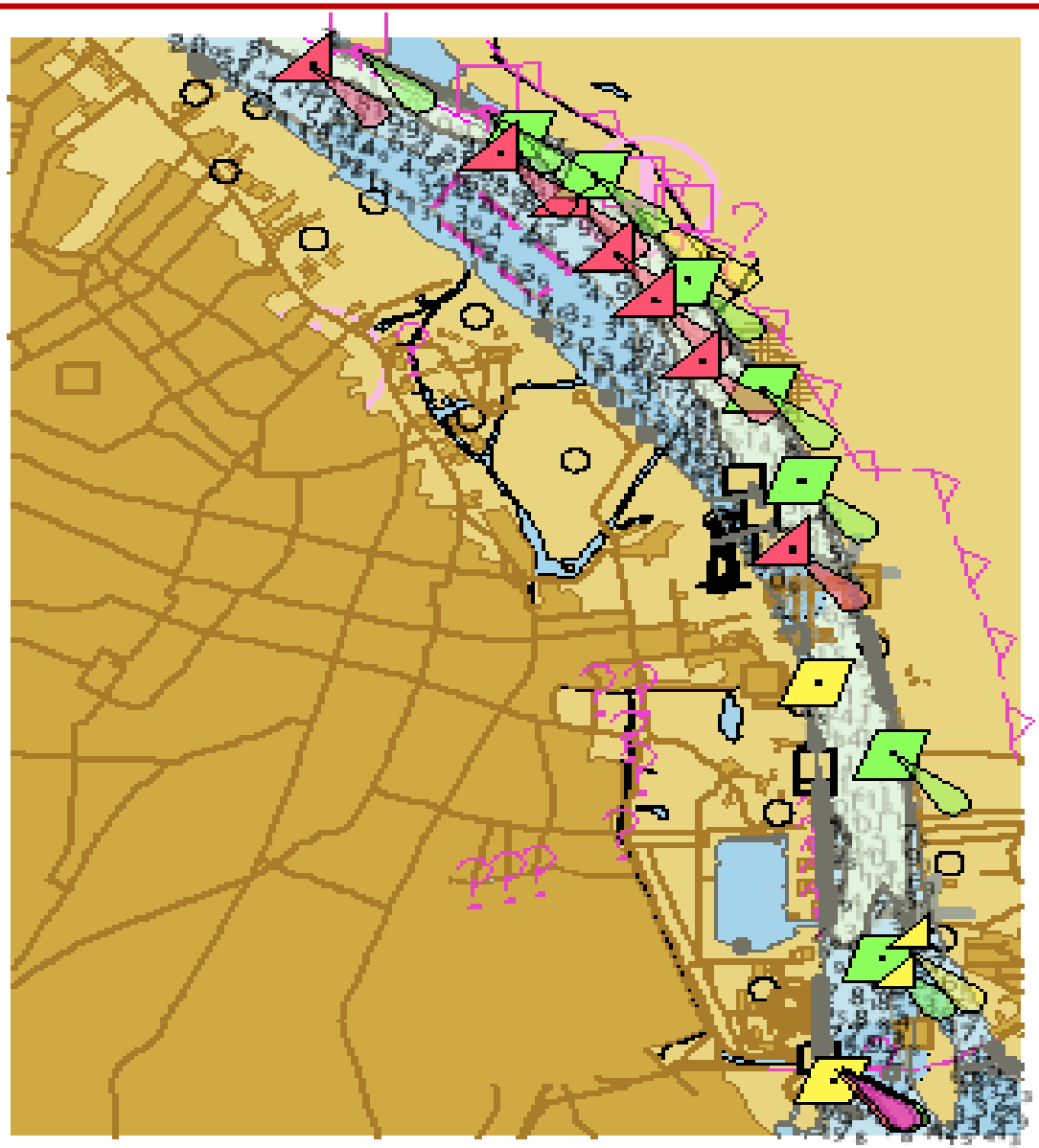
IIC Technologies and IENCs

- The Laureano Gómez Bridge encoded as per IENC Encoding Guide

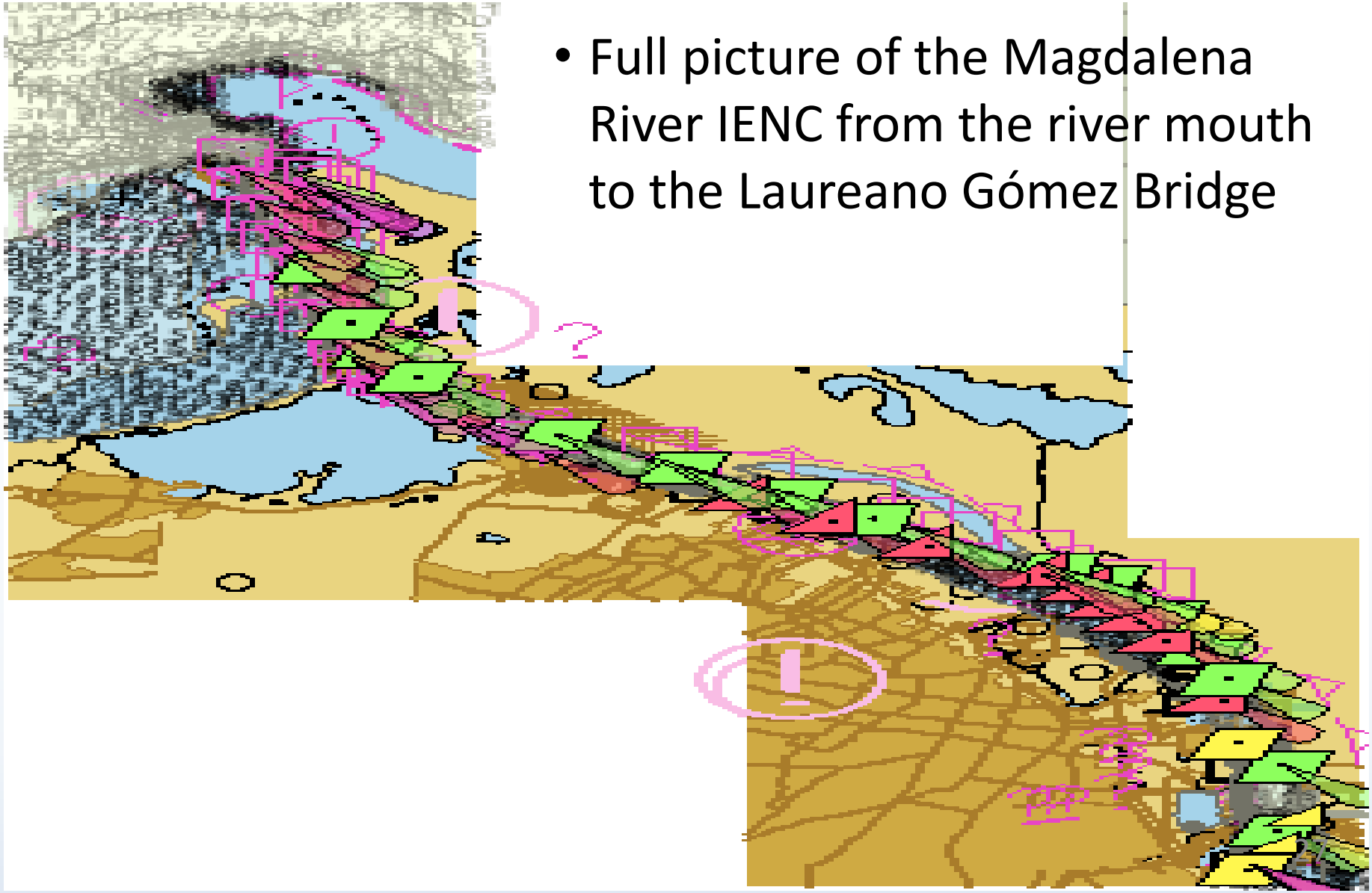


IIC Technologies and IENCs

- Detail of the Barranquilla IENC including the area of the Laureano Gómez Bridge



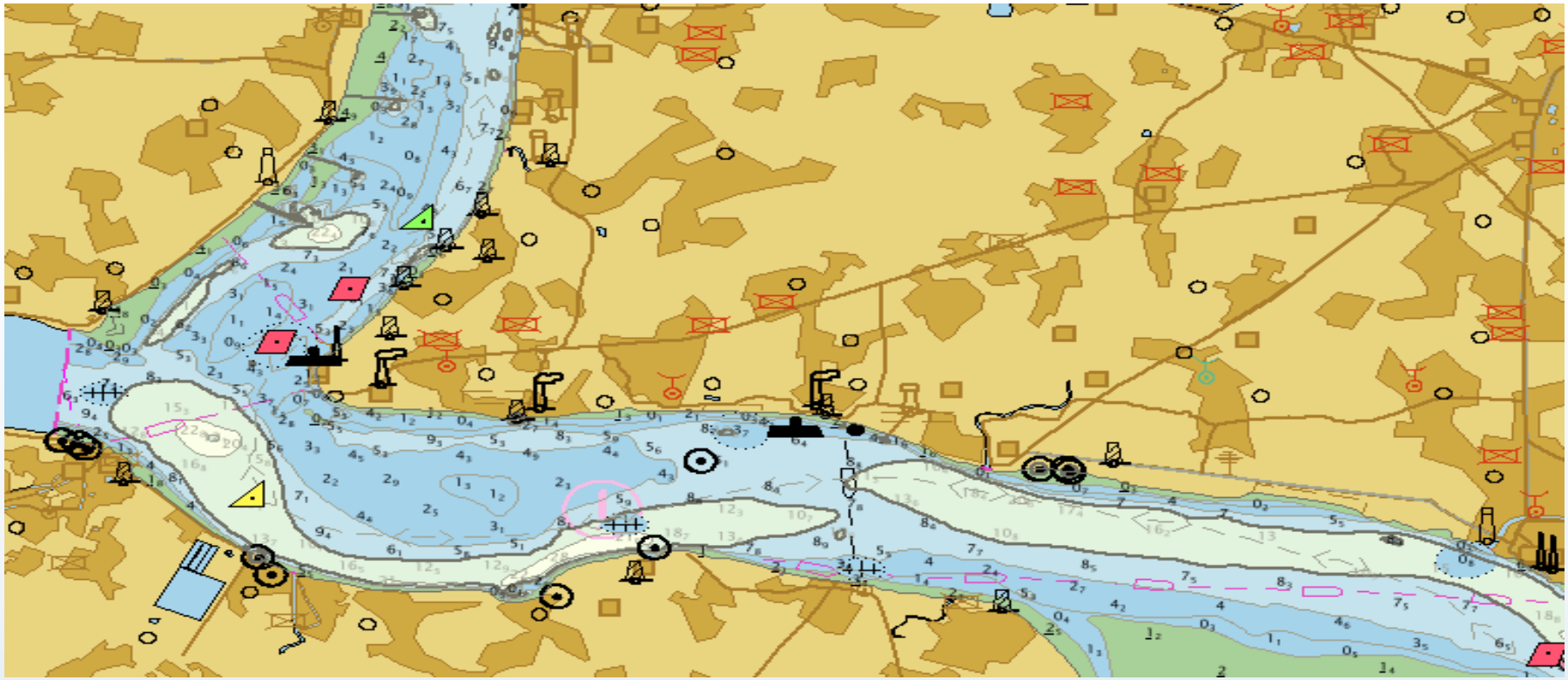
IIC Technologies and IENCs



- Full picture of the Magdalena River IENC from the river mouth to the Laureano Gómez Bridge

IIC Technologies and IENCs

- Production of ENCs for Indian River Authority
- Encoding of the ENC cells accordingly to the IENC Encoding Guide in progress



Thank You

IIC TECHNOLOGIES

“The virtue of Maps,
they show what can be done with limited space,
they foresee that everything can happen therein.”

José Saramago, in The Stone Raft