Fairway Rehabilitation and Maintenance Master Plan

– Danube and its navigable tributaries

EU Strategy for the Danube Region,

Priority Area 1a – To improve mobility and multimodality: inland waterways

Version 13 November 2014

This document was prepared within the framework of the EU Strategy for the Danube Region, Priority Area 1a on Inland Waterways and in cooperation with the NEWADA duo project (co-funded by the South-East Europe Transnational Cooperation Programme). The compilation and analysis of the data was performed by the PA1a Technical Secretariat, in close coordination with both the PA1a Steering Group Members and the NEWADA duo project partners.

This is a technical document and does not constitute international law. In its implementation, international law as well as EU and national legislation have to be respected. Graphical presentations (maps) and written descriptions regarding the borders are made exclusively for the purpose of this document as an information and this document shall not affect in any way the determining and marking of state borders.

Contents

1. Executive summary

Unstable and unpredictable water levels on Danube lead to cargo vessels that are not optimally loaded. This results in unreliable logistics chains and transport prices per transported tonne that are too high to be competitive. Apart from structural river engineering works on a limited number of strategic waterway bottlenecks**, proper fairway maintenance helps in securing stable fairway conditions** for waterway operators and their customers.

In 2012, a majority of the Transport Ministers of the Danube Region signed a declaration expressing their commitment towards the implementation of effective waterway maintenance measures ("Luxemburg Declaration", 2012). This Fairway Maintenance Master Plan for the Danube and its navigable tributaries is addressed at the Ministers of Transport of the Danube Region. It **highlights national needs and short-term measures** in order to **ensure the efficient and effective realisation of harmonised waterway infrastructure parameters along the entire Danube and its navigable tributaries** within the existing legal framework (especially the AGN and Belgrade Convention) and along the lines of the **Luxemburg Declaration**.

This Master Plan includes an overview of existing critical waterway sections or locations, needs and actions. For the main part, the data provided in this document are based on the statements and data inputs by the responsible waterway administrations, which are united in the "NEWADA duo" project. These waterway management experts defined so-called common minimum Levels of Service for different waterway maintenance activities (i.e. fairway depth of 2.50 metres). The minimum Levels of Service only apply to the countries participating in "NEWADA duo". Additional data (notably for Germany, Bosnia and Herzegovina and Ukraine) were acquired through the Steering Group Members of Priority Area 1a of the Strategy for the Danube Region.[1] This document defines – for each riparian state – the key issues and remaining needs for action, which are necessary in order to reach the different Levels of Service.

This Master Plan also estimates the required investment costs and operational costs per country in order to achieve the common Levels of Service, based on the circumstances of the last years. Unforeseen extreme weather events and floods require specific measures and additional budget. The waterway management authorities governing the Danube and its navigable tributaries have estimated **total costs of 93 million EUR** in order to bridge the gap between the current status quo in fairway maintenance and management and the common minimum levels of service. These involve **investment costs of about 84.9 million EUR** and annual **operational costs of about 8.1 million EUR**. Whereas the majority of investments are needed for **dredging equipment, riverbed surveying and fairway marking**. In terms of regional distribution, the majority of investments will be needed on the Lower Danube (particularly Romania and Bulgaria).

[1] These countries are not partners of the NEWADA duo project and consequently have not formally agreed on the common minimum Levels of Service developed in this project

2. Introduction

1.1 Main purpose of the Fairway Maintenance Master Plan

The Danube waterway serves as a backbone for the Danube Region and its economy. Competitive transport services on the Danube highly depend on the provision of minimum fairway parameters. As large parts of the Danube are free-flowing, efforts to eliminate infrastructure bottlenecks not only require structural river engineering measures but also – and of even higher importance – effective and continuous waterway maintenance.

This Fairway Maintenance Master Plan for the Danube is drawn up as a supporting document to the meeting of the Transport Ministers of the riparian Danube Countries. It highlights national needs and short-term measures in order to ensure the efficient and effective realisation of harmonised waterway infrastructure parameters along the entire Danube and its navigable tributaries.

The Danube and its navigable tributaries are a living and dynamic waterway system with continuous changes in the morphology of the riverbed, either in the form of sedimentation or erosion. This document therefore also has a living and dynamic character. The contents are to be monitored and updated in the framework of the PA1a Steering Group and in coordination with the Danube Commission on a regular basis.

1.2 Need for coordinated actions

This Master Plan is designed to provide a basis for coordinated actions on a transnational level, as only those will lead to efficient and effective overall investments. Waterway management authorities of the riparian Danube countries should pursue the harmonisation of their investment strategies with priority for critical bottlenecks.

The continuous reduction or even neglect of waterway maintenance measures on the Danube over several years has resulted in a serious degradation of critical fairway parameters, especially fairway depths and widths and thus available vessel draught. The severe and long low-water season in autumn 2011 clearly demonstrated the lack of capacity at waterway management authorities to ensure minimum fairway parameters.

For this reason a majority of the Transport Ministers of the Danube Region signed a declaration expressing their commitment towards the implementation of effective waterway maintenance measures (“Luxemburg Declaration”, 2012). The Priority Area Coordinators of the Danube Region Strategy's Priority Area 1a monitor the progress of the Luxemburg Declaration. As navigation problems remain to exist on critical sections, the PA 1a Steering Group sent out an Appeal for the implementation of the Luxemburg Declaration to the respective Transport Ministers in February 2014, announcing the elaboration of this Fairway Maintenance Master Plan.

1.3 How this Master Plan was developed

This Master Plan includes an overview of existing critical waterway sections or locations, needs and actions. For the main part, the data provided in this document are based on the statements and data inputs by the responsible waterway administrations, which are united in the “NEWADA duo” project, the Network of Danube Waterway Administrations. NEWADA duo is co-funded by the South-East Europe Transnational Cooperation Programme and deals with integrated waterway

management. NEWADA duo assessed current and future maintenance activities as well as the needs to fulfil a common minimum level of service. Additional data (notably for Germany, Bosnia and Herzegovina and Ukraine) were acquired through the Steering Group Members of Priority Area 1a of the Strategy for the Danube Region. The final draft of this document was discussed and acknowledged within the framework of the PA1a Steering Group.

1.4 Key definitions

Fairway Maintenance Cycle

A river such as the Danube is a living system with continuous changes to the riverbed and its morphology. Locations of critical fairway sections can therefore change from week to week and from year to year. A typical "fairway maintenance cycle" should therefore be first and foremost based on continuous monitoring of the fairway. Each of the process steps in this cycle fulfils specific purposes which are interdependent: The availability of skilled staff, up-to-date sounding and dredging equipment, efficient methods for data collection and tools for targeted information transmission to the users of the waterway are all prerequisites for efficient and effective waterway maintenance on the Danube and its navigable tributaries.

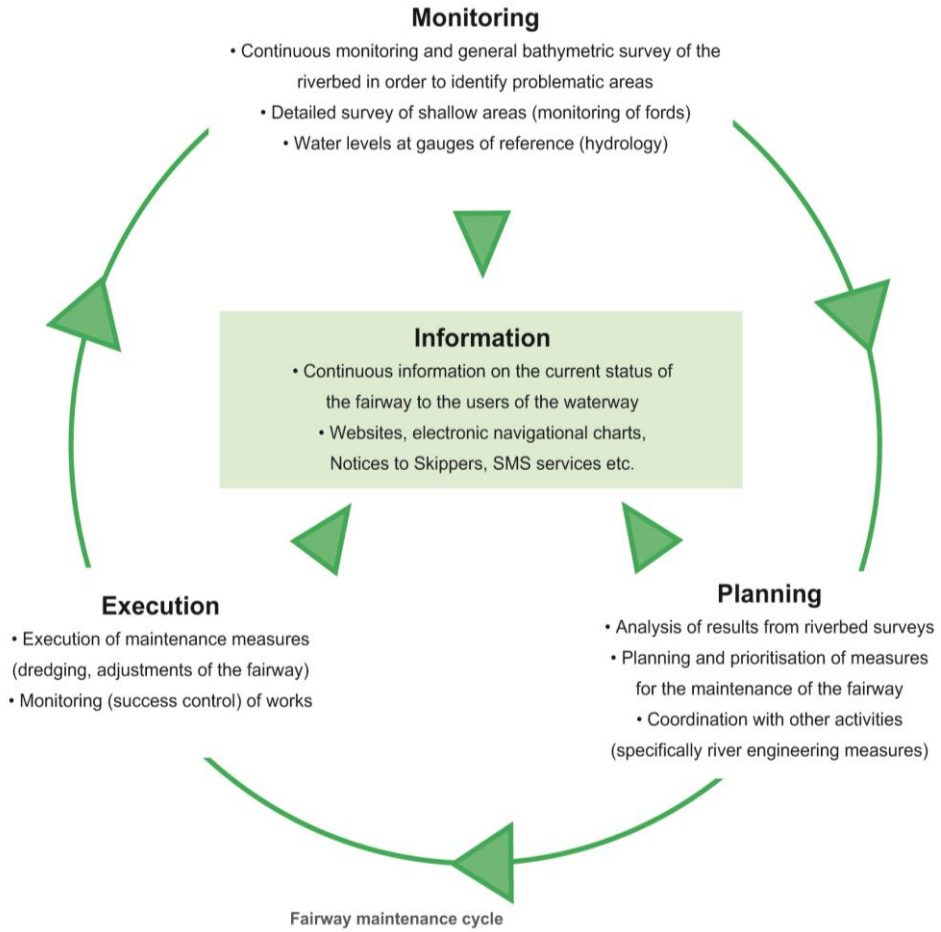


Fig. 1: Fairway maintenance cycle (Source: viadonau)

In this Master Plan, the status of maintenance works in the different riparian countries will be presented according to these four phases of the fairway maintenance cycle.

Types of critical locations

Critical locations with a very dynamic morphological behaviour are of top priority for maintenance measures. A distinction needs to be made between critical locations with **fords** and **lateral sedimentation**. Fords are thereby given the highest priority, as such shallow areas usually extend over the entire width of the fairway (as opposed to locations with lateral sediment accumulations).

Structural and new engineering projects, as well as navigational limitations due to bridge clearances and lock dimensions are not part of this Master Plan, as they do not directly relate to fairway maintenance activities.

Recommended minimum Levels of Service

Notwithstanding the provisions of the "European Agreement on Main Inland Waterways of International Importance" (AGN) and the "Recommendations on Minimum Requirements for Standard Fairway Parameters, Hydrotechnical and Other Improvements on the Danube" published by the Danube Commission, the waterway management experts represented in NEWADA duo recommended different *minimum* Levels of Service for the different phases in the waterway maintenance cycle. For example, the recommended minimum Level of Service related to fairway depth is defined as 2.50 m at Low Navigable Water Level (LNWL or ENR /Etiage navigable et de régularisation)[2].

The prioritisation of critical locations as to needed maintenance interventions is based on the principle of “continuity”, by which we understand the proactive establishment of the continuous availability of minimum fairway parameters, i.e. the creation of a "deep fairway channel" as a priority measure before the beginning of the annual low water season. As many transport activities take place over a long transport distance on the Danube – showing a mean transport distance between 600 and 700 km –, the weakest critical location determines the capacity of the entire stretch. This principle has to be translated into the maintenance philosophy and activities.

[2] Fairway depth of 2.5 m at Low Navigable Water Level (ENR), i.e. on 94% (343 days) of the year, calculated on the basis of the discharge observed over a period of 30 years with the exception of ice periods. Fairway width (range of values accounts for different curve radii):

- 40 to 80 m in Austria
- 60 to 100 m in Slovakia and Slovakian-Hungarian border section
- 80 to 120 m in Hungary
- 80 m in Croatia, Serbia, Romania and Bulgaria (including border sections) – no range for curve radii as there is usually no passing of vessels/convoys in bends on these sections

3. Country sections

With 10 riparian states and 2,414 navigable river-kilometres, the Danube is not only the most international river in the world but also shows a large variety in nautical, hydrological and hydro-morphological characteristics. Some parts are compounded stretches and large parts of the Danube are free-flowing. These circumstances have far-reaching impacts on the maintenance activities required by the Danube's different region countries.

2.1 General characteristics of the Danube

According to the Danube Commission, the Danube can broadly be divided into three main sections (Upper, Central and Lower Danube) with different nautical characteristics.

	Upper Danube Kelheim – Gönyű	Central Danube Gönyű – Turnu-Severin	Lower Danube Turnu-Severin – Sulina
Length of section	624 km	860 km	931 km
River-km	2,414.72–1,791.33	1,791.33–931.00	931.00–0.00
Ø gradient per km	~ 37 cm	~ 8 cm	~ 4 cm
Height of fall	~ 232 m	~ 68 m	~ 39 m
Upstream travel speed of vessels	9–13 km/h	9–13 km/h	11–15 km/h
Downstream travel speed of vessels	16–18 km/h	18–20 km/h	18–20 km/h

Nautical characteristics of the different Danube sections

Source: via donau, Danube Commission

Fig. 2: Nautical characteristics of the different Danube sections (Source: viadonau, Danube Commission)

The hydrological and hydro-morphological characteristics of the Danube, together with river engineering interventions, determine the nautical situation on the waterway. Figure 3 depicts the maximum possible dimensions of vessels and convoys on the Danube waterway from Kelheim in Germany to the Black Sea related to waterway classes as defined by the UNECE.

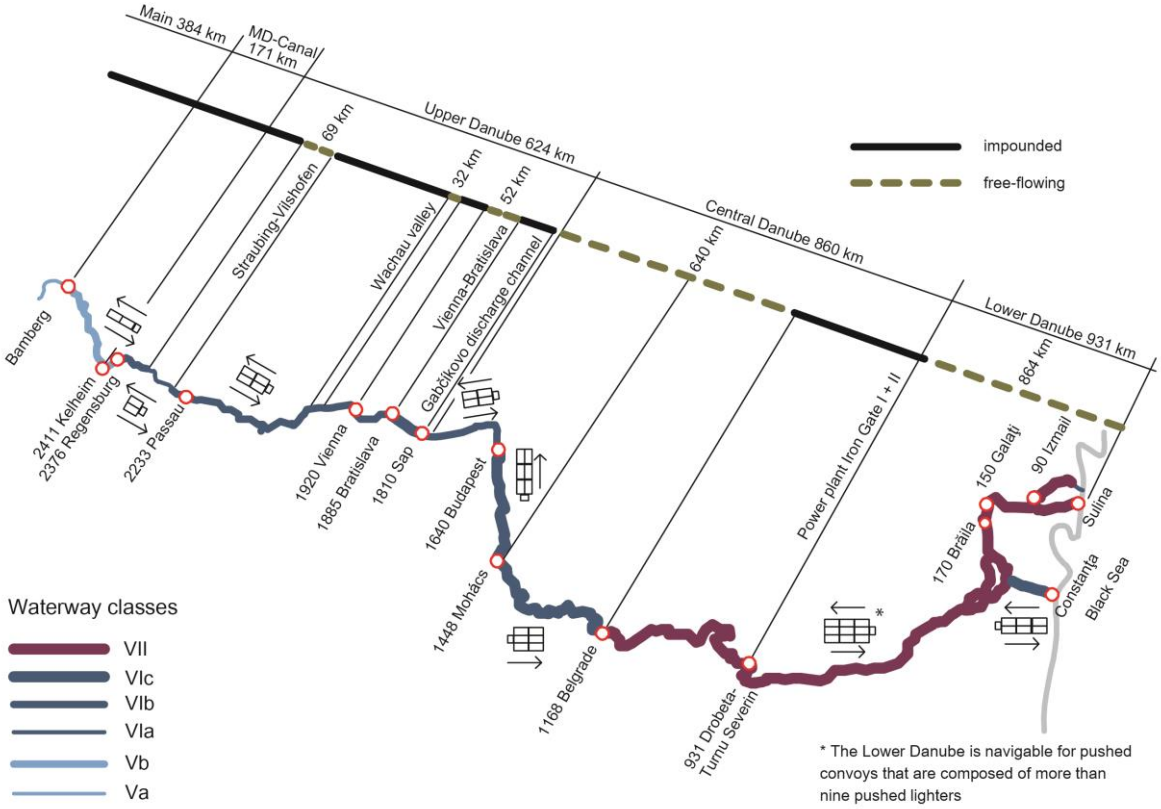


Fig. 3: Maximum possible dimensions of convoys on the Danube waterway according to UNECE waterway classes (Source: viadonau)

2.2 Location of critical sectors

The status of maintenance works for the different riparian countries is described in detail in the following chapters.

Germany

DE 1 Characteristics of the Danube waterway

The German Federal Waterway Danube proceeds from Kelheim at river-km 2,414 to Jochenstein at river-km 2,202. About one third (69 km) of this stretch are free-flowing (including river engineering structures), 67% (143 km) are made up of backwater sections of 6 barrages with locks. On the last 20 km downstream of Passau, the Danube is a border river between Austria and Germany. The upper Danube is characterized by sudden changes in water levels with maximum values in summer (snow melting in the Alps, atmospheric precipitation) and low levels in winter. Due to the confluence of the river Isar in Deggendorf, the average Danube slope abruptly increases from 0.1‰ to 0.3‰, which additionally increases the effects of sediment transport (bed load and suspended load). In the free flowing section between Straubing and Vilshofen the minimum fairway depth of 2.5 m as defined by NEWADA duo cannot be achieved by fairway maintenance. In this section the objective of fairway maintenance is to maintain the faiway depth of 2.0 m related to LNWL (in Germany: RNW).

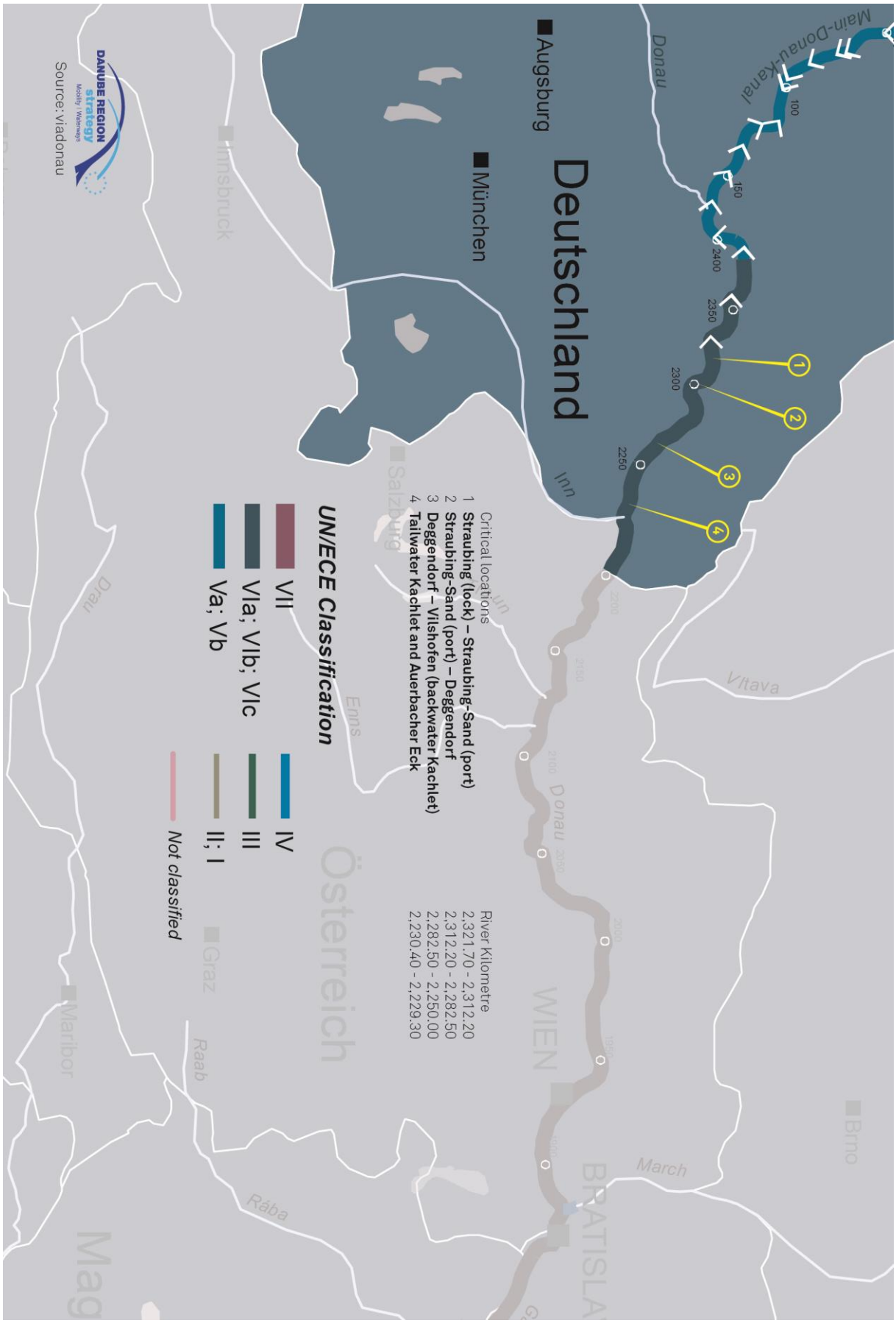
DE 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	Federal Waterways and Shipping Administration (WSV)
Number / length of critical locations of high priority	4 / 72.8 km (34% of national stretch)
Fairway depth in 2012	Impounded section Kelheim–Straubing: 2.9 metres Free flowing section Straubing–Deggendorf: 2.0 m (351 days) Free flowing section Deggendorf–Vilshofen: 2.0 m (361 days) Impounded section Vilshofen–Jochenstein: 2.7 m
Main issues in waterway maintenance – high priorities	Sediment management: Dredging and concerted insertion in the free flowing section Emptying of silting basins in all sections Riverbed stabilization above all in case of potholes
Indicative investment cost/operating cost for needed actions	Dredging activities: 500,000 EUR (status 24th October 2012) Riverbed surveying: 460,000 EUR (as in 2012) (EUSDR Report June 2013)

DE 3 Critical locations

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
2,321.7	2,312.2	9.5	DE / DE	Straubing (lock)–Straubing-Sand (port)
2,312.2	2,282.5	29.7	DE / DE	Straubing-Sand (port)–Deggendorf
2,282.5	2.250.0	32.5	DE / DE	Deggendorf – Vilshofen (backwater Kachlet)
2,230.4	2.229.3	1.1	DE / DE	Tailwater Kachlet and Auerbacher Eck

Germany: Overview of Critical Locations



DE 4 Overview of action points

DE 4.1. Monitoring

Monitoring of the fairway is conducted twice a year, once as an area-sounding (survey for several purposes) and once by means of trifold single-beam (right edge, left edge and centre of the fairway) sounding (survey for safety of transport). Additional surveying is executed after special incidents (e.g. floods, naval accidents). Moreover, hydrographic measurements in the free flowing section are performed using the sounding vessels "Kepler" and "Tangens".

For the **monitoring of water levels** automatic gauging stations are available for the entire German Danube. Data is transferred regularly via landline (back-up: GPRS).

In the area of monitoring there is no additional need for action.

DE 4.2. Planning

The EU-funded study ("*Variant-independent investigation on the development of Danube waterway between Straubing and Vilshofen*") contains a sediment management concept in combination with regulation structures. When the development is finished, efforts and costs for operating and maintaining the free-flowing section are expected to decrease significantly.

Each year dredging statistics and charts are prepared ex-post for documentation purposes and to set up the future sediment management (lessons learned, identification of critical locations).

DE 4.3. Execution

Dredging activities depend on sounding results and statistics of the previous years. 80% of dredging works are awarded to expert companies by way of public invitations to tender. In the free-flowing section, about 87,000 m³ of sediment are dredged and reinserted every year.

	Key issues	*Need for action*
DE 01	20% of dredging works are conducted by WSV itself, while 80% are tendered.	Preserve a certain percentage of execution by the authority itself in order to keep professional expertise, skilled staff, autonomy, and the capacity to act in emergency situations

DE 4.4 Information

Current water levels (1x/hour for flood events) and **48–72 h forecasts** (floods: provision by Bavaria, low water: provision by WSV) are available online: https://www.pegelonline.wsv.de, http://www.hochwasserzentralen.de, www.elwis.de

Information on fairway depths/restrictions is provided regularly after survey and at short notice in case of special incidents (e.g. floods, naval accidents). Current fairway information is available by Notices to skippers. IENCs are available and updated once a year (including fairway information, but no bathymetric IENCs). Publication is done via ELWIS (www.elwis.de), apps for smartphones, e-mail news service and at locks (score board, display panel).

	Key issues	*Need for action*
DE 02	Enhancing the information on water levels	Implementation of an hourly push-mode (currently pull-mode via modem)

Austria

AT 1 Characteristics of the Danube waterway

22% of the 350.5 km of the Austrian Danube are free-flowing (including river engineering structures like groynes and training walls), 78% are made up of backwater sections of ten hydroelectric river power plants. The Danube in Austria shows the characteristics of an alpine river with a complex "winter-nival" hydrologic regime and maximum discharge values between March and August. The mean slope of about 0.45 ‰ (measured at medium water levels) results in high flow velocities in the two free-flowing sections. This produces continuous changes of the riverbed due to sediment transport (bed load or suspended matter, predominantly gravel), either in the form of sedimentation or erosion, which poses the main nautical problem. The trajectory of the navigation fairway is normally not subject to change due to the narrow cross-section of the river and the numerous river engineering structures. The majority of maintenance activities are performed on a high level of quality, the needs for action mainly refer to their further enhancement.

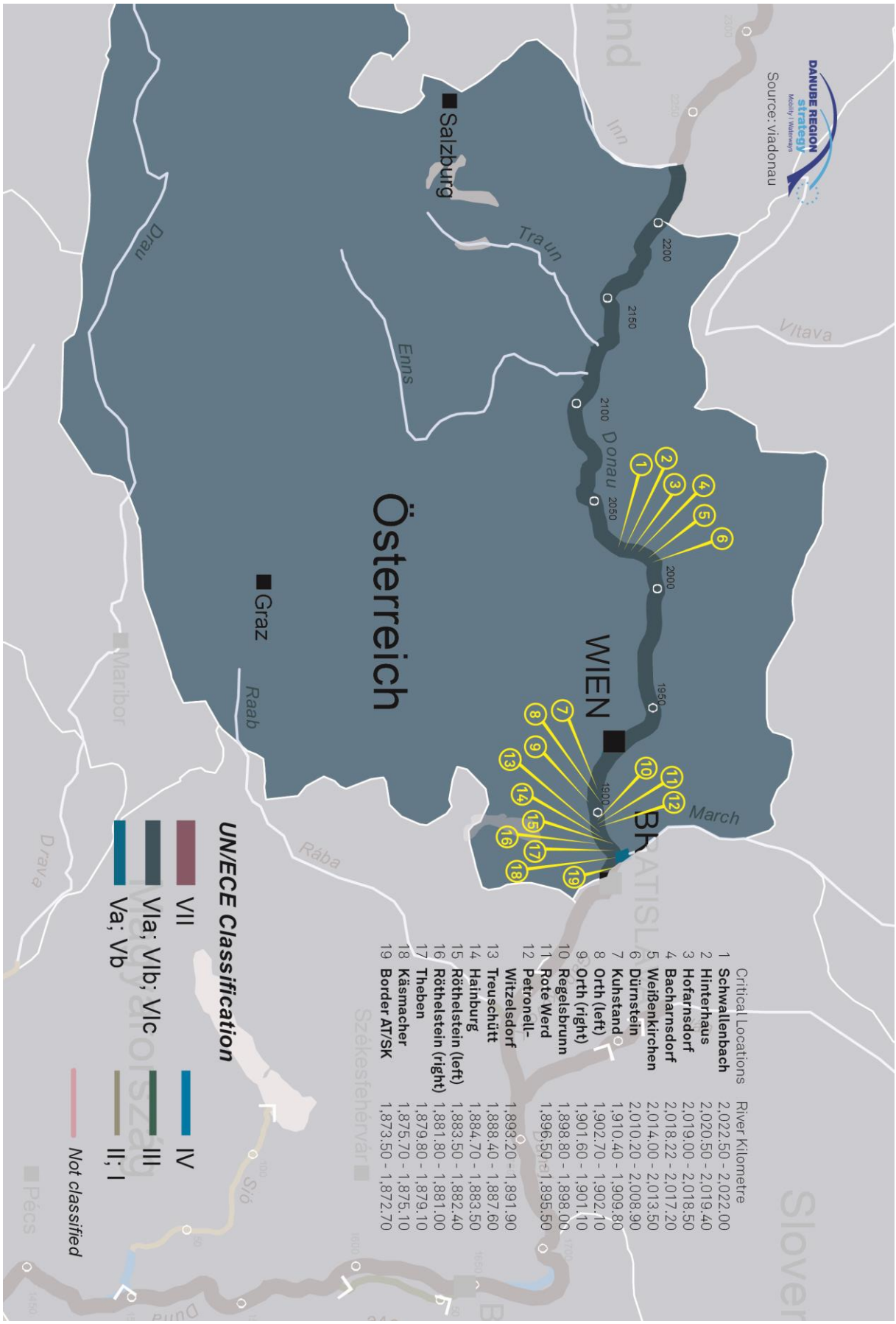
AT 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	viadonau– Österreichische Wasserstraßen-Gesellschaft mbH (state owned)
Number / overall length of critical locations of high priority	19 / 15.7 km (4% of national stretch) 3 cross-border critical locations with Slovakia (2.1 km)
Medium length of critical locations	860 metres (variation 500 - 1,300 metres)
Fairway depth of 2.5 m in 2012	Free flowing section East of Vienna: 86% (315 days/year) Free flowing section Wachau: 98% (359 days/year) Fairway depth in impounded sections is not critical
Main issues in waterway maintenance – high priorities	Limited dredging equipment/services available on the market for effective intervention in critical, i.e. low-water, periods– recommendation to optimise tendering processes and improve market structure
Indicative investment cost/operating cost for needed actions	Operational costs / year: 40,400 EUR

AT 3 Critical locations

Location / Length (km)			Right bank/ Left bank	Name of sector / location
River-km (from / to)		Length		
2,022.50	2,022.00	0.50	AT / AT	Schwallenbach
2,020.50	2,019.40	1.10	AT / AT	Hinterhaus
2,019.00	2,018.50	0.50	AT / AT	Hofarnsdorf (Spitz)
2,018.20	2,017.20	1.00	AT / AT	Bacharnsdorf
2,014.00	2,013.50	0.50	AT / AT	Weißenkirchen
2,010.20	2,008.90	1.30	AT / AT	Dürnstein
1,910.40	1,909.80	0.60	AT / AT	Kuhstand
1,902.70	1,902.10	0.60	AT / AT	Orth (left bank)
1,901.60	1,901.10	0.50	AT / AT	Orth (right bank)
1,898.80	1,898.00	0.80	AT / AT	Regelsbrunn
1,896.50	1,895.50	1.00	AT / AT	Rote Werd
1,893.20	1,891.90	1.30	AT / AT	Petronell-Witzelsdorf
1,888.40	1,887.60	0.80	AT / AT	Treuschütt
1,884.70	1,883.50	1.20	AT / AT	Hainburg
1,883.50	1,882.40	1.10	AT / AT	Röthelstein (left bank)
1,881.80	1,881.00	0.80	AT / AT	Röthelstein (right bank)
1,879.80	1,879.10	0.70	AT / SK	Theben
1,875.70	1,875.10	0.60	AT / SK	Käsmacher
1,873.50	1,872.70	0.80	AT / SK	Border AT / SK

Austria: Overview of Critical Locations



AT 4 Overview of action points

AT 4.1. Monitoring

The **monitoring of the fairway** is conducted regularly with single- and multi-beam equipment (twice per year), while the two free-flowing sections are surveyed on a monthly basis. Additional detailed measurements of all critical sections are performed in early summer before the low water period. Dredging sites are monitored per default before and after the interventions; in the case of larger cubatures, intermediate measurements may be conducted. The monitoring of fairway conditions is undertaken by viadonau in close cooperation with the Navigation Surveillance. Monitoring of backwater sections is undertaken by viadonau in cooperation with Verbund Hydro Power as the operator of hydropower plants on the Danube. Concerning riverbed monitoring, no urgent needs are identified.

For the **monitoring of water levels** automatic gauging stations are available on both free-flowing sections, the density of stations is sufficient. Data is transferred by GPRS, for some stations also via landline. Currently, there is a difficulty in maintaining water level measurements during extreme weather events due to lacking back-up energy supply systems. In addition, staff or weekly or even daily on-site checks would be needed in order to maintain technical equipment and to avoid data errors and gaps.

Fairway marking is supervised once a week by the Navigation Surveillance which is tasked by the Supreme Navigation Authority in the Federal Ministry for Transport, Innovation and Technology. Navigation signals are controlled minimum once per week. There are no major issues regarding monitoring of fairway marking.

	Key issues	*Need for action*
AT 01	Maintaining water level measurements during extreme weather events	Establishment of back-up energy supply systems at automatic gauging stations
AT02	Maintaining technical equipment of gauging stations to avoid data errors and gaps	Staff for weekly or even daily on-site checks

AT 4.2. Planning

Based on the monitoring, continuous prioritisation of critical areas for dredging is undertaken by viadonau in cooperation with the Navigation Surveillance. By proactive dredging of those areas before the low water period, critical situations shall be minimized. Each year in late summer, a prioritisation of dredging interventions at the most critical locations is conducted. The coordination and planning of measures in the common stretches with Germany and Slovakia is done in the two Transboundary Water Commissions. Automated assessment of fairway conditions is under development, including an analysis of the effectiveness of dredging interventions based on pre- and post-monitoring (multi-year database).

In the area of planning there is no additional need for action.

AT 4.3. Execution

Dredging activities according to the prioritisation of dredging interventions at critical locations are contracted out by viadonau. The amount of dredged material is strongly dependent on the development of discharge during the year (low and high water periods).

Marking activities fall under the responsibility of the Navigation Surveillance as part of the Ministry for Transport, Innovation and Technology. In contrast to lower Danube countries, no marking plan is implemented for the Austrian stretch of the Danube due to the fact that the trajectory of the fairway is fixed to a high degree. Information on location of marking signs is transmitted to boatmasters by means of IENC. There are no major issues regarding marking activities.

	Key issues	*Need for action*
AT 03	Limited flexibility and limited dredging capacity on the market due to small number of dredging service providers	Support opening-up of limited market for dredging activities

AT 4.4. Information

For nine water gauging stations, actual **water levels** are available via internet and the official Notices to Skippers (1x/hour). For the two reference gauging stations for free-flowing sections (Wachau valley and section east of Vienna), 72h **forecasts** are provided in addition.

Information on fairway depths at critical locations in both free-flowing sections is provided once an hour on the basis of the most recent bathymetric riverbed surveys. Detailed maps (trackplots) of riverbed surveying results for the most critical locations are published at least once a month. Publication is done via the Austrian RIS website (http://www.doris.bmvit.gv.at), an app for smartphones, an e-mail news service and at locks. There are currently no urgent issues concerning information on fairways depths to tackle.

In the area of information there is no additional need for action.

Slovakia

SK 1 Characteristics of the Danube waterway

On most of the 172 km, the Slovakian Danube is a border river, comprising of 7.5 km border with Austria and 142 km with Hungary. 159 km (92%) are free-flowing. The Gabčíkovo hydropower plant influences navigation conditions upstream until Bratislava. Less than a third of the Slovakian Danube is considered part of the Upper Danube, characterized as an alpine river with an average height difference of 0.5 meters per kilometre. Gönyű is the starting point of the Central Danube, where the slope declines and gradually changes into a lowland river. The river bed mostly consists of gravel.

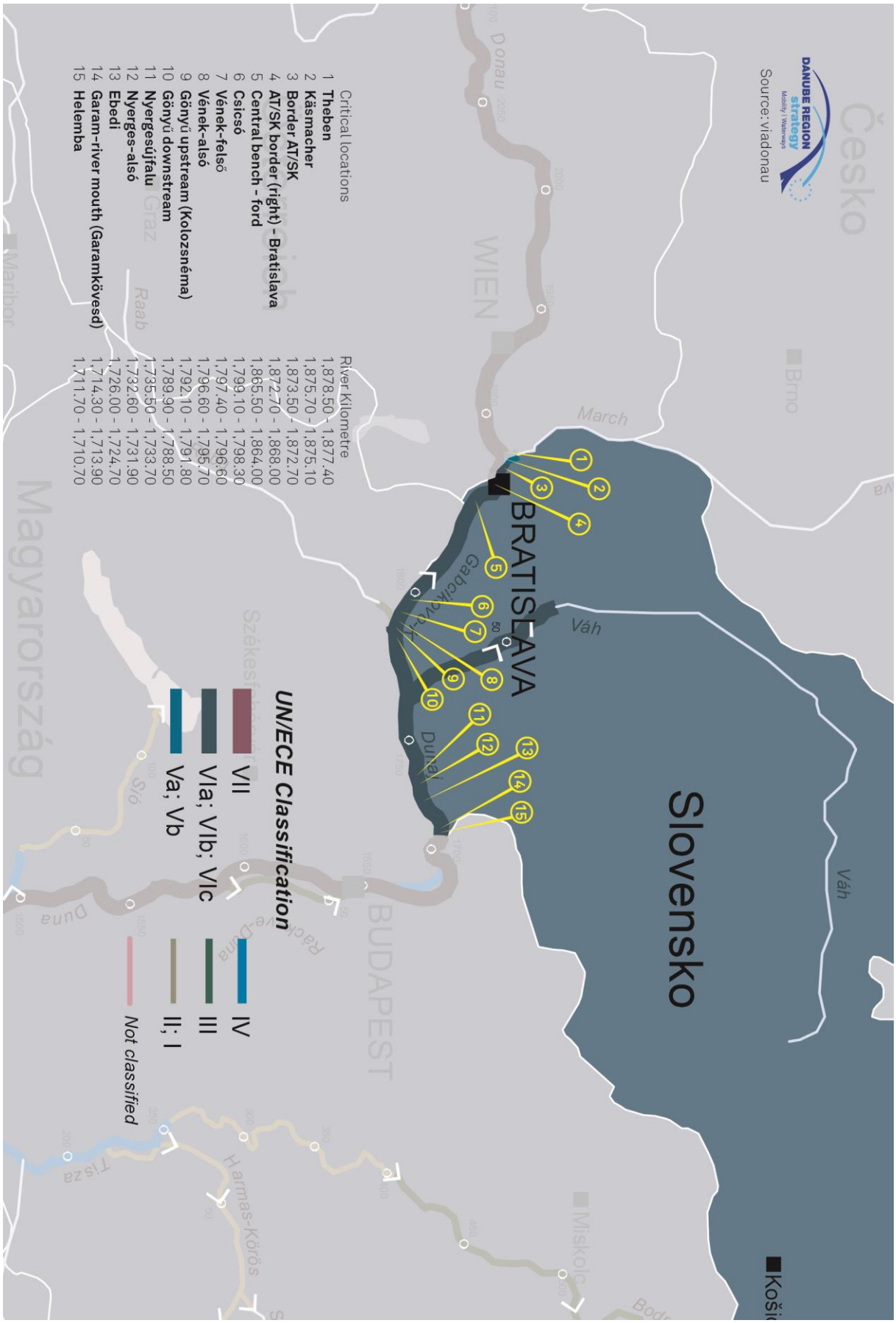
SK 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	SVP (Slovak Water Management Enterprise – state owned)
Number / overall length of critical locations of high priority	15 / 13.6 km (7% of national stretch) 3 cross-border critical locations with Austria (2.1 km) 10 cross-border critical locations with Hungary (9.4 km)
Medium length of critical locations	900 metres (variation 200 – 1,800 metres)
Fairway depth of 2.5 m in 2012	72.7% (266 days/year)
Main issues in waterway maintenance – high priorities	Insufficient and/or old equipment Shortage of qualified staff
Indicative investment cost for needed actions	Investment: 8,080,000 EUR Operational costs / year: 1,502,000 EUR

SK 3 Critical Locations

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
1,878.50	1,877.40	1.10	AT / SK	Theben
1,875.70	1,875.10	0.60	AT / SK	Käsmacher
1,873.50	1,872.70	0.80	AT / SK	Border AT / SK
1,872.70	1,868.00	0.20	SK / SK	AT/SK border (right bank) - Bratislava
1,865.50	1,864.00	1.50	SK / SK	Central bench - ford
1,799.10	1,798.30	0.80	HU / SK	Csicsó
1,797.40	1,796.60	0.80	HU / SK	Vének-felső
1,796.60	1,795.70	0.90	HU / SK	Vének-alsó
1,792.10	1,791.80	0.30	HU / SK	Gönyű upstream (Kolozsnéma)
1,789.90	1,788.50	1.40	HU / SK	Gönyű downstream
1,735.50	1,733.70	1.80	HU / SK	Nyergesújfalu
1,732.60	1,731.90	0.70	HU / SK	Nyerges-alsó
1,726.00	1,724.70	1.30	HU / SK	Ebedi
1,714.30	1,713.90	0.40	HU / SK	Garam-river mouth (Garamkövesd)
1,711.70	1,710.70	1.00	HU / SK	Helemba

Slovakia: Overview of Critical Locations



SK 4 Overview of action points

SK 4.1. Monitoring

Monitoring of the fairway is done once a year with single-beam equipment, for the common sections with Austria and Slovakia/Hungary as well as for the national sections. If needed, intermediate surveys are undertaken, but critical sections are not monitored separately as a standard procedure. All monitoring, including the reservoir upstream of Gabčíkovo (monitored every 2-3 years) is done by SVP. The different monitoring tasks are undertaken by different SVP departments.

Fairway marking is supervised once a year before adjusting the fairway marks according to a yearly plan. Navigation signals are controlled minimum once per week. There are no major issues regarding monitoring of fairway marking.

	Key issues	*Need for action*
SK 01	Level of detail of monitoring data is suboptimal for exact and cost-effective planning of dredging interventions	Support acquisition of up-to-date multi-beam sounding vessels, equipment and software
SK 02	Out-of-date information technology, missing database for monitoring data	Support establishment of Fairway Management System
SK 03	Insufficient number of skilled staff to monitor of the fairway	Secure education and provision of well-trained staff in the short, medium and long term

SK 4.2. Planning

Coordination and planning of measures in the common stretches with Austria and Hungary is done in the two Transboundary Water Commissions. Yearly interventions ("Dredging project of the Danube") are planned and amended by working groups of the border commissions in spring. Desired waterway parameters and fairway marks for the Slovak Danube stretch are determined in the "Fairway Project", which is the basis for yearly dredging interventions. Prioritizing of dredging interventions is preliminarily done according to financial parameters. Analysis of effectiveness of dredging interventions is based on pre- and post-monitoring.

	Key issues	*Need for action*
SK 04	Different departments performing the monitoring as an impediment to efficient planning	Support coordination of interfaces and establishment of common database for planning of interventions
SK 05	Different coordinate systems used for measurements in border stretches as an impediment to efficient planning	Support cross-border harmonisation of monitoring standards

SK 4.3. Execution

Dredging activities are executed by SVP according to the yearly dredging plan. On average, 150,000 m³ per year are dredged.

Marking activities are carried out under the responsibility of the SVP. Fairway marks are adjusted once a year according to an annual plan that is approved by the State Navigation Authority. Fairway marks and traffic signals are used to compensate for dredging interventions that are not feasible due to limited resources.

	Key issues	*Need for action*
SK 06	Old and dredging and marking fleet and equipment	Support acquisition of up-to-date dredging and marking vessels and equipment
SK 07	Lack of staff and resulting missing flexibility in case of urgencies (related to dredging activities).	Secure education and provision of well-trained staff in the short, medium and long term
SK 08	Frequent need to adjust fairway marking as substitution for dredging activities	Support implementation of semi-automated marking plans based on a common Fairway Management System

SK 4.4. Information

The State Hydro Meteorological institute of Slovakia is responsible for **water level information**. Information is provided and available every hour on the national website of the institute.

Water level forecast are provided daily by the Slovak Hydro Meteorological Institute, forecasts are provided for two days for important water gauges.

Information on **water depth**s is provided by the Transport Authority (Division of Inland Navigation) based on information from SVP. Online information is not provided automatically and not available on the website for the moment.

Hungary

HU 1 Characteristics of the Danube waterway

The Danube has formed a common spindle-shaped alluvial cone with the Vah River, where the majority of sediments is deposited. The 417 km Hungarian stretch of the Danube shows the morphological transition from an alpine to a lowland river, although the alpine runoff character is still preserved further downstream. At the end of the large alluvial cone at river km 1,810, the Danube slope abruptly decreases from 0.35‰ to 0.17‰ and then, at the mouth of the Mosoni Danube at Gönyű to 0.10‰. In the reach from the mouth of the Little Danube at Komarno down to Budapest, the slope decreases further to 0.07‰. The average river width increases from Gönyű (about 300 m) to about 400 m downstream. The riverbed material is mainly gravel at upper side and getting sandy going downstream. Bottlenecks caused by the worst fords (with bigger lack of water depth) cannot be removed by usual maintenance works, because these sections typically have andesite or rocky bottoms (Nyergesújfalu, Dömös). The riverbed is comparably stable, albeit that river degradation is in progress, especially downstream of the Bős power plant. In Hungary, there is no power plant operated on the Danube River.

HU 2 Fairway maintenance basic data

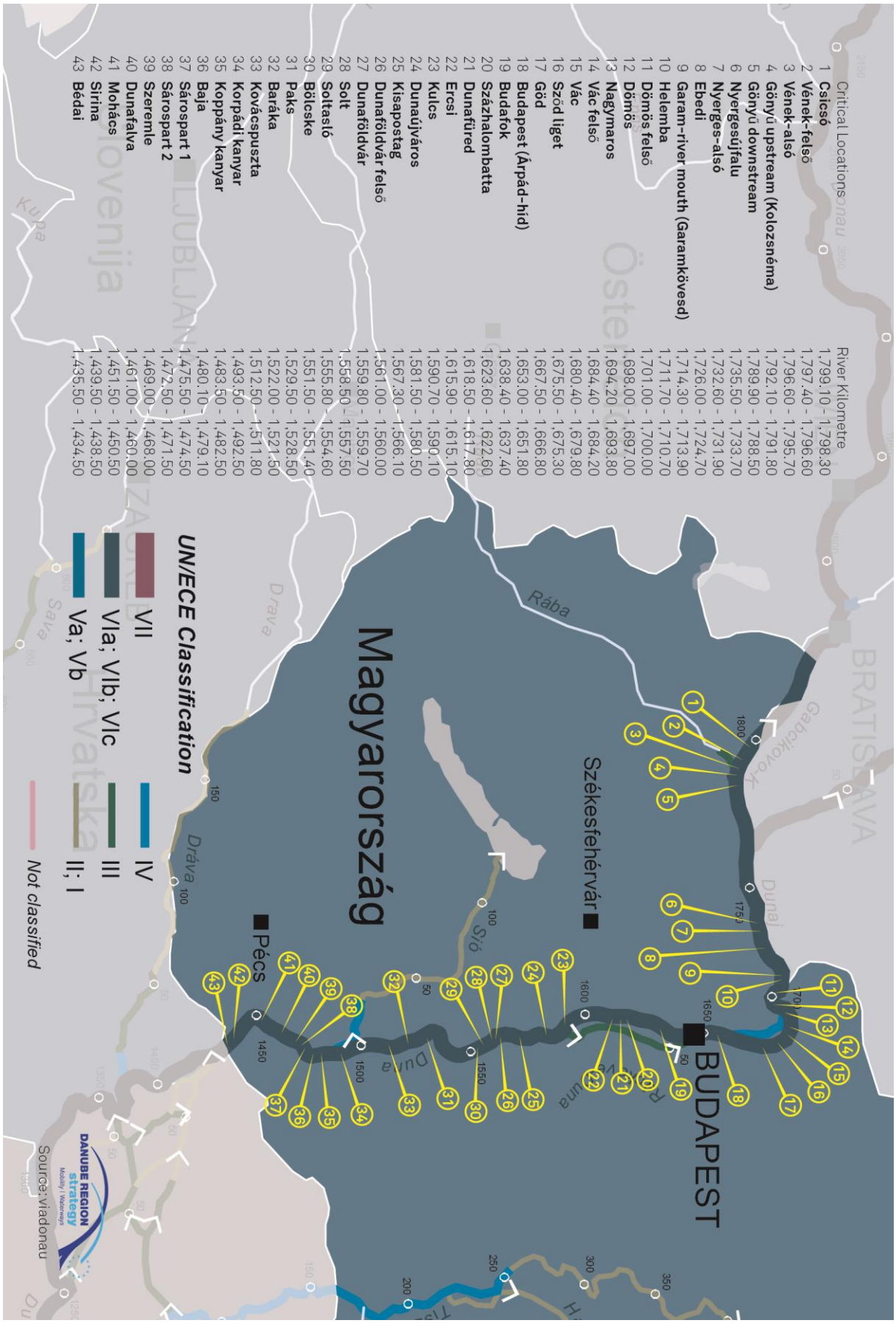
Responsible for fairway maintenance / data provided by	General Directorate for Water, it has three regional organization (Water Directorates, VIZIG) for waterway maintenance on the Danube: North-Transdanubian Water Directorate (1,811-1,708 rkm) Middle-Danube-Valley Water Directorate (1,708-1,560 rkm) Lower-Danube-Valley Water Directorate (1,560-1,433 rkm)
Number / length of critical locations of high priority	43 / 36.6 km (10% of national stretch) 10 cross-border locations with Slovakia (9.4 km)
Medium length of critical locations	850 metres (variation 100 – 1,800 metres)
Fairway depth of 2.5 m in 2012	77.8 % (284 days/year)
Main issues in waterway maintenance – high priorities	Financing of waterway maintenance and financial backup for emergency situations are assured by the Ministry of the Interior Insufficient and/or old equipment.
Indicative investment cost for needed actions	Investment: 4,333,700 EUR Operational costs / year: 803,500 EUR

HU 3 Critical Locations

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
1,799.10	1,798.30	0.80	HU / SK	Csicsó
1,797.40	1,796.60	0.80	HU / SK	Vének-felső
1,796.60	1,795.70	0.90	HU / SK	Vének-alsó

1,792.10	1,791.80	0.30	HU / SK	Gönyű upstream (Kolozsnéma)
1,789.90	1,788.50	1.40	HU / SK	Gönyű downstream
1,735.50	1,733.70	1.80	HU / SK	Nyergesújfalu
1,732.60	1,731.90	0.70	HU / SK	Nyerges-alsó
1,726.00	1,724.70	1.30	HU / SK	Ebedi
1,714.30	1,713.90	0.40	HU / SK	Garam-river mouth (Garamkövesd)
1,711.70	1,710.70	1.00	HU / SK	Helemba
1,701.00	1,700.00	1.00	HU / HU	Dömös felső
1,698.00	1,697.00	1.00	HU / HU	Dömös
1,694.20	1,693.80	0.40	HU / HU	Nagymaros
1,684.40	1,684.20	0.20	HU / HU	Vác felső
1,680.40	1,679.80	0.60	HU / HU	Vác
1,675.50	1,675.30	0.20	HU / HU	Sződ liget
1,667.50	1,666.80	0.70	HU / HU	Göd
1,653.00	1,651.80	1.20	HU / HU	Budapest (Árpád-híd)
1,638.40	1,637.40	1.00	HU / HU	Budafok
1,623.60	1,622.60	1.00	HU / HU	Százhalombatta
1,618.50	1,617.80	0.70	HU / HU	Dunafüred
1,615.90	1,615.10	0.80	HU / HU	Ercsi
1,590.70	1,590.10	0.60	HU / HU	Kulcs
1,581.50	1,580.50	1.00	HU / HU	Dunaújváros
1,567.30	1,566.10	1.20	HU / HU	Kisapostag
1,561.00	1,560.00	1.00	HU / HU	Dunaföldvár felső
1,559.80	1,559.70	0.10	HU / HU	Dunaföldvár
1,558.50	1,557.50	1.00	HU / HU	Solt
1,555.80	1,554.60	1.20	HU / HU	Soltasló
1,551.50	1,551.40	0.10	HU / HU	Bölcske
1,529.50	1,528.50	1.00	HU / HU	Paks
1,522.00	1,521.50	0.50	HU / HU	Baráka
1,512.50	1,511.80	0.70	HU / HU	Kovácspuszta
1,493.50	1,492.50	1.00	HU / HU	Korpádi kanyar
1,483.50	1,482.50	1.00	HU / HU	Koppány kanyar
1,480.10	1,479.10	1.00	HU / HU	Baja
1,475.50	1,474.50	1.00	HU / HU	Sárospart 1
1,472.50	1,471.50	1.00	HU / HU	Sárospart 2
1,469.00	1,468.00	1.00	HU / HU	Szeremle
1,461.00	1,460.00	1.00	HU / HU	Dunafalva
1,451.50	1,450.50	1.00	HU / HU	Mohács
1,439.50	1,438.50	1.00	HU / HU	Sirina
1,435.50	1,434.50	1.00	HU / HU	Bédai

Hungary: Overview of Critical Locations



HU 4 Overview of action points

HU 4.1. Monitoring

Regarding the **monitoring of the fairway**, every second year the common Hungarian/Slovakian border is surveyed. The complete Hungarian section is monitored every fifth year with single-beam equipment. Critical sectors are measured once a year, partly by multi-beam. In general, the survey areas are chosen based on the available resources and consultation of vessel crews and the river management department.

When looking at the **monitoring of the water levels**, the density of gauging stations is sufficient, albeit that in some stretches, more stations would be advantageous.

Once a year, the **fairway marking plans** are renewed and verified. Site supervision is done on a weekly basis by the VIZIGs. At cross-border sections, this is performed in turn with the neighbouring country.

	Key issues	*Need for action*
HU 01	Level of detail of monitoring data is suboptimal for exact planning	Support acquisition of up-to-date multi-beam sounding equipment and vessels

HU 4.2. Planning

The **planning of monitoring, execution and information activities** is primarily based on bilateral agreements with Austria, Slovakia, Croatia and Serbia. An annual work plan (as well as agreements on fairway marking) exists only for the common sector of Hungary and Slovakia. It is elaborated by each country taking yearly turns and approved by the Border Commissions.

Currently no dredging activities are performed. Currently, dredging equipment is only available to one Directorate; the others have to run public procurement procedures. As mentioned in point HU1, the worst fords cannot be removed using general dredging methods, and removal of them needs complex planning, therefore works are rather part of infrastructural investments than annual work plans.

Fairway signalling is done according to a signalling plan which is updated after every riverbed survey but at least once a year. Every five years, the signalling plan has to be approved by the water authority. Annual fairway marking meetings are held between the shipping authority and the VIZIGs. Further surveys are carried out before and after interventions.

HU 4.3. Execution

Dredging activities are under the responsibility of the VIZIGs. In 2013, no dredging activities have been performed.

The VIZIGs are also responsible for **fairway marking**; the water authority approves the yearly fairway marking plans. As the riverbed is rather stable, fairway relocations are not undertaken often.

	Key issues	*Need for action*
HU 02	Old monitoring equipment and fleet (related to fairway marking)	Support acquisition of up-to-date vessels and maintenance-free buoys that make marking more cost-effective

HU 4.4.Information

Water level information is transmitted twice a day via NAVINFO radio and online. **Water level forecasts** for 6 days are also available online. No information on impounded sections along the Danube is available, which makes exact forecast impossible.

Information on fairway depths below 2.7m is published once a day on www.hydrouinfo.hu. For critical sections, there are no site plans with ENR-related depths available. There is an ongoing discussion that static information about the bottlenecks shall be provided as pdf on hydroinfo.hu.

Croatia

HR 1 Characteristics of the Danube waterway and its navigable tributaries

The Croatian **Danube** is 137 km long and solely consists of free flowing sections. As part of the Central Danube it is considered as a lowland river with an average height difference of about 8cm per kilometre. Therefore no power plants were built along the Croatian Danube. The river bed consists of mostly sand.

Out of 330 km of river **Drava**, only 198.6 km are navigable. From the mouth up to 70.0 km, the Drava is an international inland waterway with free navigation for all flags. The river section from its mouth to the international port Osijek is classified as international waterway class IV (km 0.00 - 14,00 km). From 70.0 km to 196.8 km, the Drava is an interstate inland waterway between Croatia and Hungary. This is the section with navigation of lower intensity.

Out of the total length of the **Sava** in Croatia, the river is navigable in the length of 383,2 km – from Račinovci to Sisak (km 210,8 to 594 km). This is also the section that is classified as international waterway class IV according the AGN Agreement. From the border with Serbia (Račinovci) to Jasenovac, the Sava river waterway is the joint stretch with Bosnia and Herzegovina (304 km). Upstream from Jasenovac, the Sava is completely in the territory of Croatia.

The **Kupa** river is on the territory of Croatia with its entire length of 294 km. 100 km of river Kupa represents the state border with neighbouring Slovenia. The total navigable length of the Kupa is 5 km.

The river **Una** has the total length of 212 km, out of which 139 km are on the territory of Croatia, while 130 km are a state border with Bosnia and Hercegovina. A stretch of 15km of the Una is classified as inland waterway, out of which 4 km are classified as Class II and 11 km as Class I.

HR 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	AVP (Agency for Inland Waterways within the Ministry of Maritime Affairs, Transport and Infrastructure)
Number / length of critical locations of high priority	<u>Danube</u> 17 / 85 km (62% of national stretch of the Danube River) all locations are cross-border locations shared with Serbia <u>Sava</u> 9 /18.5 (4.82 % of the Sava River) <u>Drava</u> 3 / 4.5 km (17.85% of national stretch classified as international class IV)
Medium length of critical locations	Danube: 5,000 metres (variation 800 – 9,800 metres) Sava: 2,000 metres (variation 500 – 7,000 metres) Drava: 1,500 metres (variation 500 – 2,000 metres)

Fairway depth of 2.5 m in 2012	Danube: 97.8% (357 days/year) Sava: Račinovci- Slavonski Brod: 59% (215 days/year) Slavonski Brod – Sisak: 29% (106 days/year) Drava: 73.5% (268 days/year)
Main issues in waterway maintenance – high priorities	Insufficient and/or old equipment
Indicative investment/operating cost for needed actions	Investment: 4,588,000 EUR Operational costs / year: 1,425,510 EUR

HR 3 Critical Locations

Danube

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
1,429.00	1.425.00	4.00	HR / RS	Bezdan
1,424.20	1,414.40	9.80	HR / RS	Siga - Kazuk
1,408.20	1,400.00	8.20	HR / RS	Apatin
1,397.20	1,389.00	8.20	HR / RS	Čivutski Rukavac
1,388.80	1,382.00	6.80	HR / RS	Drava confluence
1,381.40	1,378.20	3.20	HR / RS	Aljmaš
1,376.80	1,373.40	3.40	HR / RS	Staklar
1,371.40	1,366.40	5.00	HR / RS	Erdut
1,366.20	1,361.40	4.80	HR / RS	Bogojevo
1,357.00	1,351.00	6.00	HR / RS	Dalj
1,348.60	1,343.60	5.00	HR / RS	Borovo 1
1,340.60	1,338.00	2.60	HR / RS	Borovo 2
1,332.00	1,325.00	7.00	HR / RS	Vukovar
1,324.00	1,320.00	4.00	HR / RS	Sotin
1,315.40	1,314.60	0.80	HR / RS	Opatovac
1,311.40	1,307.60	3.80	HR / RS	Mohovo
1,302.00	1,300.00	2.00	HR / RS	Bačka Palanka

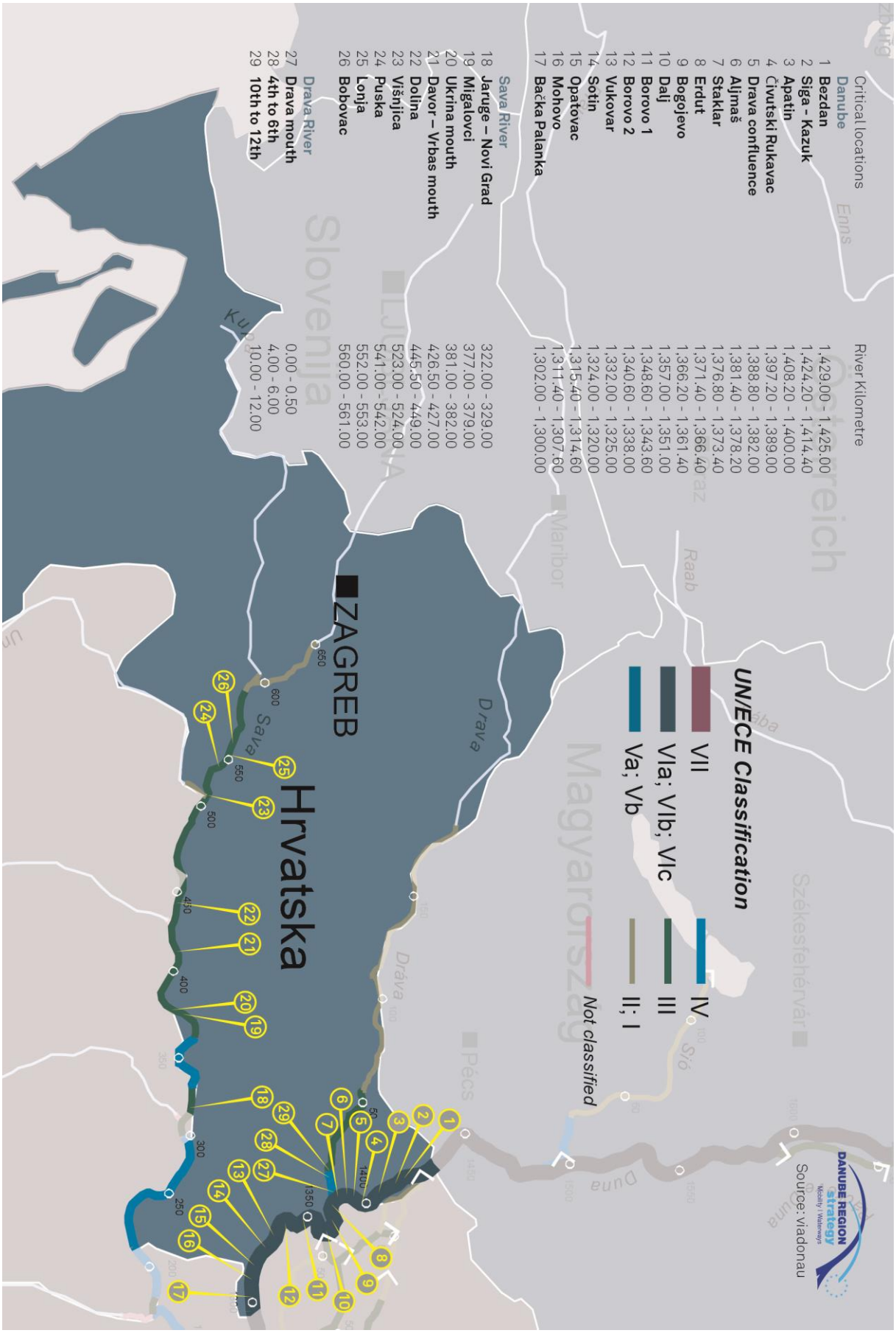
Sava River

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
322.00	329.00	7.00	BA / HR	Jaruge – Novi Grad
377.00	379.00	2.00	BA / HR	Migalovci
381.00	382.00	1.00	BA / HR	Ukrina mouth
426.50	427.00	0.50	BA / HR	Davor – Vrbas mouth
445.00	449.00	4.00	BA / HR	Dolina
523.00	524.00	1.00	HR / HR	Višnjica
541.00	542.00	1.00	HR / HR	Puska
552.00	553.00	1.00	HR / HR	Lonja
560.00	561.00	1.00	HR / HR	Bobovac

Drava River

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
0.00	0.50	0.50	HR / HR	Drava mouth
4.00	6.00	2.00	HR / HR	4th to 6th
10.00	12.00	2.00	HR / HR	10th to 12th

Croatia: Overview of Critical Locations



HR 4 Overview of action points

HR 4.1. Monitoring

Monitoring of the fairway on the Danube, Drava and Sava rivers is performed by the Agency for Inland Waterways and done according to an annual work plan. Surveying is performed as bathymetric surveying of the river bed and the navigation structures.

Bathymetric surveying of the fairway is performed as follows:

1. Regular underwater surveying of the fairway is performed by marking vessels (by echo-sounder) once a week in course of monitoring the fairway marking and controls of fairway dimensions in order to determine critical sections for navigation;
2. Detailed river bed surveying (multi-beam) is performed when required on specific sections in order to determine the river bed morphology. Surveying is performed by means of cross section profiles and intermediate profiles, with a targeted depth accuracy of ±5 cm and a horizontal accuracy of ±20 cm. In addition, surveying of the whole surface of the critical bed section can be performed
3. Annual underwater surveying on the Danube (Croatian/Serbian border) is done with single-beam equipment, alternately by both countries, in order to define the navigation conditions and possible changes in the waterway and the fairway.

Monitoring of fairways that are not marked is performed twice a year.

Water levels are measured by the Metrological and Hydrological Service (DHMZ), the authority responsible for meteorology and hydrology in Croatia. DHMZ performs measurements on five water level measurement stations (Batina, Aljmaš, Dalj, Vukovar and Ilok) at a distance between 21 and 44 km. Hydrology reports are published daily on the DHMZ web site (http://hidro.hr/hidro_e.php?id=hidro&param=Podaci_e). DHMZ also performs regular flow measurement in order to define discharge rating curves and extra measurements in exceptional situations (all done by ADCP current meter). Data are stored digitally, checked and archived. Automatic devices are introduced that directly and continuously submit data in the information system framework. A higher density would be required to provide sufficient quality of measurements.

The marking of the fairway on Croatian rivers is done according to the rules in the *Ordinance on the navigation on inland waterways*. Monitoring of waterways and control system of marking is done usually once a week and even more often if necessary, continuously over the year, through the waterway service patrol. Major changes in the waterway are published in Notices to Skippers. No major issues arise in the field of monitoring fairway marking.

	Key issues	*Need for action*
HR 01	Old monitoring fleet and equipment	Support retrofit and acquisition of up-to-date single-beam sounding equipment, software and vessels
HR 02	Insufficient number of skilled staff	Secure education and provision of well-trained staff in the short, medium and long term
HR 03	The number and the accuracy of gauging stations should be raised	Support increasing the number and quality of gauging stations

HR 4.2. Planning

Planning of monitoring, execution and information activities base on survey results and expert assessments which result in annual work plans established by AVP. The plans are approved by the Harbour Master`s offices and the inland waterway sector.

Environmental impact assessments have to be conducted before awarding concessions for the extraction of sand and gravel. The concessions are limited to certain material and a period of five years. Post-monitoring of the measures is performed in course of the annual surveys.

	Key issues	*Need for action*
HR 04	Insufficient and hardly predictable financial backings	Secure predictable and sufficient financial means for waterway maintenance

HR 4.3. Execution

AVP does not have the necessary equipment or the staff to perform **dredging activities**. Dredging is contracted out and performed one – two times a year based on the annual dredging plan. Information from regular patrols or fairway users also plays an important role. If flow regimes are favourable, dredging activities can be reduced to one-two times every year. All excavated material is reinserted into the river. Annually, sediment in range of 34,000 – 54,000 m^3 is being dredged (average amounts from 2010 to 2013 for the Danube, Sava and Drava River).

Marking activities are under the responsibility of AVP in cooperation with the Harbour Master's Office. Marks are adjusted after high water levels and periods with ice. Decisions are taken jointly with Serbia.

	Key issues	*Need for action*
HR 05	Deterioration of equipment of dredging companies	Support acquisition of modern vessels at AVP or dredging companies
HR 06	Cumbersome procurement procedures for dredging activities	Support simplification of procedures for procurement and allow concessions
HR 07	Not enough vessels available with AVP to provide quick reaction on needed marking interventions; equipment and vessel malfunctions	Support acquisition of modern maintenance and marking vessels
HR 08	Inefficient procedures, suboptimal link between surveying and marking department, insufficient data storage and analysis facilities.	Support development and harmonisation of adequate IT tools

HR 4.4. Information

The National Hydro-Meteorological Institute is responsible for data collection and publication. **Water level information** is measured every hour and updated on their website. Information provided via Notice to Skippers is updated daily. Water level forecasts are not available for now (duration of 3 or 7 days maybe in the future).

Information on fairway depths with accuracy of 10cm is not possible, as bathymetric IENCs are not yet available.

	Key issues	*Need for action*
HR 09	The low number and the accuracy of gauging stations; non-existence of water level forecasts	Support cooperation between actors involved in water level information and increase the number of additional gauging stations

Serbia

RS 1 Characteristics of the Danube waterway and its navigable tributaries

The length of the Danube River in Serbia is 588 km, out of which 137 km are a joint stretch with Croatia; 229 km are a joint stretch with Romania, while 222 km are a national stretch. Part of the Danube River between Bezdan and Belgrade is a free-flowing section, while the Danube downstream of Belgrade is under the influence of the Iron Gate reservoir. The river bed consists of mostly sand. The two hydropower plants, Iron Gate I (km 943) and Iron Gate II (km 863), form a reservoir, which is among the largest in Europe and helps to provide favourable navigation conditions downstream of Belgrade. The reservoir of the Iron Gate I dam extends to Belgrade (km 1,170) during high and average waters and to Novi Sad (km 1,255) during low waters. Low water periods are not affecting navigation in the reservoir; during extreme water periods, the reservoir needs to be partly emptied, which in most cases does not cause any obstacles to navigation.

Important tributaries to the Danube in Serbia are the international waterway of the Sava River (the Sava River in Serbia is 211 km long, including the joint stretch of the river with Bosnia and Herzegovina from rkm 178 to rkm 211) and the interstate waterway of the Tisza River (164 km in Serbia).

RS 2 Fairway maintenance basic data (Danube and Sava)

Responsible for fairway maintenance / data provided by	PLOVPUT (Directorate for Inland Waterways within the Ministry of Construction, Transport and Infrastructure)
Number / length of critical locations of high priority	23 / 123 km (21% of national stretch of the Danube River) 17 cross-border locations with Croatia (85 km) 5 / 38.6 km (18% of the national stretch of the Sava River) 2 cross-border locations with Bosnia and Herzegovina
Medium length of critical locations	Danube: 5,300 metres (variation 800 – 12,000 metres) Sava: 14,400 meters (variations 6,200 – 14,000 meters)
Fairway depth of 2.5m in 2012	Danube: 65% (238 days/year) Sava: 64% (224 days/year)
Main issues in waterway maintenance – high priorities	Budget restrictions impede necessary dredging works on the most critical locations Insufficient and/or old equipment
Indicative investment/operating cost for needed actions	Investment: 5,383,000 EUR Operational costs / year: 1,526,400 EUR

RS 3. Critical Locations

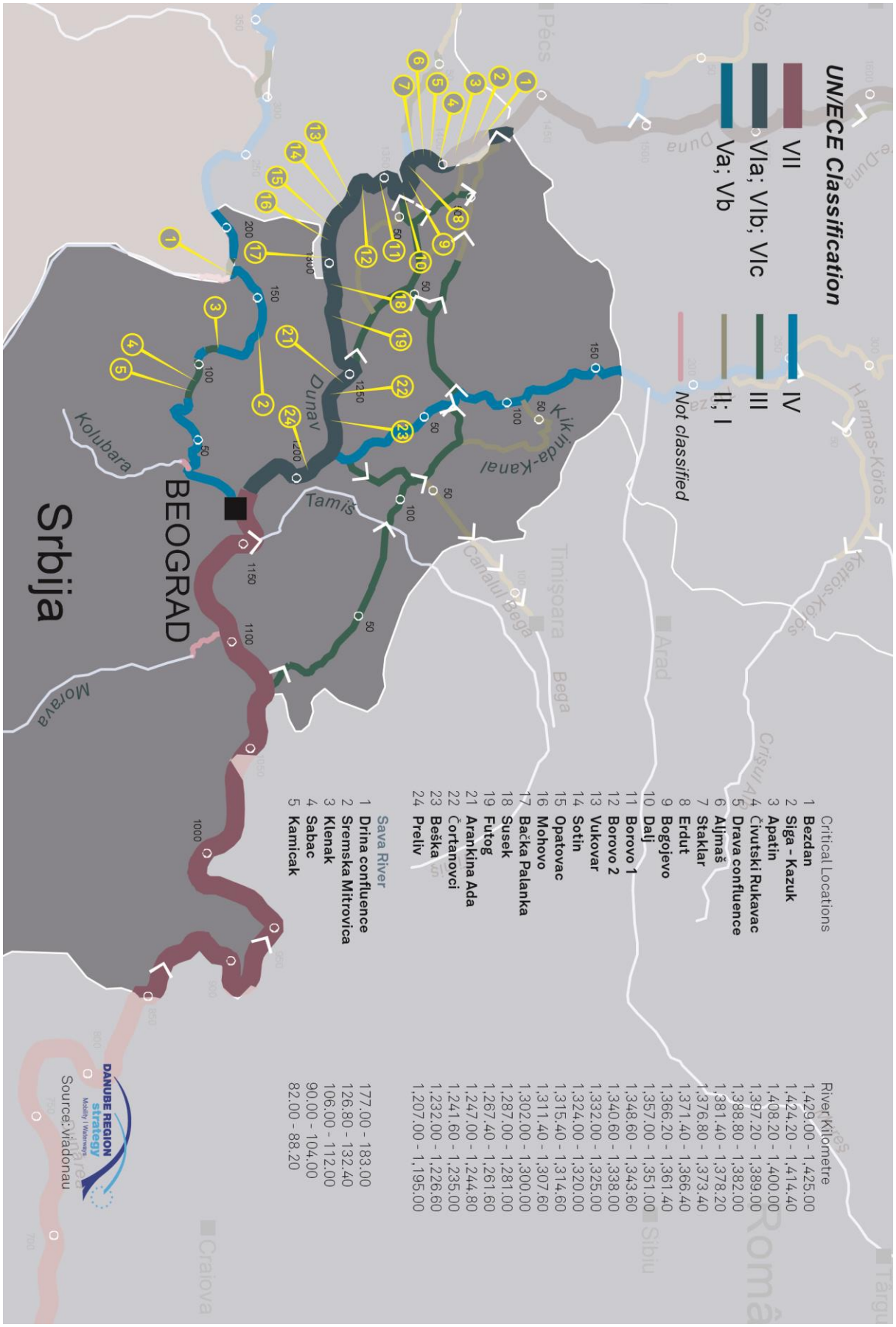
Danube

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
1,429.00	1,425.00	4.00	HR / RS	Bezdan
1,424.20	1,414.40	9.80	HR / RS	Siga - Kazuk
1,408.20	1,400.00	8.20	HR / RS	Apatin
1,397.20	1,389.00	8.20	HR / RS	Čivutski Rukavac
1,388.80	1,382.00	6.80	HR / RS	Drava confluence
1,381.40	1,378.20	3.20	HR / RS	Aljmaš
1,376.80	1,373.40	3.40	HR / RS	Staklar
1,371.40	1,366.40	5.00	HR / RS	Erdut
1,366.20	1,361.40	4.80	HR / RS	Bogojevo
1,357.00	1,351.00	6.00	HR / RS	Dalj
1,348.60	1,343.60	5.00	HR / RS	Borovo 1
1,340.60	1,338.00	2.60	HR / RS	Borovo 2
1,332.00	1,325.00	7.00	HR / RS	Vukovar
1,324.00	1,320.00	4.00	HR / RS	Sotin
1,315.40	1,314.60	0.80	HR / RS	Opatovac
1,311.40	1,307.60	3.80	HR / RS	Mohovo
1,302.00	1,300.00	2.00	HR / RS	Bačka Palanka
1,287.00	1,281.00	6.00	RS / RS	Susek
1,267.40	1,261.60	5.80	RS / RS	Futog
1,247.00	1,244.80	2.20	RS / RS	Arankina Ada
1,241.60	1,235.00	6.60	RS / RS	Čortanovci
1,232.00	1,226.60	5.40	RS / RS	Beška
1,207.00	1,195.00	12.00	RS / RS	Preliv

Sava River

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
82.00	88.20	6,20	RS	Kamicak
90.00	104.00	14,00	RS	Sabac
106.00	112.00	6,00	RS	Klenak
126.80	132.40	6,40	RS	Sremska Mitrovica
177.00	183.00	6,00	RS / BA	Drina confluence

Serbia: Overview of Critical Locations



RS 4 Overview of action points

RS 4.1. Monitoring

Monitoring of the fairway on the Danube, Tisza and Sava Rivers is performed by the Directorate for Inland Waterways PLOVPUT, who holds a survey database of the last 50 years. Single-beam and multi-beam equipment is available. Hydrographic surveys of the free-flowing sections are performed each year in spring/summer with single-beam. The border section is monitored by Croatia and Serbia, taking turns. Critical sections may be surveyed more than once a year, if necessary. The joint section of the Danube River between Serbia and Romania, which is under the direct influence of the regime of work of Iron Gate I and Iron Gate II, is currently monitored once in four years. Monitoring of sections without regulated fairways is performed twice a year. Additional monitoring of the riverbed is performed by marking vessels (echo-sounder).

Water levels are monitored using automatic gauging stations, available on the free-flowing stretch. A higher density would be required to provide sufficient quality of measurements.

The **marking of the fairway** is monitored twice per month. There are no major issues related to monitoring of fairway.

	Key issues	*Need for action*
RS 01	Limitations of available data due to insufficient number of vessels and surveying equipment Limited budget for monitoring activities	Support acquisition/retrofit of up-to-date single-beam sounding equipment, software and vessels Enforce cooperation with AVP on joint stretch and improve data exchange
RS 02	Insufficient number of skilled staff	Secure education and provision of well-trained staff in the short, medium and long term Facilitate different geographical organization of surveying teams to allow more effective and efficient performances Enable expert exchange with other Danube waterway administrations
RS 03	Insufficient number of automatic gauging stations in the free flowing section	Support acquisition and operation of additional gauging stations.

RS 4.2. Planning

Planning of monitoring, execution and information activities is based on a bilateral agreement on surveying and maintenance between Croatia and Serbia. The joint section with Romania is covered by the Interstate Commission for the Iron Gate. These discussions form the basis for the annual maintenance and marking plan of PLOVPUT, which covers Danube, Tisza and Sava, and is approved by the Ministry. Maintenance activities can only be executed if budget is granted by the Government. This has to be negotiated annually. Success control is performed after dredging activities.

RS 4.3. Execution

Dredging activities are executed by PLOVPUT based on the annual plan, but depending on the fact if financial means are provided by the Government each year. Dredged material is disposed in the river. Annually, sediment in the range of 50,000 – 150,000 m³ is being dredged, with a decreasing trend. In 2013, 62,000m³ were dredged (whereas the area of intervention was restricted to Winter Ship Shelters, meaning that no fairway areas were dredged). On average, dredging volumes amount to about 42,000m³.

In 2013, emergency dredging for fairway maintenance was performed on the Sava River, funded from the budget reserve (60,000 m³).

Marking activities are undertaken by PLOVPUT. There is a joint annual marking plan with Croatia. Romania and Serbia have separate marking plans, which are harmonised.

	Key issues	*Need for action*
RS 04	Further absence of budget for dredging activities will lead to deterioration of navigation conditions, while the cost-benefit ratio of these activities is very favourable.	Secure sufficient and predictable financial means
RS 05	Old marking vessels and equipment	Support acquisition of up-to-date marking vessels and buoys
RS 06	Inefficiencies due to missing comprehensive database and web tool for navigation aids	Support development of a web application for marking activities on the Danube and its tributaries integrating Croatia and Romania
RS 07	Limited number of skilled personnel and inability to employ new staff due to Government regulation and restrictions	Secure education and provision of well-trained staff in the short, medium and long term

RS 4.4. Information

Information on water levels is provided daily by the Hydro-Meteorological Institute, which is responsible for data collection and publication of meteorological information. **Forecasts** are available for four days.

Information on fairway depths is published on the website of Plovput every second week or as needed during low water periods. There are no major issues related to information on fairway depths.

	Key issues	*Need for action*
RS 08	The low number of gauging stations results in incomplete water level information and lead to inaccurate forecasts.	Support acquisition and operation of additional gauging stations.

Bosnia and Herzegovina

BA 1 Characteristics of the Sava waterway

All together the River Sava is 945 km long and drains 95,719 km² of surface area. The 337 km of the Bosnia and Herzegovina Sava follows the joint border with Croatia for 304 rkm and is shared with Serbia for about 32.8 rkm after the border triangle. The River Sava is categorized as an International Waterway of class III from Sisak to Slavonski Brod and almost continuously of class IV until Belgrade. Nevertheless, a Feasibility Study identified many sections of the river that not fulfil the minimum requirements for navigation. Result of the study were preliminary designs and cost estimations for the necessary engineering interventions in the waterway to return the River Sava to Class Va and/or Class IV.

Basic documents are the *Framework Agreement on the Sava River Basin* and the *Strategy on implementation of the Framework Agreement on the Sava River Basin and Action Plan for the period 2011-2015*.

The Ministry of Communications and Transport of Bosnia and Herzegovina signed an "Agreement between the Government of the Republic of Croatia and the Council of ministers of Bosnia and Herzegovina on inland waterways navigation, its signalling and maintenance". On basis of the Agreement, the Rule Book for marking of the fairway on the Sava river waterway has been signed by Bosnia and Croatia. According to the Rule Book, Bosnia and Herzegovina marks the fairway from rkm 343 to rkm 211 on the Bosnian and Croatian fairway, and from rkm 211 to rkm 178 for the Bosnian part of the fairway.

Also, an agreement between Government of Republic of Serbia and Council of ministers of Bosnia and Herzegovina on inland waterways navigation and its technical maintenance has been signed. A common implementation body consisting of the representatives of Bosnia and Herzegovina and Republic of Serbia shall work on the preparation of the Rule Book for maintenance of the common fairway on the river Sava.

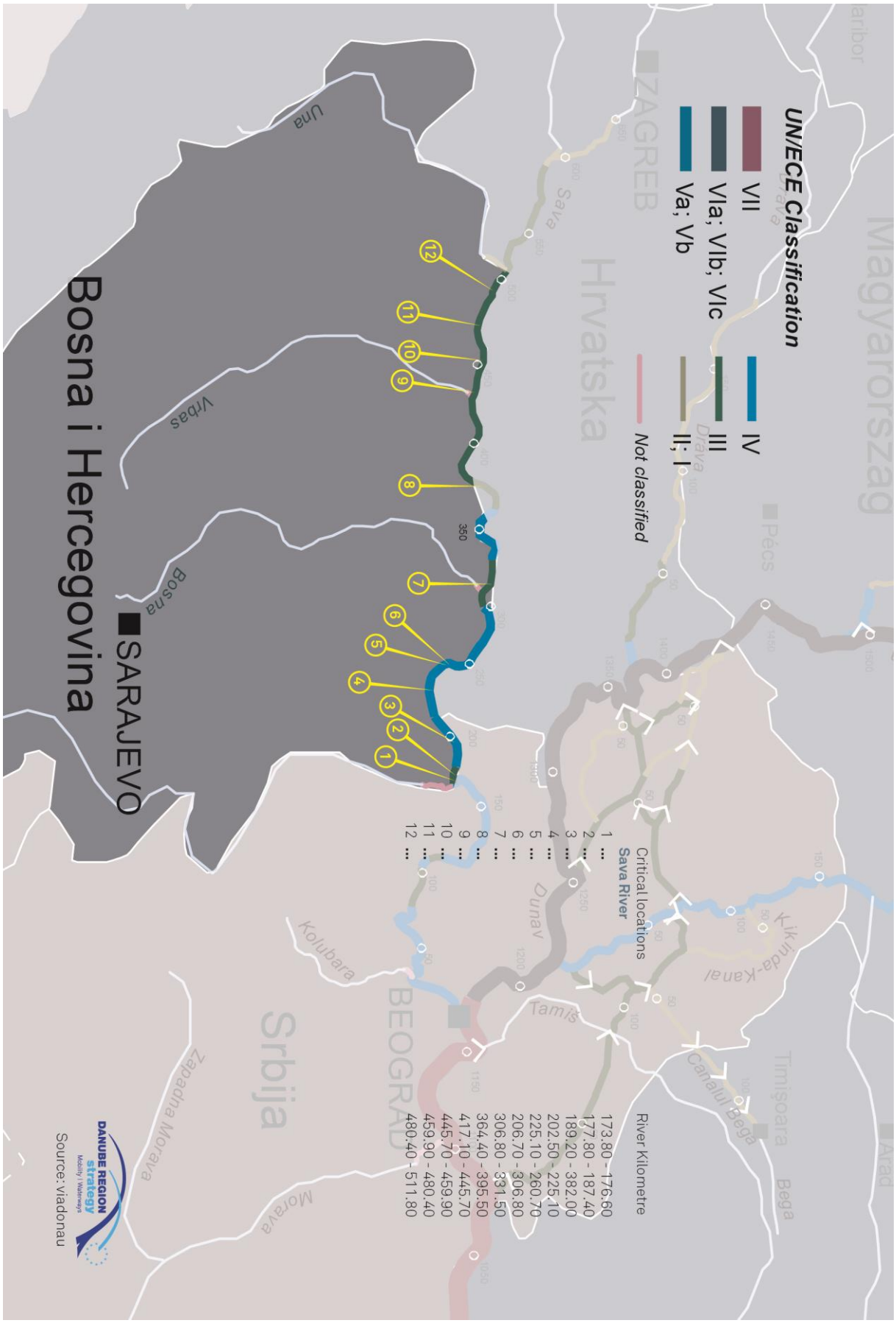
BA 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	Currently there is no agency on state level which is responsible for maintenance.
Number / length of critical locations of high priority	No data provided
Medium length of critical locations	No data provided
Fairway depth of 2.5 m in 2012	No data provided
Main issues in waterway maintenance – high priorities	No data provided
Indicative investment/operating cost for needed actions	300,000.00 EUR for maintenance of the signalling system for the period 2013-2015

BA 3 Critical Locations (Sava)

Location / Length (km)			Right bank/ Left bank	Name of sector / location
River-km (from / to)		Length		
69,7	72,9	3,2		
79,9	85,8	5,9		
88,3	101,9	13,6		
103,5	109,8	6,3		
173,8	176,6	2,8		
177,8	187,4	9,6		
189,2	202,5	13,3		
202,5	225,1	22,6		
225,1	260,7	35,6		
206,7	306,8	100,1		
306,8	331,5	24,7		
364,4	395,5	31,1		
417,1	445,7	28,6		
445,7	459,9	14,2		
459,9	480,4	20,5		
480,4	511,8	31,4		

Bosnia and Herzegovina: Overview of Critical Locations



BA 4 Overview of action points

BA 4.1. Monitoring

Currently, there is no agency on the state level, which is responsible for maintenance of the fairway in Bosnia and Herzegovina.

The fairway signalling system is currently maintained and supervised according to the contracts which Bosnia and Herzegovina / Ministry of communications and transport of BiH has signed for maintenance and supervision of the signalling system of the Sava river fairway from rkm 343 to rkm 211 on BiH and Croatian fairway/river banks, and from rkm 211 to rkm 178 for BiH part of the fairway/river bank (the same sections as agreed between Bosnia and Herzegovina and Croatia for marking of the fairway), for the period 2013 – 2015.

BA 4.3. Execution

The fairway of the Sava River in Bosnia and Herzegovina should be rehabilitated to IV/Va navigable class to enable better navigation conditions along the Sava River.

Bosnia and Herzegovina should introduce activities on monitoring, planning and execution of fairway maintenance works after completion of construction works on rehabilitation of the Sava river fairway.

BA 4.4. Information

Information activities should be introduced after completion of construction works on rehabilitation of the Sava river fairway.

Romania

RO 1 Characteristics of the Danube waterway

The Romanian waterway network consists of the main branch of the Romanian Danube with its outlet to the Black Sea at Sulina (1,075 km) and the Danube – Black Sea Canal (100 km). In the period of low water levels, the navigation runs through the alternative route on the Borcea branch, between rkm 345 and rkm 240. Therefore the waterway network maintained by Romania sums up to 1,253 km

There are locks positioned at river km 943 and 863 (Iron Gates). On the Romanian sector of Danube, depending of the flowing regime, there are three distinct sectors: a backwater sector (rkm 1,075 to rkm 863), a free flowing sector (rkm 863 to rkm 175), and a free flowing – maritime sector (rkm 175 to rkm 0). The sector from rkm 1,075 to 845.5 is shared with Serbian administrations, from rkm 845.5 to 375 with Bulgarian administrations (based on a bilateral agreement from 1955), between rkm 134.14 and rkm 133.59 with Moldova and between rkm 133.95 and rkm 79.64 (start of the Chilia branch). Only the sectors between rkm 375 and rkm 134.14 and between rkm 79.64 and rkm 0 are solely administered by Romanian authorities. Bulgaria and Romania agreed on splitting the responsibility to ensure minimum fairway depth on the joint border stretch. While Bulgaria is responsible for fairway maintenance between rkm 610 and rkm 375, Romania is in charge for the critical locations between rkm 845.5 and rkm 610. According to the AGN the Romanian Danube sector from 1,075 km to 0 km is part of class VII. The Danube-Black Sea Canal is specified as Class VI. Most of the river banks are not reinforced in Lower Danube. The stretch is characterized with highly intensive morphological changes of the river bed and undermining banks. An example for this is the occurrence of critical sectors, where the river moves large quantities of sediments on a daily basis. Regarding discharge, it is observed that the most likely period in which navigation problems appear is between July and October.

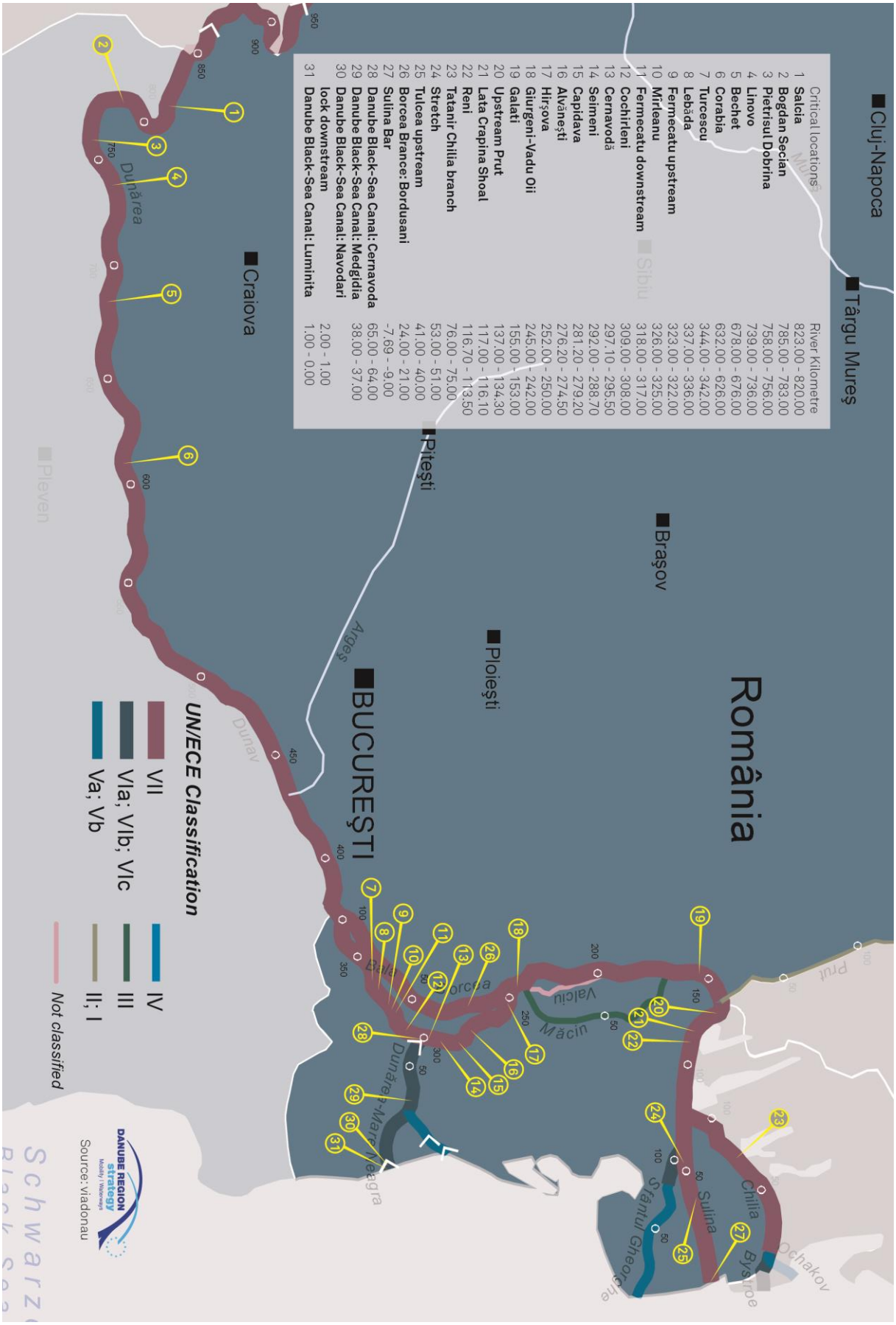
RO 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	Administration of the Lower Danube (AFDJ), Administration of the Navigable Canals (ACN)
Number / length of critical locations of high priority	31 / 60 km (5% of national stretch)
Medium length of critical locations	1,900 metres (variation 300 – 3,300 metres)
Fairway depth of 2.5m in 2012	86% (314 days/year) in free flowing sections
Main issues in waterway maintenance – high priorities	Insufficient dredging, marking and monitoring equipment
Indicative investment/operating cost for needed actions	Investment: 41,058,000 EUR Operational costs / year: 567,000 EUR

RO 3 Critical Locations

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
823.00	820.00	3.00	BG / RO	Salcia
785.00	783.00	2.00	BG / RO	Bogdan Secian
758.00	756.00	2.00	BG / RO	Pietrisul Dobrina
739.00	736.00	3.00	BG / RO	Linovo
678.00	676.00	2.00	BG / RO	Bechet
632.00	626.00	6.00	BG / RO	Corabia
Critical locations between rkm 610 and rkm 375 fall under the responsibility of Bulgaria.				
344.00	342.00	2.00	RO / RO	Turcescu
337.00	336.00	1.00	RO / RO	Lebăda
323.00	322.00	1.00	RO / RO	Fermecatu upstream
326.00	325.00	1.00	RO / RO	Mîrleanu
318.00	317.00	1.00	RO / RO	Fermecatu downstream
309.00	308.00	1.00	RO / RO	Cochirleni
297.10	295.50	1.60	RO / RO	Cernavodă
292.00	288.70	3.30	RO / RO	Seimeni
281.20	279.20	2.00	RO / RO	Capidava
276.20	274.50	1.70	RO / RO	Alvăneşti
252.00	250.00	2.00	RO / RO	Hirşova
245.00	242.00	3.00	RO / RO	Giurgeni-Vadu Oii
155.00	153.00	2.00	RO / RO	Galati
137.00	134.30	2.70	RO / RO	Upstream Prut
117.00	116.10	0.90	RO / UA	Lata Crapina Shoal
116.70	113.50	3.20	RO / UA	Reni
76.00	75.00	1.00	RO / UA	Tatanir Chilia branch
53.00	51.00	2.00	RO / RO	Stretch
41.00	40.00	1.00	RO / RO	Tulcea upstream
24.00	21.00	3.00	RO / RO	Borcea Brance: Bordusani
-7.69	-9.00	1.31	RO / RO	Sulina Bar
65.00	64.00	1.00	RO / RO	Danube Black-Sea Canal: Cernavoda
38.00	37.00	1.00	RO / RO	Danube Black-Sea Canal: Medgidia
2.00	1.00	1.00	RO / RO	Danube Black-Sea Canal: Navodari lock downstream
1.00	0.00	1.00	RO / RO	Danube Black-Sea Canal: Luminita

Romania: Overview of Critical Locations



RO 4 Overview of action points

RO 4.1. Monitoring

Monitoring of the fairway is done by monthly surveys along 3, 5 or 7 lines according to annual work plan and with a higher frequency if needed. The riparian states split the monitoring responsibilities each sector is managed entirely by one State. There is a good and permanent connection between Romania and Serbia as well as between Romania and Bulgaria regarding the maintenance of the fairway (exchange surveys). Critical locations are periodically monitored jointly (e.g. Belene area). Water levels are monitored by means of 23 classical and 20 automatic water gauging stations.

Fairway marking is monitored at monthly and sometimes even weekly travels with specialized vessels.

	Key issues	*Need for action*
RO 01	Insufficient number of sounding vessels	Support acquisition of up-to-date sounding equipment to raise the coverage of surveyed areas.
RO 02	Insufficient number of automatic gauging stations.	Support acquisition of additional automatic gauging stations, especially for critical sections.

RO 4.2. Planning of monitoring, execution and information activities

An **annual work plan** sets out the number, type and location signals, dredged areas and dredging periods. Also the fairway monitoring is conducted according to this work plan and in line with joint working group meetings of hydrology, hydrography, signalisation, dredging works departments (once or twice a year). Plans are made based on the analysis of measurements and statistical data. Depending on the morphological evolution of sectors additional measures are taken.

The monitoring plans are in line with the existing strategic documents, including the EU Strategy for the Danube Region (2010) and with Danube Commission recommendations. Romania co-ordinates with Bulgaria and Serbia related to planning activities.

Marking plans are verified and renewed monthly and updated daily in critical situations.

RO 4.3. Execution

Dredging activities are conducted within the responsibility of AFDJ. For the maritime Danube a maritime dredge is available, dredging works at the fluvial Danube are contracted out. The amount of dredged material accounts for about 1.340.000 m^3/year (mean value 2006-2012), but was significantly lower in 2012 (780,000 m^3). The dredged material is inserted in the riverbed.

Priority is given to critical areas, difficult passaged or areas of recent events to ensure the navigation depth. Dredging activities are usually realized before low water periods.

Marking activities concentrate on critical points mainly in relation to extreme water levels. Free flowing sections are marked by buoys with a distance of three kilometres on average. The

alignment of the fairway is published weekly and available daily via signalling bulletin. Navigational marks are updated daily.

	Key issues	*Need for action*
RO 03	Lack of dredging equipment, specialized personnel and deficiency of investments in river regulation	Support acquisition of dredging equipment performance to increase the efficiency of work in problem areas and the possibility of intervention at any time where it is needed
RO 04	Inefficient procedures. The documentation to draw up a contract for dredging is time consuming.	Support standardization and simplification of documentation procedures.
RO 05	Lack of efficient vessels and special equipment for marking.	Support acquisition of vessels equipped with advanced machines to perform operations board assembly / disassembly floating signals.
RO 06	Insufficient number of buoys and position monitoring equipment. Unavailable automated system for the transmission of information on the buoys. The dissemination of information could be improved.	Support acquisition of buoys and monitoring equipment. Support establishment of an automated monitoring system and improve the provision of information on fairway marks.

RO 4.4. Information

Data regarding **water levels** and water temperature is gathered and provided for 23 gauging stations on a daily basis. Additionally a Hydro-meteorological bulletin and a forecast for 48 hour related to three ports are published each day.

Information on fairway depths is available at a 10 cm scaling daily. Bathymetrical IENCs do not exist. Meteorological information is available once per day for the gauging station areas.

	Key issues	*Need for action*
RO 07	Unavailable forecast for water levels.	Support establishment of a water level forecast
RO 08	Information could be provided customer-friendly using established river information portals.	Support customer-friendly processing and dissemination of information.
RO 09	Unavailable digital terrain models for shallow sections.	Support set-up of digital terrain models for shallow sections.

RO 10	Insufficient number and quality of weather stations.	Support improvement of meteorological information.
RO 11	Missing interconnection with databases of other waterway administrations to exchange data.	Support interconnection between databases of different waterway administrations.

Comments:

Water level forecasts are provided daily by AFDJ for three locations on the Danube; Furthermore, in Romania there are a seven day forecasts, updated daily, provided by The National Institute for Hydrology and Water Management – INHGA.

Bulgaria

BG 1 Characteristics of the Danube waterway

The common Danube stretch of Bulgaria and Romania reaches 471km from the western Bulgarian border until Silistra in the east. From rkm 610 to rkm 375, Bulgaria is responsible for waterway maintenance. In the Bulgarian-Romanian section, the Danube is a typical lowland free-flowing river (66% of the common stretch), it becomes shallower and broader and has a big seasonal difference of water levels (>9m). The width of the riverbed varies form 600-720 m, while the river banks are steep, in some places up to 150m. The water quantities are not so much influenced by the tributaries, but, especially in the upper sections, directly dependant on the mode of operation of the hydrotechnical complex Iron Gates and characterised by large daily fluctuation (up to >1m). Due to the active hydromorphological processes of the river in this section, the riverbed constantly changes its geometrical and hydrological parameters. Sediment transport (mostly sand) and depth erosion is intense.

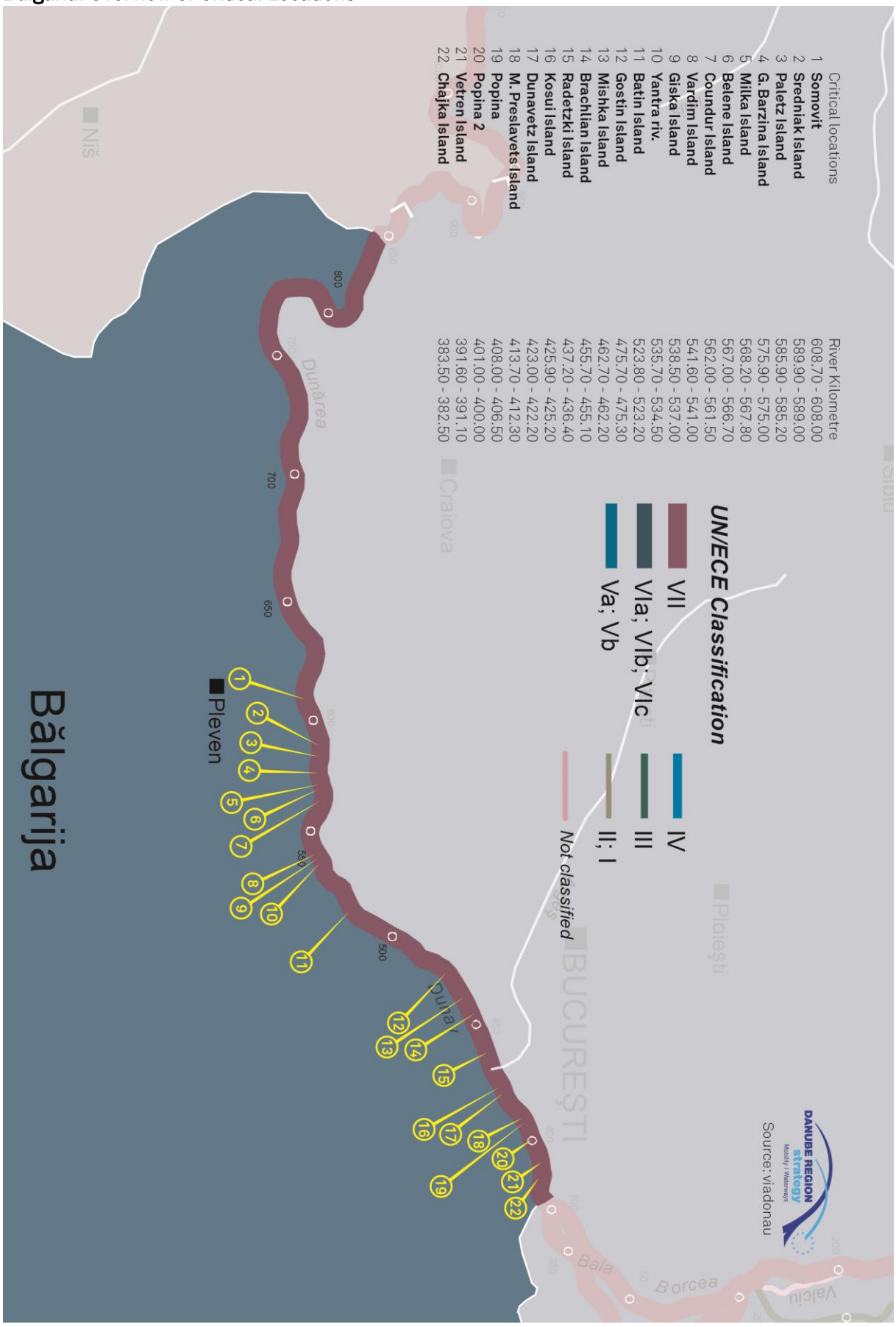
BG 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	EAEMDR – Executive Agency "Exploration and Maintenance of the Danube River" (public authority within Ministry of Transport)
Number / length of critical locations of high priority	22 / 17.5 km (7% of stretch under Bulgarian responsibility) all locations are cross-border locations shared with Romania
Medium length of critical locations	800 metres (variation 300 – 3,000 metres)
Fairway depth of 2.5m in 2012	87% (317 days/year) with fairway depth ≥ 2.5 64% (232 days/year) with fairway width ≥ 80m
Main issues in waterway maintenance – high priorities	Insufficient dredging and monitoring equipment
Indicative investment/operating cost for needed actions	Investment: 21,132,000 EUR Operational costs / year: 1,265,500 EUR

BG 3 Critical Locations

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
608.70	608.00	0.70	BG / RO	Somovit
589.90	589.00	0.90	BG / RO	Sredniak Island
585.90	585.20	0.70	BG / RO	Paletz Island
575.90	575.00	0.90	BG / RO	G. Barzina Island
568.20	567.80	0.40	BG / RO	Milka Island
567.00	566.70	0.30	BG / RO	Belene Island
562.00	561.50	0.50	BG / RO	Coundur Island
541.60	541.00	0.60	BG / RO	Vardim Island
538.50	537.00	1.50	BG / RO	Giska Island
535.70	534.50	1.20	BG / RO	Yantra riv.
523.80	523.20	0.60	BG / RO	Batin Island
475.70	475.30	0.40	BG / RO	Gostin Island
462.70	462.20	0.50	BG / RO	Mishka Island
455.70	455.10	0.60	BG / RO	Brachlian Island
437.20	436.40	0.80	BG / RO	Radetzki Island
425.90	425.20	0.70	BG / RO	Kosui Island
423.00	422.20	0.80	BG / RO	Dunavetz Island
413.70	412.30	1.40	BG / RO	M. Preslavets Island
408.00	406.50	1.50	BG / RO	Popina
401.00	400.00	1.00	BG / RO	Popina 2
391.60	391.10	0.50	BG / RO	Vetren Island
383.50	382.50	1.00	BG / RO	Chajka Island

Bulgaria: Overview of Critical Locations



BG 4 Overview of action points

BG 4.1. Monitoring

Monitoring of the fairway is executed based on an annual work plan established by EAEMDR. In some areas, Romania and Bulgaria execute common monitoring based on the work plan elaborated by an inter-ministerial committee (see "Planning"), e.g. in the critical Belene area. In critical sections, monitoring is performed once a year. The remaining sections are supervised once in 5 years. The area of the two bridges (Ruse-Guirgiu and Vidin-Kalafat) is supervised twice a year during high and low water periods. Monitoring cruises by marking vessels are done about 4 times a month, more often during low water periods. That way, the critical sections are monitored in an intensity of more than 240 times a year.

Water levels, water temperature and turbidity are measured by nine automatic gauging stations. The information is submitted every 15 minutes to a database.

Marking vessels monitor the **fairway marking** about 4 times a month, more often during low water periods. The needs concerning fairway monitoring are described in the "Information" section.

	Key issues	*Need for action*
BG 01	Old or insufficient measuring equipment	Support acquisition of up-to-date (renewed single-beam and additional multi-beam) sounding equipment
BG 02	Limited number of skilled personnel	Secure education and provision of well-trained staff in the short, medium and long term

BG 4.2. Planning

Planning of monitoring, execution and information activities base on an agreement on maintenance and improvement of the Danube River between Rumania and Bulgaria endorsed in 1955. A joint Bulgarian-Romanian Commission for Maintenance and Improvement of the Fairway was established. This Commission prepares annual monitoring and maintenance action plans. Based on these, EAEMDR elaborates annual work plans for monitoring and fairway maintenance interventions. A catalogue of the critical sections has also been prepared. The decisions are based on monitoring results, water level forecasts or information of waterway users. Assessment of the measures is undertaken as well.

	Key issues	*Need for action*
BG 03	To a large extend, interventions are planned on short term due to rapidly changing fairway conditions	Support improvement of monitoring procedures, data basics and methods for analysis and planning of interventions
BG 04	Inefficient allocation of resources due to suboptimal information support system, lack of consistent database of riverbed surveys and cumbersome procedures	Support introduction of a Fairway Management System

BG 4.3. Execution

EAEMDR owns own dredging equipment and barges for transportation of dredged material and performs **dredging activities** in-house. Nevertheless, the available equipment only allows dredging of access channels and ports. As a result the majority of the interventions need to be done by fairway marking (see "Information"). In 2013, only in the areas of Belene and Chaika island were dredged, which amounted to 46,500 m^3.

Marking activities are one of the main concerns of EAEMDR. The fairway alignment is adapted about 50 times a year.

	Key issues	*Need for action*
BG 05	Only very little dredging works of the fairway have been performed for many years because of insufficient dredging equipment and limited financial resources	Support acquisition of up-to-date dredging equipment Increase available annual resources for dredging works Support implementation of structural river engineering measures
BG 06	High traffic risks due to loss or incorrectness of navigation signs provoked by accidents with ships or insufficient maintenance	Enable improved surveillance of navigation activities by electronic means Increase resources for maintenance of floating signs
BG 07	Insufficient marking equipment	Support acquisition of monitoring and marking equipment
BG 08	Limited number of skilled personnel (regarding fairway marking)	Secure education and provision of well-trained staff in the short, medium and long term

BG 4.4. Information

Nine electric displays facing the river inform about **water levels** at the nine automatic gauging stations. The information is published on daily basis on the EAEMDR website, supplemented by 2-day **water level forecasts.** Every Wednesday, a weekly forecast for Ruse and Silistra is placed online.

Information on fairway depths of critical sections is published online once a day. Schemes of critical areas can also be found on the Agencies website. They are based on regular hydrographic measurements, which carried out on more than 240 days a year.

Notice to Skippers inform about changes in navigational conditions and the alignment of the fairway. In addition, a bulletin, based on the notice is prepared and published on the website of EAEMDR. A Hydro-meteorological bulletin is broadcasted daily via the Bulgarian National Radio as well as sent to other waterway administrations and skippers.

If needed, the marking ship stays in the most critical sections to assist the skippers.

Moldova

MD 1 Characteristics of the Danube waterway

The Danube stretch of Moldova is only about 500 metres long and is restricted to the port area of Giurgiulesti.

MD 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	Fairway administration and maintenance of the Danube waterway in Moldova is carried out by the Romanian AFDJ on the basis of a bilateral agreement
Number / length of critical locations of high priority	There are no critical locations.
Medium length of critical locations	-
Fairway depth of 2.5m in 2012	100%
Main issues in waterway maintenance – high priorities	None
Indicative investment/operating cost for needed actions	None

MD 3 Critical Locations

There are no critical locations in Moldova.

MD 4 Overview of action points

There is no need for action.

Ukraine

UA 1 Characteristics of the Danube waterway

The length of the Danube navigation route by natural free-flowing channels is 172.36 km, which passes as follows:

- Border with Moldova– the cape Ismail Chatal (72-43 mm*) – joint border stretch (maritime stretch) with Romania
- the cape Ismail Chatal - Vilkovo (43 mm - 20.55 km**) – the mouth Kilijske

This section is a natural deep-water stretch with two-way vessel traffic.

- Vilkovo - the beginning of the mouth Bystre (20.55 - 11 km)
- the entrance to the marine approach channel (11 - 0 km).

The main critical locations are:

- Section from the beginning of the cape Ismail Chatal (20.55 km - 43 mm) - passes through the mouth Kilijske, with the two-way vessels traffic (width at the bottom is 120 m). This area has 13 shallow sections where it is necessary to conduct dredging works;
- Section from the cape Ismail Chatal to the Moldovan Border: 4 critical locations.

* - mm – marine mile
** - countdown of river kilometers of the mouth Kilijske starts from the mouth Bystre '0'

UA 2 Fairway maintenance basic data

Responsible for fairway maintenance / data provided by	The State Enterprise «Ukrainian Sea Ports Authority» of the Ministry of Infrastructure of Ukraine
Number / length of critical locations of high priority	17 / 37 km (21.5% of stretch of the national and common stretch of the Danube river)
Medium length of critical locations	2,200 metres (variation 500 – 3,700 metres)
Fairway depth of 2.5m in 2012	100%
Main issues in waterway maintenance – high priorities	There is a lack of modern dredging equipment / services, available for effective intervention during critical periods – there is a need of processes optimization.
Indicative investment/operating cost for needed actions	

UA 3 Critical Locations

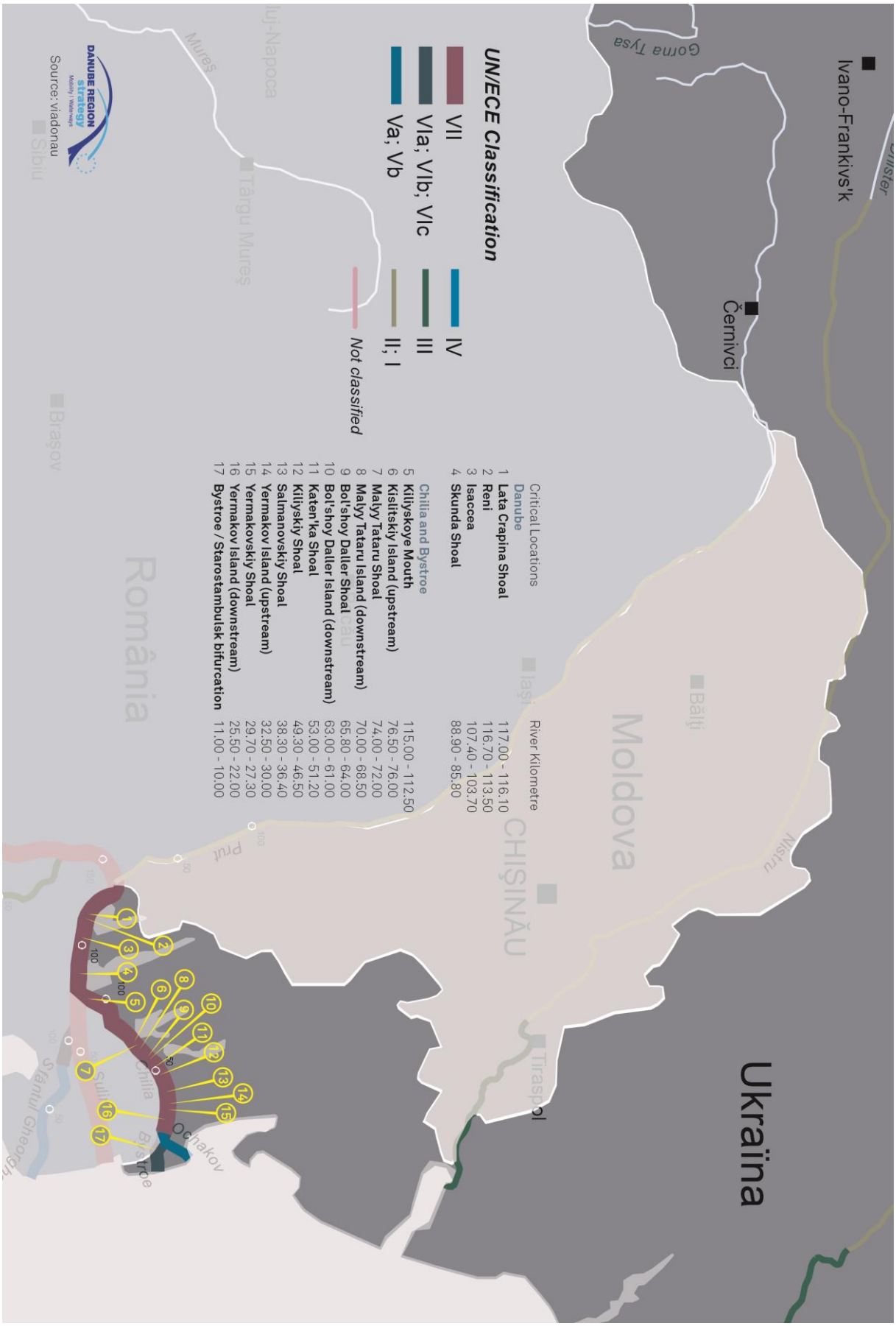
Danube

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
117.00	116.10	0.90	RO / UA	Lata Crapina Shoal
116.70	113.50	3.20	RO / UA	Reni
107.40	103.70	3.70	RO / UA	Isaccea
88.90	85.80	3.10	RO / UA	Skunda Shoal

Chilia and Bystroe

Location / Length (km)			right bank / left bank	Name of sector / location
River-km (from / to)		Length		
115.00	112.50	2.50	RO / UA	Mouth Kilijske
76.50	76.00	0.50	RO / UA	Kislitskiy Island (upstream)
74.00	72.00	2.00	UA / UA	Malyy Tataru Shoal
70.00	68.50	1.50	UA / UA	Malyy Tataru Island (downstream)
65.80	64.00	1.80	UA / UA	Bol'shoy Daller Shoal
63.00	61.00	2.00	UA / UA	Bol'shoy Daller Island (downstream)
53.00	51.20	1.80	RO / UA	Katen'ka Shoal
49.30	46.50	2.80	RO / UA	Kilijskiy Shoal
38.30	36.40	1.90	RO / UA	Salmanovskiy Shoal
32.50	30.00	2.50	RO / UA	Yermakov Island (upstream)
29.70	27.30	2.40	RO / UA	Yermakovskiy Shoal
25.50	22.00	3.50	RO / UA	Yermakov Island (downstream)
11.00	10.00	1.00	RO / UA	Bystroe / Starostambulsk bifurcation

Ukraine: Overview of Critical Locations



UA 4 Overview of action points

UA 4.1. Monitoring

Monitoring of the fairway consist of sounding works to collect data on the riverbed and the water depth for navigation activities as well as for establishing and maintaining updated river navigation charts. The works are regularly performed by the State Institution "Derzhhydrographiya". In 2013 161,000 EUR (2.6 million UAH) were spent on hydrographic surveying.

Water levels observation on the Ukrainian part of the Danube River on a regular basis is performed by the units of the Hydrometeorological Center of Ukraine on the 6 water- level measuring posts.

UA 4.2. Planning of monitoring, execution and information activities

Sounding works for navigation, collecting data on the shape of the bottom and the state of depth, as well as for establishing and maintaining updated river navigation charts are regularly performed by the State Institution "Derzhhydrographiya".

The Ukrainian part of the Danube is equipped with the aids to navigation which are maintained in a proper condition as required by the Danube Commission (Instructions for Placement of Floating Signs on the Danube River).

In case the aids to navigation are out of service, the repair works are conducted within the shortest possible time.

UA 4.3. Execution

Starting from June 2014 only maintenance **dredging activities** are performed on a limited section. Mentioned works are carried out to ensure the safety of navigation, to support navigation parameters of the channel and to prevent accidents.

Dredging works on the river shallow sections of the Danube are carried out as works in transboundary waters.

Note: Art. 2 "Objectives and Principles of Cooperation" of the Agreement between the Government of Ukraine and the Government of Romania on Cooperation in the Field of Water Management in Transboundary Waters:

"Paragraph 3. Neither Party without prior approval will not perform work on its national territory and will not take any actions that may lead to significant changes in flow regime or qualitative changes of the transboundary waters."

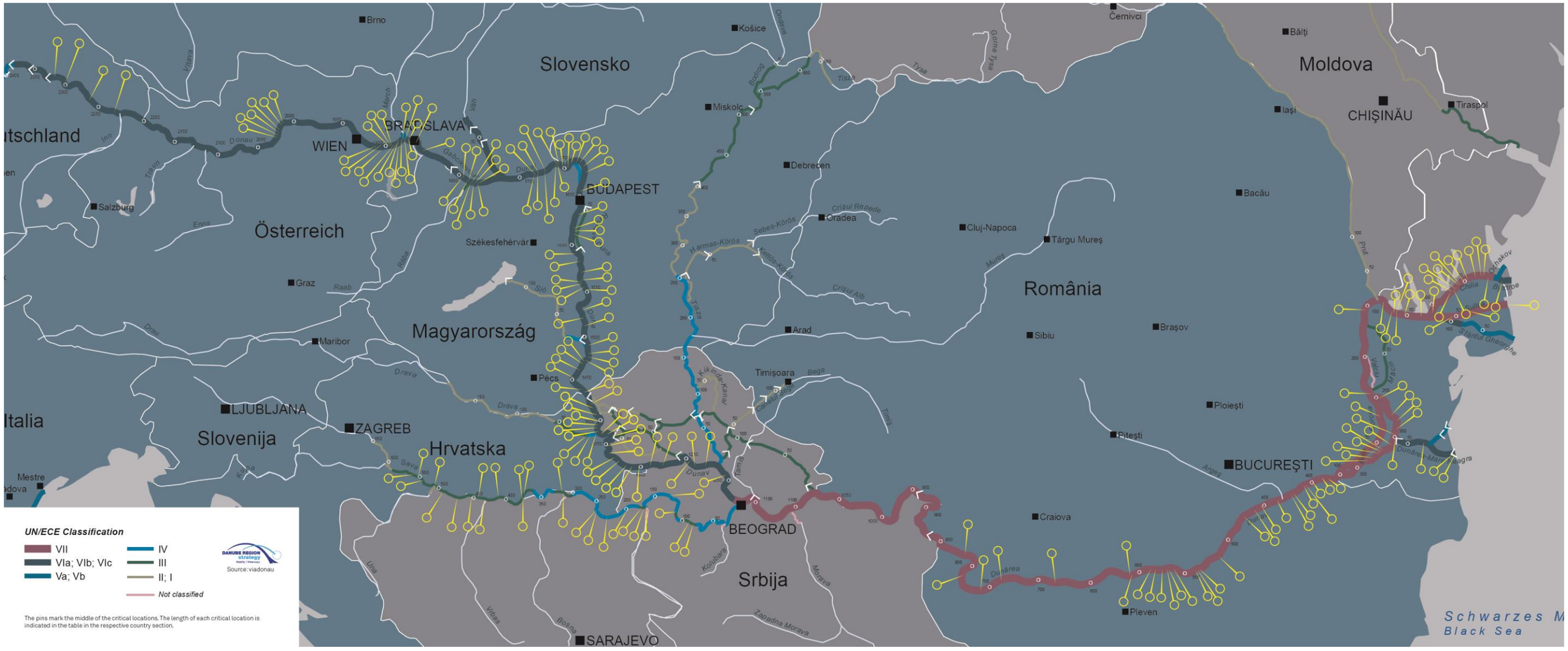
	Key issues	*Need for action*
UA 01	Maintenance of the waterway	Ensuring compliance with the international environmental conventions and bilateral agreements with Romania

UA 4.4.Information

Information on fairway depths, detected navigational hazards, performance of navigational equipment is constantly brought to the attention of skippers upon detecting changes in fairway marking.

Bringing information to skippers is performed by means of publication in the Notices to Mariners of Ukraine and transfer of navigational warnings in the NAVTEX system.

4. Overview on critical sectors on the Danube and its navigable tributaries



5. Synthesis of key issues

This Master Plan also estimates the required investment costs and operational costs per country in order to achieve the common Levels of Service, based on the circumstances of the last years. Unforeseen extreme weather events and floods require specific measures and additional budget. The waterway management authorities governing the Danube and its navigable tributaries have **estimated total costs of 93 million EUR** in order to bridge the gap between the current status quo in fairway maintenance and management and the common minimum levels of service. These involve **investment costs of 84.9 million EUR** and annual **operational costs of 8.1 million EUR**. Whereas the majority of investments are needed for **dredging equipment, riverbed surveying and fairway marking**. In terms of regional distribution, the majority of investments will be needed on the Lower Danube (particularly Romania and Bulgaria).

For the different **need areas**, the total investment and operational costs add up as follows:

Need area	One-time investment costs (EUR)	Operational costs / year (EUR)
Minimum fairway parameters (depth and width)	38.770.000	4.147.000
Surveying of the riverbed	10.943.700	1.830.200
Water level gauges	555.000	91.900
Marking of the fairway	32.791.000	1.660.010
Availability of locks / lock chambers	400.000	0
Information for users on water levels and forecasts	256.000	17.000
Information for users on fairway depths	492.000	0
Information for users on marking plans	127.000	25.000
Meteorological information for users	440.000	0
Other needs	100.000	319.200
Sum total	**84.874.700**	**8.090.310**

Important note: Costs included in the following table only relate to needs identified for routine or day-to-day waterway maintenance and management activities; costs for large-scale **river engineering projects** planned or ongoing in the various Danube riparian countries are excluded in this report, as they constitute one-time structural interventions which are co-funded by the European Union with funding rates of up to 100%. The focus of this report lies on additional efforts for routine or day-to-day fairway maintenance activities, in order to reach the common levels of service.

In a more detailed way, the tables provided on the following pages specify the identified one-time investment and annual operational costs together with an overview on total costs by need areas and Danube countries.

Investment costs

Countries / Need areas	Germany WSV	Austria viadonau	Slovakia SVP	Hungary OVF + RSOE	Croatia AVP + DHMZ	Serbia Plovput	Bosnia and Herzegovina	Romania AFDJ + ACN	Bulgaria EAEMDR	Sum total
Minimum fairway parameters (depth / width)	0	0	6.100.000	150.000	1.000.000	0	0	23.500.000	8.020.000	**38.770.000**
Surveying of the riverbed	0	0	450.000	749.700	241.000	260.000	0	5.433.000	3.810.000	**10.943.700**
Water level gauges	0	0	0	150.000	57.000	48.000	0	300.000	0	**555.000**
Marking of the fairway	0	0	1.510.000	3.187.000	3.230.000	5.075.000	300.000	10.274.000	9.215.000	**32.791.000**
Availability of locks / lock chambers	0	0	0	n/a	n/a	0	0	400.000	n/a	**400.000**
Information on water levels and forecasts	0	0	0	50.000	0	0	0	206.000	0	**256.000**
Information on fairway depths	0	0	20.000	0	60.000	0	0	400.000	12.000	**492.000**
Information on marking plans	0	n/a	0	47.000	0	0	0	80.000	0	**127.000**
Meteorological information	0	0	0	0	0	0	0	365.000	75.000	**440.000**
Other needs	0	0	0	0	0	0	0	100.000	0	**100.000**
Sum	**0**	**0**	**8.080.000**	**4.333.700**	**4.588.000**	**5.383.000**	**300.000**	**41.058.000**	**21.132.000**	**84.874.700**

Operational costs / year incl. staff costs

Countries / Need areas	Germany WSV	Austria viadonau	Slovakia SVP	Hungary OVF + RSOE	Croatia AVP + DHMZ	Serbia Plovput	Bosnia and Herzegovina	Romania AFDJ + ACN	Bulgaria EAEMDR	Sum total
Minimum fairway parameters (depth / width)	500.000	0	632.000	600.000	487.000	750.000	0	536.000	642.000	**4.147.000**
Surveying of the riverbed	460.000	0	260.000	144.000	268.000	97.200	0	1.000	600.000	**1.830.200**
Water level gauges	0	40.400	0	0	18.000	0	0	30.000	3.500	**91.900**
Marking of the fairway	0	0	610.000	17.500	652.510	360.000	0	0	20.000	**1.660.010**
Availability of locks / lock chambers	0	0	0	n/a	n/a	0	0	0	n/a	**0**
Information on water levels and forecasts	0	0	0	17.000	0	0	0	0	0	**17.000**
Information on fairway depths	0	0	0	0	0	0	0	0	0	**0**
Information on marking plans	0	n/a	0	25.000	0	0	0	0	0	**25.000**
Meteorological information	0	0	0	0	0	0	0	0	0	**0**
Other needs	0	0	0	0	0	319.200	0	0	0	**319.200**
Sum	**960.000**	**40.400**	**1.502.000**	**803.500**	**1.425.510**	**1.526.400**	**0**	**567.000**	**1.265.500**	**8.090.310**

TOTAL COSTS

Countries / Need areas	Germany WSV	Austria viadonau	Slovakia SVP	Hungary OVF + RSOE	Croatia AVP + DHMZ	Serbia Plovput	Bosnia and Herzegovina	Romania AFDJ + ACN	Bulgaria EAEMDR	Sum total
Minimum fairway parameters (depth / width)	500.000	0	6.732.000	750.000	1.487.000	750.000	0	24.036.000	8.662.000	**42.917.000**
Surveying of the riverbed	460.000	0	710.000	893.700	509.000	357.200	0	5.434.000	4.410.000	**12.773.900**
Water level gauges	0	40.400	0	150.000	75.000	48.000	0	330.000	3.500	**646.900**
Marking of the fairway	0	0	2.120.000	3.204.500	3.882.510	5.435.000	300.000	10.274.000	9.235.000	**34.451.010**
Availability of locks / lock chambers	0	0	0	n/a	n/a	0	0	400.000	n/a	**400.000**
Information on water levels and forecasts	0	0	0	67.000	0	0	0	206.000	0	**273.000**
Information on fairway depths	0	0	20.000	0	60.000	0	0	400.000	12.000	**492.000**
Information on marking plans	0	n/a	0	72.000	0	0	0	80.000	0	**152.000**
Meteorological information	0	0	0	0	0	0	0	365.000	75.000	**440.000**
Other needs	0	0	0	0	0	319.200	0	100.000	0	**419.200**
Sum	**960.000**	**40.400**	**9.582.000**	**5.137.200**	**6.013.510**	**6.909.400**	**300.000**	**41.625.000**	**22.397.500**	**92.965.010**

6. Co-funding perspectives

The political and executing authorities of the Danube riparian countries are advised to use European funds of the forthcoming programming period to tackle the needs identified in the previous chapters of this Master Plan, in parallel to continuing the maintenance activities that are already being executed now.

In the past, surveying and monitoring equipment as well as means for dredging or marking of the fairway were hardly covered by European funds. In the current programming period, the **European Structural and Investment Funds** (ESIF) as well as the **Connecting Europe Facility** (CEF) offer possibilities for financial support by the European Union related to *equipment*. Dredging *activities* as such are not eligible.

However, "*maintenance*" defined as "*technical, administrative and managerial actions including equipment for maintenance during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function*" is generally not eligible to receive co-financing from EU funds. Projects need to target "*rehabilitation*" of infrastructure, i.e. result in "*achieving the original characteristics of existing infrastructure facilities combined with the long-term improvement of its quality compared to its current state, in line with the application of the requirements and provisions of the TEN-T Regulation*" to be eligible.

In terms of rehabilitation, **ESIF** (managed by the Directorate General for Regional Policy) funds may be used for the "*acquisition of multifunction equipment/vessels*", which ensure "*complex operations including, e.g., measuring water depth, quality of the air or environmental/clean up dredging (e.g. to reduce the level of phosphorus or other polluters from water) and capital dredging*" and are embedded in "*integrated development strategies/plans*".

The **CEF** (managed by the Directorate General for Mobility and Transport) provides financial support for purchasing "*equipment for ice-breaking, hydrological services and dredging of the port and port approaches to ensure year-round navigability*". Detailed conditions are described in Regulation 1315/2013 on Union guidelines for the development of the trans-European transport network ("TEN-Regulation"), Article 14.3, as well as Regulation 1316/2013 (establishing the Connecting Europe Facility) and the respective calls for tender.

Further information on concrete funding opportunities, calls, application formalities etc. can be retrieved from the different national contact points. The national contact points are identified and listed in the online funding database operated by the PLATINA 2 consortium: http://www.naiades.info/funding/.