STUDY ON SUPPORT MEASURES FOR THE IMPLEMENTATION OF THE TEN-T CORE NETWORK RELATED TO SEA PORTS, INLAND PORTS AND INLAND WATERWAY TRANSPORT

Lot 3: Study on Good Navigation Status

Task 3 report:

Specification GNS requirements

Client Name: European Commission Directorate-General for Mobility and Transport (DG MOVE)

DISCLAIMER
This Report presents work in progress as regards the study on Good Navigation Status. The views and inputs from stakeholders are welcomed and will be duly taken into account. The report does not represent any final view, at this stage, neither from the European Commission nor from the GNS consortium

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Introduction

This report about the findings of Task 3 comprises a summary of the Task 2 results, the user's view and socio-economic arguments in one consolidated document and concludes on the requirements for GNS (Good Navigation Status). This Task 3 report will be followed-up by a specific report on the KPIs and the monitoring and reporting requirements (Task 4), based on the requirements for GNS.

The main focus of the Task 3 was to get the feedback and technical input from the professional users. This was done through expert workshops, dedicated meetings with users, several interviews and an electronic survey. Next the input was compared with the approaches and views from the waterway managers (Task 2 results) and desk research was done concerning various costs and benefits for inland waterways infrastructure measures. Subsequently conclusions were made on the requirements for Good Navigation Status that need to be taken into account.

Current GNS approaches

Main references are the CEMT classification from 1992 and the AGN from 1996. This provides a basic framework for the dimensions of waterways. However, not all EU Member States ratified the AGN agreement. In general it is concluded that there is a large variety of different targets for the draught and width of the fairway channels.

In particular the target for the draught is a topic that is up for discussion since this is not always predefined and depends into large extent on natural conditions (e.g. free flowing sections of rivers).

User requirements and socio-economic rationale

Users indicate that reaching the existing standards for the physical waterway dimensions is the key requirement. GNS shall contribute to the enforcement of agreed standards and classifications (AGN, ECMT). This is in particular the case for certain countries along the Danube and also for the Elbe and Oder which suffer from a lack of draught. In particular the draught is a critical issue for users, notably shippers, as this reduces the payload of vessels and might even make transport over these waterways impossible during longer periods in the year. As a result it raises the costs of transport by inland waterways and required lead-times of transport can noit be guaranteed to shippers. Consequently this may have a negative impact on the modal share of IWT and can cause additional external costs, because of loss of efficiency and because of cargo shifting to other modes of transport. Moreover, on some waterways, mostly canals the bridge clearance is seen as insufficient to provide competitive container transport operations.

Furthermore reliability of network (24/7) and better forecasting is desired to ensure predictable navigation which addresses the predictability of waiting times at locks and bridges and also the available water levels and information about closures. In this way the inland navigation services will become more predictable and reliable which improves the attractiveness of IWT. Reliability is in particular relevant for the waterways with significant traffic and freight volumes on the waterways, such as the Rhine basin. For these countries the basic infrastructure is available, the focus is on ensuring the high reliability and availability over time (e.g. minimising time loss due to closures because of maintenance/repair works or accidents and 24/7 operation of locks and bridges on the canal networks).

Users also request anticipating authorities undertaking long-term planning (e.g. Mosel Commission at the start) and streamlining procedures for works and authorities coordinating cross-border and 1 year in advance incl. consultation of sector on closures for repair and maintenance.

Ship-owners stress the need to provide sufficient mooring places and car-lift jetties while companies active in passenger cruise transport stress the need for proper facilities in the ports and minimum hindrance due to closures or waiting times at locks.

The users indicate that the focus shall be on the parameters of the waterway channel and providing sufficient capacity (e.g. locks). Making Cost Benefit Analyses (CBA) is seen as the main tool to find the optimum for the required physical parameters of the waterway dimensions such as the draught, height under bridges and the possible length and beam of vessels.

Requirements for GNS

One of the key observations as regards the requirements is that GNS will need a systematic approach that enables flexibility and differentiation to the specific circumstances and prioritising the most important needs of the transport sector. The setting of targets for the parameter values of waterways (e.g. the draught, height under bridges, lock capacity) will depend on a wide number of factors (e.g. type and volume of traffic, required investments, other uses of the waterway, ecological status, and the type of waterway (free-flowing, regulated river, canal, lake)). Such details can only be effectively taken into account on national/regional level.

It is therefore required to have a roll-out of a process to develop targets concerning GNS on national/regional level. This shall be done by means of a standardised approach and methodology to systematically set targets for the sections of the TEN-T inland waterways addressing topics such as the transport potential, the cost-benefits of reaching targets, the situation as regards the environmental targets and other users and the local conditions as regards the waterway sections such as the hydrology and hydro-morphology. Obviously these targets can go beyond the CEMT class IV requirements and will lead to higher standards as regards the dimensions of waterways.

It is required to make a distinction between hard components and soft components of GNS. Hard components are mainly the direct measurable characteristics of the navigation channel and lock capacities. This directly influences the navigation conditions. Examples are the physical dimensions such as the draught and height under bridges and the allowed width and length of vessels as well as the lock capacity to enable seamless and reliable transport.

One of the most relevant elements of Good Navigation Status is to ensure the reliability of the waterway. Therefore proper attention shall be paid to the issue of waterlevels and proper maintenance (e.g. dredging) as well as minimising closures of stretches and locks as result of planned or unplanned maintenance or accidents. Also targets for reliability levels can be discussed and determined on local/regional level. TENtec is the obvious instrument for the future to monitor GNS and to facilitate the discussion about setting of target for GNS indicators.

Required soft components to be taken into account address the management processes for the infrastructure (e.g. maintenance) and the traffic (e.g. information to users) as well as facilities along waterways.

1 Introduction

1.1 About this report

In 2015 the European Commission DG MOVE published the Invitation to tender N° MOVE/B3/2015-224 concerning "Study on support measures for the implementation of the TEN-T Core network related to sea ports, inland ports and inland waterway transport". The consortium coordinated by STC-Holding BV with partners STC-NESTRA, viadonau, PLANCO, Inland Navigation Europe and Vlaamse Overheid, was assigned the contract. The contract for this work was signed on 31st of December 2015 with a maximum duration of 24 months.

This report presents the results of Task 3 of the contract. This Task 3 report comprises a summary of the Task 2 results, the user's view and socio-economic arguments in one consolidated document and concludes on the requirements for GNS.

Chapter two presents the summary of the Task 2 report and therefore presents an overview of the current approaches aiming on the quality of the navigability of waterways. Next, the chapter three presents the feedback and input received from users. Chapter four presents socio-economic arguments for the components of Good Navigation Status. Finally the fifth chapter presents the requirements for Good Navigation Status.

It shall be noted that in the Task 4 report the requirements will be used as input to conclude about the Key Performance Indicators (KPIs) and the suggested monitoring and reporting requirements for Good Navigation Status. After finishing Task 4 it will be possible to conclude on the overall GNS concept. Furthermore as result of Task 7 a Good Practice manual will be developed in order to give guidance and input to the further GNS implementation process.

1.2 Objectives and approach

The objective of Task 3 is to specify the elements of Good Navigation Status to be achieved by 2030 for the various waterways in Europe. The specification shall cover requirements for rivers, canals and lakes of the TEN-T network. This concerns requirements for:

- physical infrastructure (waterway links, locks and bridges)
- operational services (e.g. in relation to locks and movable bridges)
- Information services about fairway conditions
- fairway maintenance including maintenance planning and coordination requirements;

The main focus of the Task 3 was to get the feedback and technical input from the professional users. This was done through expert workshops, dedicated meetings with users, several interviews and an electronic survey. Next the input was compared with the approaches and views from the waterway managers (Task 2 results) and research was done about various cost-benefit studies for inland waterways infrastructure. Subsequently conclusions were made on the key elements of Good Navigation Status that need to be taken into account in the GNS concept.

2 Summary GNS approaches

This chapter presents the main findings from the Task 2 of the study which presents the current approaches towards a Good Navigation Status on European Inland Waterways. The identification of these approaches is the starting point for determination of GNS requirements. Based on the extensive consultation of experts it is clear that the GNS requirements towards 2030 shall build on the existing (legal) agreements and practices and there is a need to strengthen existing frameworks and to add missing elements.

2.1 Introduction on existing transnational frameworks

The existing transnational legal framework for navigation channel-related provisions and minimum requirements is basically shaped by the **TEN-T Regulation (EU) No. 1315/2013 and the European Agreement on Main Inland Waterways of International Importance (AGN).** In addition to those transnational provisions, river commissions and national guidelines and directives are applied in certain regions and countries. This chapter gives an overview of those existing and sometimes overlapping frameworks.

In Articles 15 and 39 of the **TEN-T Regulation (EU) No 1315/2013** on Union Guidelines for the Development of the Trans-European Transport Network the minimum inland waterway infrastructure requirements for core network inland waterways are described. The Member States have to comply with these requirements by 31 December 2030. Of particular relevance for GNS are the articles 15.3 (a), where the **minimum infrastructure requirements** are explicitly set and the possibility for exemptions lined out, 15.3 (b) that calls for implementation of Good Navigation Status, 15.3 (c) that calls for implementation of RIS. The minimum requirements on draught are generally defined at 2.50m. No width requirements are formulated in the TEN-T Regulation, however a reference is made to the CEMT 92/2 classification, which in turn defines minimal length and width of TEN-T waterways (min. Class IV). Minimum bridge clearance is set at 5.25m.

In 1996, the Inland Transport Committee of the United Nations Economic Commission for Europe (UNECE) adopted the **European Agreement on Main Inland Waterways of International Importance (AGN).** The Agreement came into force in 1999. It constitutes an international legal framework for the planning of the development and maintenance of the European inland waterway network and ports of international importance. It is based on technical characteristics and operational criteria for inland waterways (specified in Annex III of the Agreement). To date, the AGN comprises 18 contracting parties (on the basis of ratification, acceptance, approval or accession). For free flowing sections 2.50m draught is required for Class IV waterways on 240 days per year. For upstream sections this minimum value should be achieved on 300 days per year. Like in the TEN-T Regulation, the minimum bridge clearance is set at 5.25m in the AGN Agreement. No width requirements are formulated in the AGN Agreement. For those countries that effectively acceeded the AGN, the provisions are binding in principle and some countries have made a reference to AGN in their national legislation. Consequences of not meeting the targets are however not monitored or defined.

2.2 Classification of waterways and their interpretation

The regulation 1315/2013 Article 15 3(a) refers in the second subparagraph to minimum height under bridges while there is in the first subparagraph a direct reference to the ECMT classification. The reference to ECMT concerns the Resolution No. 92/2 ON NEW CLASSIFICATION OF INLAND WATERWAYS [CEMT/CM(92)6/FINAL] by the Council of Ministers meeting at Athens, on 11 and 12 June 1992. It shall however be noted that for classification of waterways the ECMT recommends to make the classification based only on the horizontal dimensions for vessels (the length and width of the vessel) while the vertical dimensions (draught and height under bridges) are not applied to decide if a waterway section shall be categorised as for example class IV, V or VI. Therefore, the vertical dimensions are mainly a topic to be further investigated in the GNS study.

It shall therefore be noted that waterway sections which are classified to higher classes than CEMT IV (based on the horizontal dimensions) can have limitations as regards the minimum requirements to have 2.50 metre draught for vessels and 5.25 metre height under bridges. Moreover, it shall be noted that the article 15.3(a) and the second subparagraph prescribe these values (2.5 and 5.25) for all European waterways which are part of TEN-T, therefore also addressing higher classes of waterways (Va,Vb,VIa,VIb,VIc,VII).

The vertical dimensions are depending on the water level which can be fluctuating. ECMT 92/2 Resolution does not provide a recommendation on how to specifically deal with such water level conditions. There is however a second footnote at the ECMT table that states: "*The draught of an inland waterway must be specified with reference to local conditions*". This may be a link to water level fluctuations as well as the required safety distance between the vessel and the bottom of the navigation channel.

Moreover, in that same year 1992, the UN-ECE provided a document addressing the exact same topic: "CLASSIFICATION OF EUROPEAN INLAND WATERWAYS Resolution No. 30". This resolution was adopted by the UNECE Principal Working Party on Inland Water Transport on 12 November 1992 and became part of the AGN agreement that was signed and ratified by many countries, including many EU Member States. In this UN-ECE document it is acknowledged that it is desirable to have a unique classification of inland waterways in Europe. Therefore, it takes into account the classification table that was adopted within the European Conference of Ministers of Transport (ECMT) in June that year, which is the direct reference in Regulation 1315/2013.

The UN-ECE provides the following (additional) guidance to the ECMT table:

- The new system of classification of European inland waterways should provide for flexibility concerning the draught and bridge clearance values to be determined with due regard to local conditions
- The draught value for a particular inland waterway is to be designated according to the local conditions.
- On the waterways with fluctuating water levels, the value of the recommended draught should correspond to the draught reached or exceeded for 240 days on average per year.
- The value of recommended bridge clearance (525, 700 or 910 cm) should be ensured, even over the highest navigational level, where possible and economically reasonable.

2.3 Provisions for bridge clearance

As regards the height of bridges a safety margin has been set by ECMT at 30 centimetres for all waterway classes and takes account of the following factors:

- inaccuracies in knowledge of the actual height above waterline
- errors in reading the height scale beside the bridge
- vertical movements of the vessel due to waves or to variation in the number of revolutions and/or speed

In addition, the ECMT Resolution 92/2 makes clear in the footnote 6 that the values for height under bridges are aimed on facilitating container transport:

> *"6. Adapted for container transport:*
>
> - *5.25 metres for vessels carrying two layers of containers;*
> - *7.00 metres for vessels carrying three layers of containers;*
> - *9.10 metres for vessels carrying four layers of containers;*
>
> *50 per cent of the containers may be empty, otherwise ballast must be used."*

As regards the measurement of the minimum bridge clearance, the reference high water level is commonly applied in Europe.

2.4 Provisions for draught of the navigation channel

For the draught of a navigation channel the situation is less clear on how to approach and measure the 2.50 metres as prescribed in Regulation 1315/2013 Article 15 3(a) in the second subparagraph. The draught of the vessel is not measured by the waterway administrations; they can measure the depth of the navigation channel and maintain the targets for the minimum depth of the channel. In order to transfer required draught of a vessel to required fairway depth of the navigation channel, a value is needed. However, there is no fixed value between the draught of the vessel and the required depth of the navigation channel. This value is specific for the waterway section in question and depends on local conditions. For example a rocky river bed requires more safety distance compared to river bed existing of sand. Therefore distinctions shall be made as regards the required keel clearance - the safety distance between vessel (including squat) and bottom of the fairway channel -taking into account the type of bed of the cross section of the waterway (e.g. sand vs rock). Consulted experts indicate that this may differ between 0 and 50 cm. This safety distance value (keel clearance) needs to be specified by the waterway manager who has the know-how and data to make a solid judgement in relation to safety of navigation.

Moreover, water levels are subject to changes due to influences of nature, which is especially relevant for free-flowing rivers. Thus, planning and monitoring of measures on waterways can only be done based on a stable reference water level, which is a statistical value based on a longer period of time, for example the values measured during the past 10 to 30 years.

It shall be noted that there are different regimes in place as regards the reference low water level. On the Rhine distributaries, the water level is measured relative to the agreed low river discharge

(OLR/GIW20), a level that is not exceeded on 20 days on which the temperature is above zero, and thus occurs approximately 5% of the time.

On the Danube a similar statistical value is used, the so called RNW. This is the low navigable water level (LNWL) = the water level reached or exceeded at a Danube water gauge on an average of 94% of days in a year (i.e. on 343 days) over a reference period of several decades, usually 30 years.

There are other reference values applied for free-flowing rivers. At the river Oder for example a reference water level (EMW) is applied, which is based on the design discharges (m3/s). The target water levels refer to the exceedance of design water discharges with a probability of 80% (292 days) respectively 90% (328 days). Another example of lower targets for the number of days compared to Rhine and Danube regimes is the Po in Italy (section Cremona-Casalmaggiore) where 300 days is the target for the future is to reach the draught of 2.5 metres and currently the draught of 2.5 metres is ensured during 250 days per year. Moreover, it shall be noted that for inland waterways close to the sea, there is a tidal influence due to the fluctuation of the sea level.

2.5 Institutionalised river basin management and national fairway targets

In addition to the AGN and the TEN-T Regulation, for some river basins well institutionalised transnational coordination systems as regards waterway management and development exist (notably on the Rhine, Danube, Moselle, Meuse, and Sava). However, it needs to be remarked that the governance systems are quite heterogeneous (e.g. some have direct regulatory powers, some provide recommendations and guidelines).

On a national level, sometimes the provisions of the AGN or the provisions of the applicable river commission are transposed into national law.

The table on the next page present summary of key characteristics of these different river-basin governance systems across various European countries. Subsequently the following table presents the basic fairway-related regulations in all European countries with TEN-T inland waterways as well as some third countries (Bosnia & Herzegovina, Serbia, Ukraine).

River basins	international River Commission	Legal status of provisions	Minimum fairway requirements (navigation channel; varying for different local conditions) – lowest value identified in official provisions/guidelines			
			Depth	*Width*	*Height*	*Temporal availability (days per year)*
Danube	Danube Commission	Recommendations	2.50m draught	50-180m	6.40-10.00m	343
Moselle	Moselle Commission	Binding	3.00m fairway depth (regulated sections)	40m	6.00m	365
Rhine	Central Commission for the Navigation on the Rhine	Binding	1.90-3.00m fairway depth	88-150m	7.00-9.10m	345
Sava	International Sava River Basin Commission	Binding	2.50m draught (up to 2.80m) for class IV sections	55m	7.00m	343
Elbe	-	not applicable	for free-flowing section Geesthacht – CZ: DE: 1.5m – 1.6m navigation channel depth; CZ: 1.9 m navigation channel depth of free-flowing section; 2.2 m draught of regulated section	not specified	not specified	-
Meuse	International Meuse Commission	recommendations	2.50m draught	not specified	5.25m	-
Oder	-	not applicable	Target for border section: 1.80 m navigation channel depth (90% respectively 80% availability); Klützer Querfahrt: 3.00 m navigation channel depth;	not specified	not specified	-
Scheldt	International Scheldt Commission	recommendations	2.50m draught	not specified	5.25m	-

(*empty fields means: not specified or no generally applicable target value identified or defined*)

Countries	AGN applicable (ratified, approved acceded or accepted)	EU Regulation No. 1305/2013 applicable	**Targets for hard GNS factors as laid down in national law or formalised waterway design guidelines for Waterway Class IV** **Lowest value identified in official provisions/guidelines:** For countries with more than one waterway and different conditions varying targets apply.	
			Depth	Height
Belgium			2.50m draught	5.25m
Germany			2.80m draught (canals) Varying for rivers: strategic objective is to achieve at least 2.8 m and two-lane traffic for the main waterways. However, local restrictions may apply.	5.25m (canals) Varying for rivers
Netherlands			Varying for rivers: strategic objective is to achieve at least 3.00m draught	7.00m
Austria			2.50m draught on 300 days p.a.	5.25m
Bosnia & Herzegovina				
Bulgaria				
Croatia			2.50m draught on 240 days p.a.	
Czech Republic			varying (water-level dependent) depending on waterway section	varying depending on waterway
Finland			Authorised vessel draught depending on waterway	Authorised vessel height depending on waterway
France			2.50-4..00m draught targets (Class VIb) for Seine-Scheldt and Rhone	
Hungary			2.70m fairway depth in loose river bed 2.80m fairway depth in rocky river bed	
Italy				
Lithuania			varying depending on waterway	varying depending on waterway
Poland			varying depending on	varying depending on

Countries	AGN applicable (ratified, approved acceded or accepted)	EU Regulation No. 1305/2013 applicable	Targets for hard GNS factors **as laid down in national law or formalised waterway design guidelines for Waterway Class IV** **Lowest value identified in official provisions/guidelines:** For countries with more than one waterway and different conditions varying targets apply.	
			Depth	Height
			waterway	waterway
Portugal				
Romania			2.50m draught on 240 days p.a.	
Serbia			2.50m draught on 240 days p.a.	
Slovakia			2.50m draught on 300 days p.a.	5.25m
Spain			2.50m draught	5.25m
Sweden			National regulation determines varying targets depending on waterway	National regulation determines varying targets depending on waterway
Ukraine			2.50m draught on 240 days p.a.	

For countries with more than one waterway and different conditions varying targets apply.

The most relevant GNS value of fairway depth and/or draught encountered most often in the national regulations or formalised design guidelines for Class IV waterways is 2.50m. This value is sometimes used as an absolute figure, sometimes related to the water levels and statistical discharge figures. This is mainly determined by the waterway type at hand (free-flowing, regulated, canal). These target values are then for instance formulated as “2.50m draught at Low Navigable Water Level” or “2.50m draught on at least 300 days per year”.

The most common bridge clearance level encountered is 5.25m over high navigable water level. Explicit or absolute figures and targets for waterway width are not defined very often, as they depend on local conditions. Fairway width targets are for instance provided by the Danube Commission for 4 different sections of the Danube (ranging from 50 to 180m for the Upper and Lower Danube respectively). Likewise the Commission for the Navigation of the Rhine issued a waterway profile with 4 different width values for the different sections of the Rhine.

The main conclusions to be drawn from the analysis contained in the Task 2 report are following:

- The focus should not be on the definition of new target values for fairway related parameters. There are already sufficient international agreements or national guidelines which ultimately aim at achieving roughly the same targets. The focus should be on defining ways, methods and approaches to achieve the already defined targets.

- The GNS concept cannot be a one-size-fits-all approach, as local and natural conditions have a strong impact on how realistic certain target values can be. In order to cope with these regional differentiations, target values should generally always be linked to the type of waterway (canal, regulated, free-flowing), the discharge regime and local reference water levels.

3 Transport user's views on the needs as regards inland waterways

The views of the transport users have been collected by means of the following ways:

- Responses on the survey carried out in May 2016 concerning the GNS concept
- Pan-European expert group meeting in Rotterdam in June 2016 (TEN-T days)
- Individual meetings and interviews with experts from representing organisations
- Participation of representatives from users at regional GNS workshops (Klaipeda, Budapest, Strasbourg, Berlin in September/October 2016)
- Dedicated workshop on 13th of October with experts representing users
- A specific session at the meeting of the members of the skippers association royal Dutch Schuttevaer International on 17th of December 2016

3.1 Major expectations from users towards easy-to-use navigation

From the consultation it was concluded that the most important requirements for users as regards Good Navigation Status are expected:

- **reaching the existing standards for the physical waterway dimensions**. GNS shall contribute to the **enforcement of agreed standards** and classifications (AGN, ECMT). This is in particular the case for certain countries along the Danube and also for the Elbe and Oder which suffer from a lack of draught for navigation. In particular the draught is a critical issue for users, notably the shippers as this reduces the reliability and raises the costs of transport by inland waterways.

- **reliability of network** (24/7) and better forecasting is desired to ensure predictable navigation which addresses the predictability of waiting times at locks and bridges and also the available water levels and information about closures.

- anticipating authorities undertaking **long-term planning** (e.g. Mosel Commission at the start) and **streamlining procedures for works** and authorities **coordinating cross-border** and 1 year in advance incl. **consultation of sector** on closures for repair and maintenance

- ship-owner/operators stress the need to provide sufficient mooring places and car-lift jetties while companies active in passenger cruise transport stress the need for proper facilities in ports and the requirement to have minimum hindrance from waiting times at locks and closures.

The users indicate that the focus shall be on the parameters of the waterway channel and providing sufficient capacity (e.g. locks). Making Cost Benefit Analyses (CBA) is seen as the main tool to find the optimum for the required physical parameters of the waterway dimensions such as the draught, height under bridges and the possible length and beam of vessels. First priority is to have the basic inland waterway infrastructure available, notably the required draught of the navigation channels and sufficient bridge height to allow efficient navigation operations. The dimensions shall be ensured by means of monitoring, financing and enforcement. A next step is the accelerated harmonization of RIS to further optimise the use of waterways and the efficiency and productivity of transport operations.

3.1.1 Need for differentiation between types of transport

It needs to be remarked that the requirements will depend on the type of transport and the commodity. In 'traditional markets' for large scale transport of bulk products the transport ,in most cases, takes place between origins and destinations which are directly located along waterways. In these markets the total transport costs are primarily the costs for the vessel. An example of such a market is transport demand for coal and ore transport from the seaport to power plant or steel plant located directly at a canal or river. Infrastructure characteristics and the traffic management have, comparatively, the highest impact in precisely these types of markets. Good maintenance of the waterway network (e.g. dredging) is extremely important for heavy bulk products because the fairway depth determines the maximum load factor of vessels and therefore the costprice per ton for the operation. This again could influence the transport price and the modal share of IWT. In particular during dry/low water periods the impacts of backlogs in maintenance become very clear. The final consequences could be very serious; e.g. the higher transport prices can result in loss of market share of IWT. Moreover at low water conditions, higher levels of fuel consumption are required to attain the same transport speed (due to higher resistance). Well maintained waterways are therefore not only important for enabling the economic efficiency of transport but also for the fuel consumption and the environmental performance of transport.

In particular the reliability of transport is a decisive factor for the modal choice. Reliability is of course impaired when waterways become temporarily partly or completely unavailable for transport. However, in the context of modal choice the factor of reliability usually has a broader meaning for customers. Most customers do not just want reliable arrival/departure of the goods but also appreciate reliable transport prices, preferably fixed prices in order to know beforehand the share of transport costs in their overall production costs. In the worst case low water periods could, temporarily, make a waterway partly or completely inaccessible for vessels. Low water periods increase the risks of grounding of vessels in particular and accidents in general. Depending on the circumstances, both the grounding and other types of accident could lead to the situation that there is a closure of the waterway section. These risks therefore directly affect the reliability of IWT as a transport mode in the corridor in which the waterway is located. Furthermore, due to the impact of the water level on the capacity of vessels, customers often have to cope with fluctuating transport prices in periods with rapidly changing water levels. These periods occur on average a few times per year. Lack of waterway maintenance could aggravate this situation and could make transport prices much more volatile.

For less traditional markets, e.g. intermodal chains, the situation is different. The share of the costs for operating a container vessel within the overall transport chain costs (door-to-door) is usually much smaller than in bulk markets. The reason is that much more frequently clients are not directly located at waterways and transhipment to other modes or storage areas is needed. As a result in this type of door-to-door transport the costs for pre- end haulage and transhipment at terminals are mainly critical for the competitiveness of intermodal chains using IWT. However, as there is a need to plan the processes linked to the inland waterway transport, it is very important to have a reliable and predictable barge service. For container transport there is in particular the issue of the bridge height. Through CBAs, authorities could focus on economically most important areas for container transport. Users indicate that the CEMT requirements (Resolution 92/2) are outdated in view of the growing share of high-cube containers which require higher bridge clearances. Moreover, transporting with at least 3 layers should be possible to make it more attractive and competitive and a real alternative for direct road haulage and intermodal chains using rail transport.

3.1.2 Need for differentiation between waterways

Users indicate that there needs to be a strong differentiation according to the characteristics of the waterways. The sector considers a 365 days obligation for the TEN-T requirements as regards 2.50 metres draught unrealistic, even for a number of canals. Fairway dimensions should be linked to the characteristics of the waterway. For free flowing rivers, groynes are helpful and best practices shall be applied as much as possible. The approach for the Rhine (Rhine Profile) is seen as a good practice by the users.

As regards the exemptions for 2.50 meter draught it was remarked to take into account the required width of the navigation channel for which the 2.5 draught. It makes a big difference if the vessel is 6 meters in beam or 17 meters in beam.

Some experts representing users believe that climate change effects could already be visible in more abrupt variations of water levels for the free-flowing sections of the network. This requires more anticipating authorities on these type of waterways with attention for longer forecast (preferably 10 days) and accelerated diversion of flood water to retentions basins in case of high water and to discharge basis in case of low water situations. Such approaches to mitigate the extreme water levels in free flowing sections shall be further explored.

3.1.3 Corridor management, locks and user involvement

As regards locks it is believed that a proper problem analysis precedes corridor management. Working with slots for lock passage can push the problem down the chain while the entire route is of importance and should be linked to capacity and intensity. The performance of individual locks needs to be analysed and optimized from a corridor perspective, also in view of the high capital cost to expand physical lock capacity. It is important to detect patterns of delays and incidents to ensure reliability before organizing the spread of traffic. This information is important to reduce waiting times and to be able to have a reliable Estimated Time of Arrival (ETA). Lock management also includes timely and regular maintenance to prevent breakdowns. A good example indicated by users is the lock maintenance along the Main and Mosel where the locks are out of service for about 8 days in a row but the locks prove to be very reliable during the rest of the year.

For the reliability of the network it is paramount to inform and consult the sector on annual closures for repair and maintenance. Closures shall be coordinated cross-border to avoid supply chain disruptions. The consulted experts representing the users propose to replicate the good practice of 1 year in advance information and consultation for the Mosel.

Concertation between the waterway managers and the waterway users should take place twice a year according to the experts representing users. They see the “COV process” in the Netherlands as a good practice and similar processes involving users, engineers and waterway managers shall be applied in other countries as well and for cross-border waterways within corridors. There are concertation efforts in other countries as well, e.g. chomage in Germany and France for the locks on the upper Rhine (installed after persistent complaining by the sector). In most of the EU Member

States the transport users are usually consulted about the infrastructure plans in a transparent manner. However, in some countries the situation is quite problematic (e.g. Hungary was mentioned). Furthermore, the outcome of such planning processes is not always satisfactory for the IWT sector (e.g. the impact of strict prioritization in the German Bundesverkehrswegeplan is not appreciated by the sector).

Moreover, in case there are ad hoc incidents (e.g. accidents or unplanned repair/maintenance works) possible related closures shall be swiftly communicated through the entire international corridor via traffic centres and not just locally.

3.2 Specific viewpoints of user groups

3.2.1 Shippers

Shippers in particular are sensitive to the reliability and costs of inland waterway transport. If costs are becoming too high, they will shift the transport to other modes of transport or make changes in their location of production or sourcing of materials. Therefore, the shippers / freight forwarders have a strong influence on the transport performance (tonkilometres) and the modal split of inland waterways.

Shippers acknowledge that maintenance of waterways and locks are indispensable but should cause minimal economic damage to business. This can be achieved in their view by:

- better coordination between waterway authorities (e.g. to prevent simultaneous works on parallel or alternative routes)
- a transparent planning of the works with recognition of the economic interests of stakeholders that depend on IWT services
- consultation of all involved stakeholders

Maintenance of waterways and locks are indispensable but often depend on the available budget of the respective waterway manager. Some in Europe waterways have poor maintenance because of lacking budgets. Therefore trade and industry (shippers) and transport carriers are lobbying for more budgets to be allocated to waterway maintenance at national and regional administrations in order to support the actual performing of the works for maintenance and repairs.

Furthermore, in some cases maintenance works can entail the reduction of the passage for barges, or even a complete closure of a waterway. In a worst case this occurs for a longer period of time. Such situation cause economic damage for businesses. Though some financial damage must be accepted, for minimalizing this damage shippers recommend to notify and consult the planning of (protracted) maintenance works with the concerned shippers and transport service providers in advance e.g. through the associations representing the shippers.

Recognising the economic interests of the stakeholders at sector level that depend on IWT services choosing the right period of a year for the maintenance work is of importance for minimalizing the economic damage (including loss of business) for all involved stakeholders. Shippers recommend timely consultation, such as at least 12 months in advance, of these stakeholders to inform them about the maintenance works, impact for the use of the waterway and determining the period for the works that is acceptable for all.

A timely consultation will enable shippers and transport service providers to find alternate solutions and discuss the most suitable planning of the works with the waterway manager. Part of these discussions could also be the assessment of suitable alternative waterway routes. Of course, these alternative routes must be usable and thus simultaneous maintenance works in the routes must be prevented. Therefore, if alternative routes would encompass waterways of other managers, it is strongly recommended to have a mutual consultation between the relevant waterway managers.

Moreover, unforeseen incidents (i.e. leading to collateral damage, traffic congestion, closures lasting longer than 12hrs) of course leave no time for intensive consultation of all stakeholders. However, for facilitating the quick taking of appropriate measures it is recommended to prepare scripts, in particular to accelerate the lifting of a (partial) closure. These scripts should be at least available for 'weak spots' on crucial waterway corridors (e.g. many transports on barges for big companies without suitable alternative routes or alternative modes of transport).

As regards the operation of locks and bridges it is clear that limited operation can cause higher transport costs (excessive waiting times, longer round trips resulting in the need for more ships etc.). Users indicate that problems get serious when 24/7 operations, of business that depend on continuous supply and delivery of goods, are hampered. The impact will depend on the economic activity around the relevant waterway and therefore a differentiation needs to be made, taking into account the costs to provide 24/7 services and the related socio-economic benefits of such regimes. It needs to be explored on regional level into what extent industries and terminals can benefit from 24/7 operations (if not yet available). Furthermore, it was stressed that having reliable ETAs is of key interest for the shippers in order to allow them to plan the linked processes to the transport very efficient to ensure a swift supply chain and high utilisation of production plants and to reduce storage costs.

3.2.2 Freight shipping lines and ship-owner/operators

For the users of the waterways the conditio sine qua to guarantee their services remains a properly maintained network of waterways without bottlenecks.

According to the users the core of the GNS would be:

- the availability of physical infrastructure(access of vessels to waterways)
- waterway management plans
- capacity issues

These mentioned elements are a precondition to guarantee a safe, secure, cost- and time efficient transport for its users. Ship owner/operators mention also in particular the need for sufficient mooring places and car lift facilities. It was suggested to have at least at each 30 kilometres of the waterway a mooring place with a car lift facility. From the side of the experts representing skippers it was stressed that ensuring the quality and capacity of mooring places and car-lift facilities shall be included in the GNS requirements. This shall be seen in view of the growth of waterway traffic as well as safety requirements in case of incidents. With the growing share of 24/7 operation of vessels, there is an increasing need to change the crew on board of vessels which requires car-lift facilities for transporting the mobile workers between their homes and the location of the vessel.

It was also seen by ship-owners that an availability of 2.5 metre draught on 365 days per year is not feasible because of the free-flowing sections in the waterway network. Furthermore, while it might be technically feasible to build more (costly) locks and dams to regulate the water level, the locks also limit the capacity of the waterway and cause waiting times, which is not favourable either.

As regards the required keel clearance for the vessel the ship-owner/operators indicate that the minimum shall be 30 centimetres, but for safe navigation 50 centimetres is preferred. In the end the ship-owners decide for themselves how much cargo is taken on board and what the maximum draught of the vessel can be. For that reason the information about forecasted water levels is seen as very important.

Concerning the required bridge clearance it was indicated that for modern container transport with high-cube containers the target should be 9.10 metres for 3 layer transport and for 4 layers 12 metres. An issue is the way how the actual bridge clearance is indicated. This differs country by country; a more harmonised way is desired to avoid accidents. Furthermore, it is not always known to the ship-owner/operator how much safety distance is actually taken into account. An issue to further implement as regards locks and bridges is the service times for smaller locks and bridges. There is no need to have personnel on location, the handling of the lock/bridge can also be done from centralised traffic centres which are manned 24/7.

Although the ship-owners indicate that sufficient draught is crucial for the reliability of inland navigation, it shall be noted that low draught is not always seen as a problem by ship-owner/operators. Because of the low-water surcharge and the need for more vessels to transport the same amount of cargo during low-water periods, there is usually a big turnover, high prices paid on the spot market for barge services and consequently there are big profits for ship-owners. However, on long term, such high costs may give shippers reason to reduce demand for transport by inland waterways.

A specific issue addressed by the users is the lack of enforcement of the agreed standards and parameters for the waterway dimensions, in particular as regards the draught in relation to maintenance efforts. The main concern about poor maintenance in relation to draught is that larger vessels cannot navigate anymore on certain links of the waterway (e.g. free flowing sections on the Danube) which leads to a loss of revenue and poor reliability of the transport services by inland waterways. However, similar concerns exist as regards the poor maintenance of locks or bridges that may have break-downs which may result in reduced capacity (longer wiaitng times) or even closures of waterway links until the lock or bridge is repaired.

As regards the closures for repair and maintenance it was indicated by ship-owners that they rather have a longer duration of a closure (e.g. 10 days) for preventative maintenance which is announced a long time in advance, rather than shorter ad-hoc maintenance works that come as a surprise.

Apart from this also the facilities along the waterways and ports, the information to the users and certainly the administrative processes in relation to efficiency of inland waterway transport are considered of high importance to the transport and shipping industry.

3.2.3 Passenger transport

Passenger transport is an important economic activity in many regions, in particular the cruise industry as this creates leisure and tourism industry for cities and areas located along waterways.

The draught is a bit less relevant compared to freight transport vessels, since the draught of a passenger cruise vessel is limited to about 1.5 - 1.7 metres, which is much lower compared to the average freight vessel. However, it is obvious that sufficient draught shall be provided to allow the vessel to navigate safely. For the passenger transport more relevant is the height under bridges, this may be an issue because passenger cruise vessels can have a height of 6.5 metres.

Also relevant for the passengers is to have reliable transport and arrival times, in order to plan subsequent activities, such as excursions to cities. While the crew on the vessel can manage speed of the vessel and therefore the travel time on links, an external factor is the waiting time at locks. For this reason the lock waiting times, and in particular the reliability, are critical issues for operators of passenger cruise vessels. Of key relevance is therefore to know in advance when delays are expected at locks, e.g. in case of planned maintenance works. Similar to the freight barging industry, the companies active in passenger cruise transport would like to be involved in the planning process of such maintenance works, in order to be able to anticipate in due time.

Since the passenger cruise industry is mainly active in the summer period (March – October) it is therefore suggested to avoid planned maintenance during this time of the year in order to avoid hindrance.

Furthermore the facilities in ports are important for the passenger cruise vessels. The quays shall have sufficient capacity to provide safe and direct access for passengers to connecting modes such as taxis and touring cars. Another relevant item is to have sufficient capacity of waste reception facilities in the ports.

4 Socio-economics of as regards waterway dimensions and capacity issues

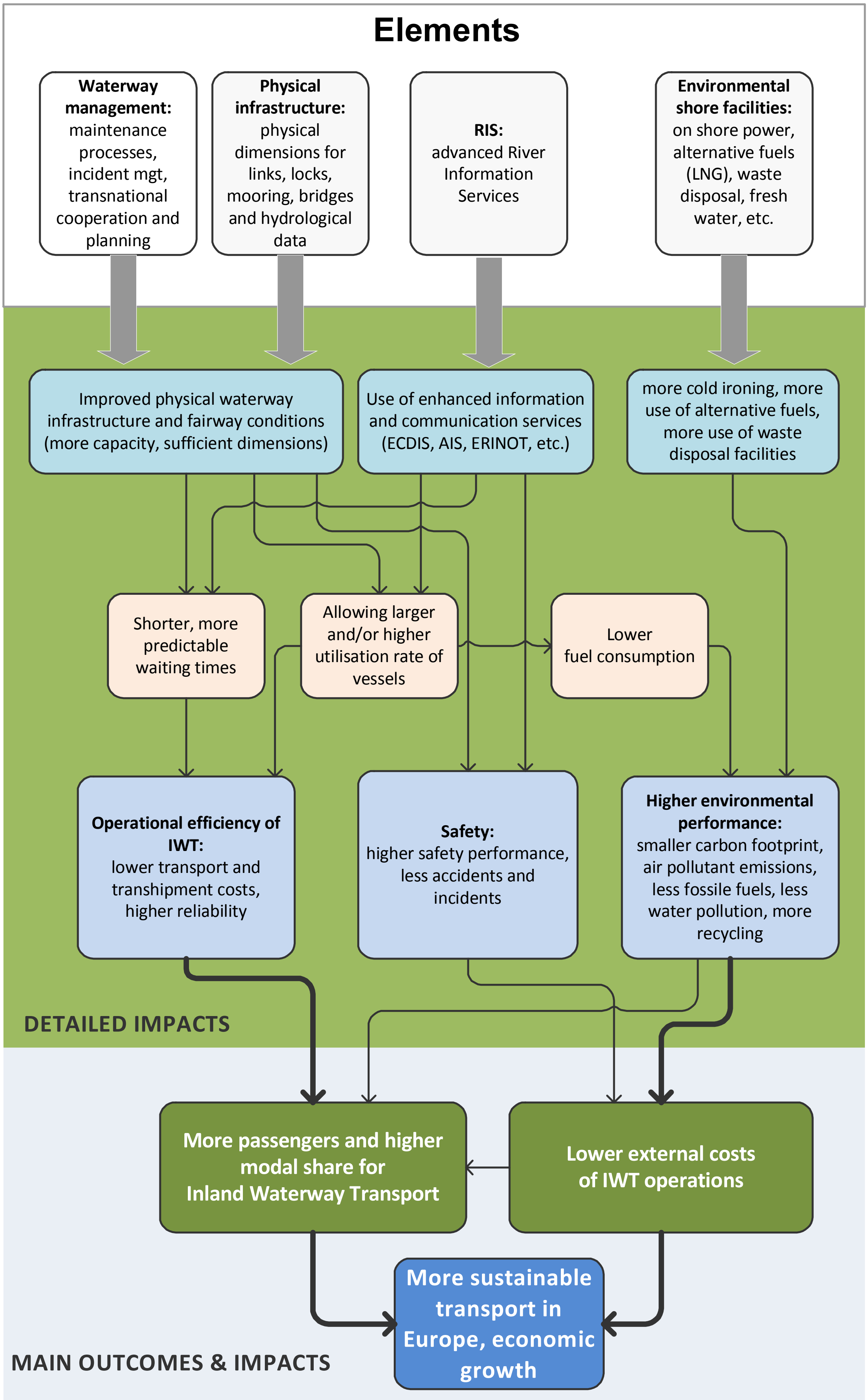
The proposed GNS requirements need to have a rationale based on the benefits from the viewpoint of the society. For this reason Cost Benefit Analyses are usually made to decide upon the targets and measures to improve the navigation conditions of the waterway in question. Furthermore assessments (e.g. Impact Assessments) provide the grounds for transport policy, e.g. the aim to increase modal share of inland waterway transport and to reduce the external costs.

4.1 Socio-economic rationale for improved waterway infrastructure

For the IWT industry, the infrastructure is one of the critical production factors in the supply of transport services (besides the vessel and the crew). Only with sufficient size and fairway depth of waterways the companies can benefit from scale effects of operations. The existence of waterway connections as such, the physical characteristics of the waterway network and traffic management of waterways are therefore determining factors in the reliability and costs of transport.

Given this dependence, the infrastructure conditions directly determine the competitiveness and modal share of IWT. Moreover, traffic management and the physical characteristics of waterways are also determining factors for the fuel consumption of vessels (energy efficiency) and safe navigation. They thus influence the environmental performance and external costs of IWT.

The above logic is presented in the next figure.


Elements
Waterway management: maintenance processes, incident mgt, transnational cooperation and planning
Physical infrastructure: physical dimensions for links, locks, mooring, bridges and hydrological data
RIS: advanced River Information Services
Environmental shore facilities: on shore power, alternative fuels (LNG), waste disposal, fresh water, etc.
Improved physical waterway infrastructure and fairway conditions (more capacity, sufficient dimensions)
Use of enhanced information and communication services (ECDIS, AIS, ERINOT, etc.)
more cold ironing, more use of alternative fuels, more use of waste disposal facilities
Shorter, more predictable waiting times
Allowing larger and/or higher utilisation rate of vessels
Lower fuel consumption
Operational efficiency of IWT: lower transport and transhipment costs, higher reliability
Safety: higher safety performance, less accidents and incidents
Higher environmental performance: smaller carbon footprint, air pollutant emissions, less fossil fuels, less water pollution, more recycling
DETAILED IMPACTS
More passengers and higher modal share for Inland Waterway Transport
Lower external costs of IWT operations
More sustainable transport in Europe, economic growth
MAIN OUTCOMES & IMPACTS

Since the draught, bridge clearance and locks are seen as key elements for a good navigation status a general explanation is provided in the next paragraphs.

4.1.1 Limited draught of the waterway

In general the removal of draught limitations by means of dredging provides substantial benefits to the society. There is a direct impact on the transport efficiency as more cargo can be carried with the same vessel. Each additional centimetre counts. As a result of dredging, not only the transport costs reduce but also the environmental performance of navigation improves significantly. The socio economic cost-benefit ratio for such investments is therefore usually rather positive. However the ratio depends on the transport intensity and required investments for dredging which depends on local conditions. Specific knowledge of the circumstances and the local transport characteristics (e.g. freight flows, transport costs, ecological status, required investments) is needed to judge the profitability for society. Therefore, it is recommended to decide about the most appropriate draught level on a national/regional level taking into account the specifics of the waterway and the traffic and transport demand (including forecasts).

In particular markets with transport operations that fully utilise the available fairway depth will have benefits. Examples of these types of markets are: the transports of ores, coal, sand & gravel as well as liquid cargo. Container transport is usually less affected by a lack of draught (the cargo is less heavy). Furthermore, if there is a problem with lack of draught in only a small part of the entire corridor it will be, comparatively, very cost effective to remove that particular barrier.

4.1.2 Limited bridge clearance

The cost-benefit ratio will depend to a large extent on the size of the container transport intensity as well as the options and the costs to heighten the bridge. For bulk transport bridge clearance is not an issue. After increasing the bridge clearance it could become possible to add another layer of containers, for example:

- an increase from 2 to 3 tiers of containers per vessel, thus increasing the maximum payload for a standard 86 metre container vessel from 60 to 90 TEU
- an increase from 3 to 4 tiers per vessel, thus increasing the maximum payload from 156 TEU to 208 TEU for a standard 110 metre container vessel.

The transport costs per TEU for the container vessel could then decrease with approximately 20%. It has to be noted however that in intermodal chains the share of cost required for the vessel is usually modest in the overall port-to-door or door-to-door chain as there are also relatively high costs for transhipment and pre-end haulage operations. Therefore, for those stretches that are very important for hinterland transport of containers to/from seaports such investments to increase bridge clearance could have a positive cost-benefit ratio.

4.1.3 Limited lock capacity and/or dimensions

Locks can be a bottleneck in two ways:

- Lack of capacity resulting in waiting times for vessels which are hard to predict,
- Too small dimensions, limiting the access to waterways for larger vessels.

The construction and/or expansion of locks are relatively costly compared to other types of infrastructure measures such as dredging or the increase of bridge clearance. Whether or not a project regarding locks has a favourable cost-benefit ratio depends highly on the specific circumstances. One of the indicators is the Intensity/Capacity ratio of the lock (I/C). If the I/C ratio becomes high (e.g. 0.8 or 0.9) there will be longer waiting times for vessels and therefore the costs of transport will increase resulting in loss of modal share and higher costs for shippers and consumers. In the Netherlands it turned out that for the replacement of locks an I/C ratio between 0.6 to 0.8 is needed in order to have a positive cost-benefit ratio in order to reduce waiting times for vessels. The redundancy of lock chambers and other infrastructure objects reduce the risk of closures. This strengthens the reliability and the position of inland waterway transport in intermodal competition.

Locks can also be the major components in a corridor to upgrade in order to allow access for larger vessels. For example there are projects to upgrade the waterway class from CEMT class II or III to class IV or V by means of expanding the lock dimensions. Often a completely new locks need to be constructed along the respective corridor. The question whether or not to invest in upgrading of locks and waterways is rather complex. Detailed and extensive studies are needed to identify and determine various costs and benefits in relation to transport demand.

4.2 Arguments derived from the German Federal Transport Infrastructure plan 2030

One of the most recent plans addressing the socio-economic arguments for governmental expenses in the inland waterway network is the German Federal Transport Infrastructure plan 2030. Furthermore since Germany is the country with the highest transport performance of IWT and it has both canals and rivers, the recent infrastructure policy plan was reviewed as regards the socio-economic arguments behind the decisions.

The proposed projects address in particular the extension of waterway and lock dimensions to allow navigation with larger vessels and higher draughts. The upgrade of capacities and redundancy of locks are other project objectives. All these measures aim to improve the competitiveness of inland waterway transport.

The political selection of projects is based on a socioeconomic benefit-cost-analysis. The methodology of the analysis addresses the reduction of transport cost and external cost of inland waterway transport as key benefits. Transport cost influences the competitive position, which is reflected in the traffic forecast for 2030. The project evaluation of priority projects selected for the

German Transport Infrastructure Plan 2030 shows the high impact of increased waterway parameters on transport cost and external cost of inland waterway transport.[1]

4.2.1 Increasing draught of the fairway

Projects solely aiming to increase the vessel draught show a high feasibility related to substantial cost reductions and rather low investment cost. Examples include the increasing of navigation channel depth at the Middle Rhine River with investment cost of 60.0 mil. € and a cost-benefit-ratio of 30.7 as well as at the Lower Main River with investment cost of 28 mil. € and a cost-benefit-ratio of 27.6. According to the project evaluation the increase of the navigation channel depth between St. Goar and Wiesbaden from 1.9 m to 2.1 m leads to transport cost savings of 28.7 mil. € per year. External cost savings related to improved fuel economy amount to 5.1 mil. € per year. The upgrade would reduce the restrictions at this bottleneck, which limits the payload for a wide range of routes running through this section and other waterways with higher draughts. The deepening of the Main River to increase vessel draught from 2.9 m to 3.1 m between the Mouth of the Rhine and Aschaffenburg leads to transport cost savings of 11.4 mil. € per year. Emission reduction yields external cost savings of 2.2 mil. € per year.

The evaluation of the deepening of the Danube River between Straubing and Vilshofen shows a benefit-cost-ratio of 2.6. The extension of the draught at RNW from 1.6 m to 1.8 m is planned. The upgrade of this bottleneck will generate transport cost savings of 9.9 mil € per year and external cost savings of 0.6 mil. € per year. Investment cost amounts to 255 mil. € excluding maintenance and replacement investment covered by the project.

The benefit-cost-ratio of the planned deepening of the navigation channel at the Lower Rhine is 2.1. The upgrade of the navigation channel depth between Duisburg and Stürzelberg from 2.5 m to 2.7 m respectively 2.8 m generates transport cost savings of 3.3 mil. € per year. The external cost savings are calculated with 1.1 mil. € per year.

4.2.2 Combined upgrade of waterways and locks

A number of priority projects selected for the German Federal Transport Infrastructure Plan does address waterway and lock dimensions in a coordinated way to improve navigation conditions. The investment cost for the upgrade of the Datteln-Hamm-Kanal for navigation of vessels with a length of 135 m and with a draught of 2.8 m is calculated with 156 mil. € excluding maintenance and replacement investment. The upgrade is a substantial improvement compared with the limitation to 85 m vessel length and a maximum draught of 2.5 m. Higher payloads and the reduction of waiting times through improvement of passing conditions for vessels at the one-way section generate transport cost savings of 11.8 mil. € and external cost savings of 0.8 mil. €. This yields a benefit-cost-ratio of 3.5. A coordinated upgrade of waterway and lock dimensions is also planned for other sections in the canal network.

[1] For the following see the Project Information System (PRINS) for the German Federal Transport Infrastructure Plan 2030, <www.bvwp-projekte.de>.

Other projects such as the upgrade of the Wesel-Datteln-Kanal are a combination of waterway dimensions upgrade and lock capacity extension. The investment cost of 103 mil. € exclude substantial lock maintenance and renewal investments, which are calculated separately. The benefit-cost ratio is 3.6 showing substantial benefits of the project. The canal upgrade from 2.8 m to 3.4 m draught jointly with the replacement of lock chambers with extended capacity generate transport cost savings of 8.9 mil € per year and external cost savings of 0.4 mil. € per year. Apart from higher payloads the avoidance of lock waiting times is a key benefit of this project and contributes to transport cost savings. Depending on the traffic volume, the planned upgrades may include one-way sections with restrictions for passing vessels.

4.2.3 Upgrades of locks

A number of projects address only lock upgrades. The measures include lock dimensions, capacity and redundancy. The planned extension of lock dimensions at the River Neckar aims to accommodate vessels with a length of 135 m. Increasing payloads lead to transport cost savings of 5.3 mil. € per year.

The accelerated renewal of the Scharnebeck lock at the Elbe-Seiten-Kanal aims to increase dimensions and to improve the reliability. The existing lock is in a rather weak condition with a risk for failures, which would lead to a closure of the canal. Transport cost savings related to the project amount to 5.5 mil. € per year and external cost savings to 0.5 mil. € per year.

At the Mosel River, the completion of the lock chain with two chambers aims to reduce the risk of waterway closure due to lock closure. Moreover, the availability of second chambers would avoid the planned annual closure of the waterway for lock maintenance. The improvement generates up to 3.9 mil. € transport cost savings per year.

4.2.4 Heightening of bridges

The heightening of bridges to increase bridge clearance is the objective of a number of proposed projects, in particular for the canal network. The projects were not selected for the German Federal Transport Infrastructure Plan due to the high investment cost and the limited container traffic expectations. Anyway, the height under bridges is a key factor for higher payloads and transport cost savings in container traffic.

5 Requirements for Good Navigation Status

5.1 Proposed definition of "Good Navigation Status"

Based on the extensive consultations of experts and the desk research carried out, the following definition of Good Navigation Status is proposed:

"Good Navigation Status (GNS) means the state of the inland navigation transport network, which enables efficient, reliable and safe navigation for users by ensuring minimum waterway parameter values and levels of service."

Moreover, GNS is to be achieved considering the wider socioeconomic sustainability of waterway management.

The wider objective of GNS is to support and promote Inland Waterway Transport in Europe in order to have more sustainable transport in Europe and to enhance the competitiveness of the European economy and the living conditions of European citizens. This is also illustrated in the scheme presented in section 4.1.

Given the clear benefits of inland waterway transport compared to other modes such as less external costs such as accidents, congestion and low transport costs, reaching the good navigation conditions allows taking benefit of the merits of IWT.

5.2 Implications of the proposed definition

The definition determines GNS as reference for efficiency, reliability and safety of inland navigation, taking into account the sustainability from a wide socioeconomic viewpoint. According to the definition GNS should implement this by ensuring **minimum waterway parameter values** (targets for waterway managers) and **level of service**.

- The waterway parameter values such as the draught, bridge clearance, allowed width and length of vessels/convoys refer to the physical dimensions of the waterways, which are key determinant for economies of scale and efficient inland navigation. These parameter values are the targets for waterway managers.
- The level of service addresses a wide scope of navigation conditions relevant for efficiency, reliability and safety of inland navigation. As regards reliability, the level of service is determined by the availability of physical dimensions and capacity to ensure efficient and predictable navigation without time restrictions and to avoid delays related to lack of capacity. Various factors focusing on information and traffic management determine the safety of navigation.

The GNS requirements take up all these aspects and also consider the wider socioeconomic sustainability.

The requirements shall be **consistent with the existing regulations and shall consolidate the relevant requirements as regards the inland waterway network which are covered by various**

paragraphs of the TEN-T Regulation 1315/2013[2]. The specific GNS requirement as specified in TEN-T (article 15.3 b) will bring **added value on top of the existing requirements** as regards the state of the inland navigation transport network. It shall address the transport potential striving for optimised dimensions from a socio-economic viewpoint while taking into account the environmental sustainability and other uses of the waterway.

The dimensions of waterways are already directly addressed by articles 15.3 a) and 16 b) of the TEN-T regulation. GNS as stipulated by article 15.3 b) can build on these provisions. Furthermore, article 15.3 c) requires implementation of River Information Services (RIS) and 39.2 b) requires the availability of alternative clean fuels for inland waterway infrastructure.

An added value to be brought by elaborating "Good Navigation Status" is the requirement that a **process will be started across the Member States of the European Union that have TEN-T waterways which includes implementation of measures to improve the navigation quality on the network as well as monitoring of the status.**

Based on the TEN-T Regulation 1315/2013, achieving GNS in 2030 for the TEN-T comprehensive network -as described above - requires the following, broken down by **4 items**:

1) Implementation of article 15.3 a): **Class IV** dimensions and **minimum requirements**
2) Implementation of article 16.b): Introducing **higher targets than Class IV where appropriate**
3) Implementation of articles 15.3c) and 39.2 b): availability of **RIS and alternative clean fuels**
4) Implementation of article 15.3 b): the **overall concept of GNS which includes**
    - The definition of GNS and the KPIs
    - Guidance on how to implement GNS (Good practices, minimum steps to develop targets and measures to reach GNS)

5.3 GNS requires the setting of minimum standards for a process and methodology

Article 15.3 b) states that "rivers, canals and lakes are maintained so as to preserve good navigation status".

In order to specify this requirement, the consortium proposes a concept with:

- output-oriented and quantitative measureable **GNS "hard" components addressing directly the navigability of the fairway and capacity of locks ,**
- **GNS "soft" components which are more indirect, process-oriented and/or qualitative** of nature**,**
- **minimum standards for the process of achieving GNS** for the relevant parts of the network including the implementation of measures, standards for monitoring and exemptions

It is required to design the overall GNS concept in such a way as to be open to anticipate and benefit from external factors such as innovations, climate changes and market developments. Regular updated of the concept is therefore recommended.

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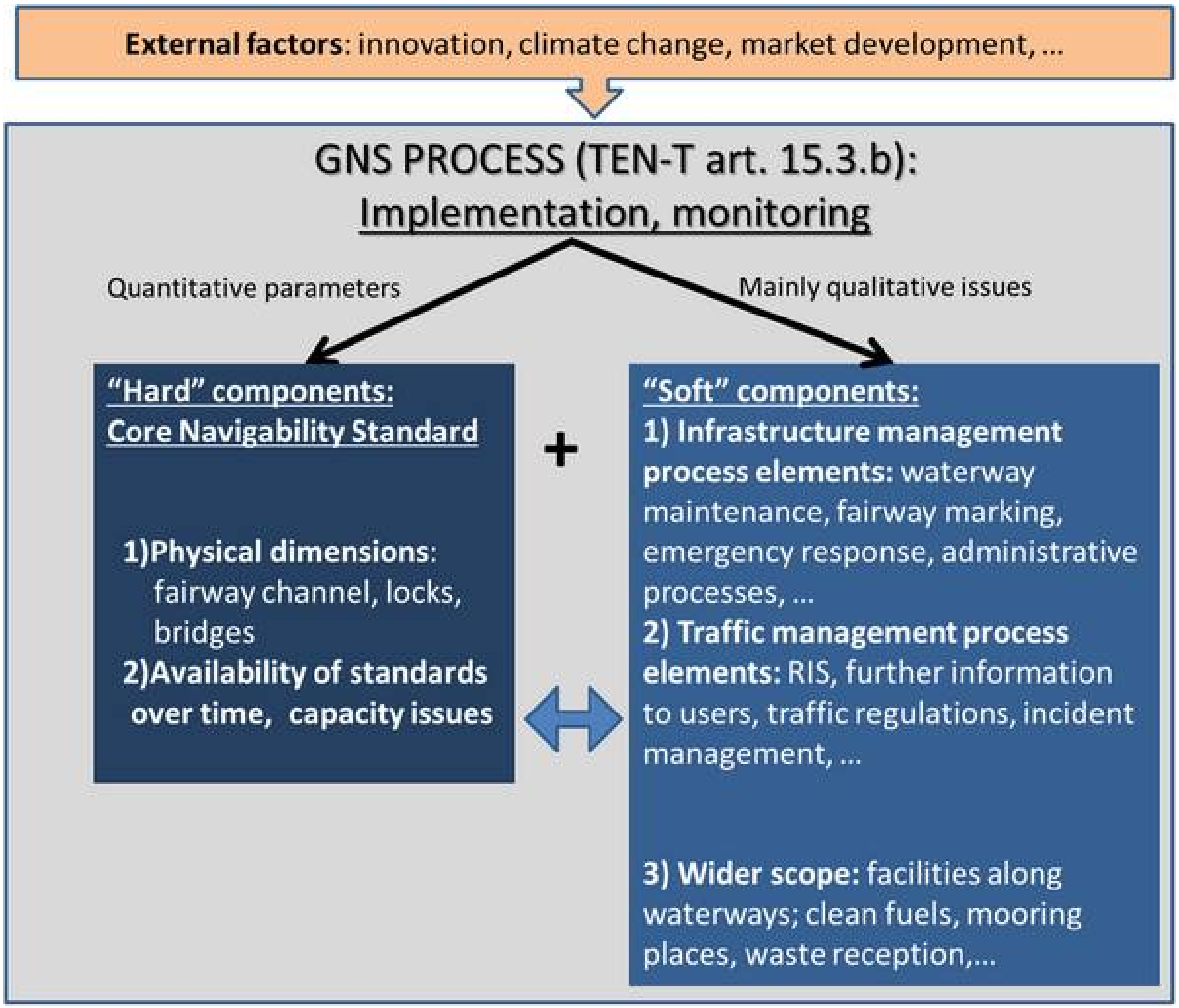
[2] Good Navigation Status is mentioned explicitly in the TEN-T regulation 1315/2013 in article 15.3b: http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32013R1315&from=EN



5.3.1 Specification GNS "hard" components

- The "hard" components shall have the **following characteristics**.
  - Focus on physical waterway infrastructure as direct output of waterway management activities and measures
  - Coherent set of measurable quantitative indicators (presenting the parameter value) applicable to the entire TEN-T waterway network identified according to a common methodology making Good Navigation Status measureable and comparable on sections of the TEN-T waterway network
  - They are directly targeted by TEN-T Regulation and/or AGN

- The indicators for GNS "hard" components relate to **the physical waterway infrastructure** and its use. They will:
  - describe the **dimensions of the navigation channel in rivers, canals and lakes** (e.g. depth, width, height standards) and of **locks, ship lifts and bridges**, which are determining the vessel dimensions and will allow a comparison with the target parameter value (e.g. current draught versus target draught).

- describe the **availability** of the navigation channel (e.g. closures, available draught during the year) and the availability and capacity of locks, ship lifts and moveable bridges

➢ For GNS ”hard” components, exemptions may be granted by the EC as regards the TEN-T minimum requirements: the target value on the draught (2.5 metres) and height under bridges (5.25 metres) as regards the full year availability of these values. The starting point for setting tarthget is to provide these parameter values through out the year in case they are not already included in local targets (e.g. some canals and rivers already comply with higher targets). In case these values can not be achieved, there shall be a solid approach to derive targets values that have a sufficient level of ambition in order to maximise the performance of IWT on the specific sections concerned.

5.3.2 Specification GNS ”soft” components

➢ The ”soft” components include both process-related **management aspects** of infrastructure (e.g. maintenance, marking) or of traffic (e.g. information to users), which contribute to an improved the score on the indicator linked to the ”hard” components. For example, improved maintenance processes shall provide a better value for the draught on the section. Another example is the more accurate information about the water levels which allows ship-owners to increase the payload (transport efficiency). Furthermore, soft components may optionally address a **wider[3] scope** of inland navigation infrastructure which is not directly related to navigation itself (e.g. facilities along waterways).

➢ GNS ”soft” components have the following characteristics:
- Waterway and traffic management process components are important for GNS as they influence the level of ambition and achievement of the targets for the GNS ”hard” components (e.g. actual draught and waiting times).
- The impact of introducing GNS ”soft” components might vary from region to region, depending for example on whether infrastructure management processes are already in place or have to be newly introduced
- Specific EU regulations apply for these components:
  - Implementation of standards set out in the RIS Directive on the comprehensive network (Article 15.3 c)
  - Implementation of the standards set out in the Clean Fuels Directive on the core network (Article 39.2 b)
- ”Soft” components are not always measurable in a quantitative manner the TEN-T network at the level of specific sections. Some can then be monitored by means of qualitative descriptions about processes covering multiple sections of the TEN-T network or even entire Corridors. An example may be the information systems in place to provide forecasts about the expected water level situation.

5.3.3 Requirements as regards the minimum standards for the GNS development process and methodology

[3] beyond navigation channel, locks, ship lifts and bridges

The GNS concept shall include minimum standards for both the process and methodology for achieving “Good Navigation Status” in a systematic way for all the sections of the TEN-T network. Achieving GNS by 2030 will require deployment of a process which is characterised by the following five steps:

1. Identifying waterway sections for which GNS will be defined. As a starting point, these sections are the ones referred to in the TENtec system.

2. Setting **for each of the sections** targets in a coordinated way between waterway managers (if applicable – (trans-)nationally/regionally coordinated) and with consultation of the various stakeholders, taking systematically consideration of:

   - The minimum TEN-T requirements; CEMT class IV compliance.

   - The transport potential demand and user requirements of a waterway section from an international corridor perspective, where appropriate setting higher standards for waterways (e.g. class V, IV dimensions). Higher parameter values than class IV are to be defined on sections of the waterway network where necessary to meet user requirements / market demand.

   - Taking into account possibilities of innovation and technological development, e.g. more sophisticated monitoring systems to allow more cost efficient dredging operations.

   - Cost and benefits of measures from an objective and broad socio-economic perspective to set, validate and or justify the targets. This CBA approach shall focus on finding the optimum for the parameter values and services for the navigation quality, while taking into account the transport potential on the corridor. This CBA process may therefore well lead to higher local targets compared to the CEMT class IV minimum requirements. The CBA shall start from the viewpoint of navigation and potential transport development to build the case and subsequently take into account further relevant dimensions for the waterway such as other uses and environmental legislation which may have an impact on the possible targets.

   - Local conditions as regards the waterway sections such as the hydrology, hydro-morphology, impact of extreme weather events, climate change.

   - The applicable environmental law and where possible creating synergies (“working with nature”) linking to for example the Water Framework Directive

   - Further uses of a river, lake or canal; application of a cross-sectoral approach

3. Document the current status of the waterway sections and communicate status and measures to the involved users of the river, lake or canal by the waterway managers and discussing them jointly before realisation (to be further developed in the GNS guidance document).

4. Regular monitoring of status of the inland waterway sections as regards the GNS ”hard” and “soft” components parameters and KPIs for GNS and the progress.

5. Implementation of remediating measures in case of deviation, targeting full compliance by 2030 and communicate status and measures to the involved users of the river, lake or canal by the waterway managers and discuss them jointly before realisation.

Based on a systematic consideration of the mentioned elemens above, at request of a Member State in duly justified cases, alternative targets may be found and, if below the minimum requirements, exemptions can be granted by the European Commission from the minimum requirements on draught (less than 2,50 m) and from minimum height under bridges (less than 5,25 m). This can relate to the free-flowing rivers that may have difficulties to provide the 2.5 metre draught on 365 days throughout the year. As outcome of the process alternative targets shall be derived (based on the process and systematic consideration of criteria) and enforced.

Through the GNS process it shall be ensured and demonstrated all possible and feasible measures have been taken to ensure the maximum availability of draught and height under bridges.

5.4 Differentiated requirements as regards GNS

As indicated in section 5.3.3 the targets shall be discussed and determined for specific sections targets in a coordinated way between waterway managers (if applicable – (trans-) nationally/regionally coordinated) and with consultation of the various stakeholders. Seen from a European perspective this approach will allow taking into account the local conditions and characteristics of the waterway network (e.g. free-flowing rivers, canals, lakes) and the socio-economic rationale (CBA) for target and related maintenance and works measures, taking into account the environmental considerations.

For example on sections with high traffic intensities there will be a socio-economic rationale to set higher standards for the fairway dimensions and the reliability of the section compared to a similar type of waterway (e.g. a canal) with much lower traffic potential. For example this may lead to differentiation in terms of the dimensioning of sections, lock capacity and also for the service times of locks.

Another example is the differentiation between free flowing rivers and canals. Users of free flowing rivers have a different needs. Since the waterway is naturally fluctuating and less stable compared to regulated rivers or canals, there is a much bigger need for reliable information about the current situation and forecasted situation as regards the discharge and water levels. Furthermore, lack of maintenance is more quickly leading to limitations for navigation on free flowing rivers compared to canals and therefore needs more attention on free flowing rivers.

Another issue is the interaction with other functions of the waterways, such as the ecology. This may also lead to a different position and priority given to inland navigation compared.

Moreover, for some regions various components as regards GNS may already be achieved and would not require additional attention or measures rather than monitoring. But there are less developed waterways as well where the focus on on the basics of GNS.

As presented in the Task 2 report (part A) there were regional workshops addressing GNS and the specific views from the regions. The following subsections present the specific views from the various regions where the workshops did take place.

5.4.1 Views from the Nordic region

National regulations thereby determine varying targets depending on the particular waterway. A specific issue regarding GNS requirements is the link or combination between requirements for inland navigation vessels and the requirements for river-sea and coastal traffic with larger dimensions operate along these waterways. Another specific issue and requirement is how to deal with the ice that may lead to closures of waterways and/or ice-class requirements for the access of vessels. Moreover, fairway marking is of high relevance, in particular for lakes.

Consequently, especially in Sweden and Finland since the waterways are shared with sea-river vessels and coastal vessels, it is demanded to put the focus of GNS on “soft” components such as traffic management and regulations.

In Nordic countries, as waterways crossing/running along EU borders, the coordination with third countries (Russia) is important for GNS.

5.4.2 Views from the Rhine region

The Netherlands, Luxembourg and Switzerland have ratified the AGN, whereas Germany and France have solely signed the AGN (Belgium is not a signatory state to the AGN). Through the Central Commission for the Navigation of the Rhine a well-institutionalised transnational coordination mechanism with direct regulatory powers is already available. The experts from the area indicate that a good navigation status is already existing on the Rhine as the Mannheim Convention forms the supranational legal basis for it. Furthermore, as this is already a longstanding practive with very substantial freight volumes transport via waterways, the Rhine area is seen as a rather mature area as regards the hard components while also soft components are in place. Issues for users are the lack of areas to mooring places and car-lif jetties, in particular along the German network (e.g. Rhine river).

However, while waterway parameters of GNS “hard” components are permanent (infrastructure related), the draught of vessel depends on payload and the available water level. It needs to be highlighted that different sections have different characteristics that require a tailor made approach; no general rules can apply for rivers because of geography and influence of external natural factors like water supply. It is highlighted to develop waterways with nature, not against. The link to the environmental requirements is important.

As regards the waiting times for vessels at locks it is for the Rhine countries better to focus on the transport time of the whole journey, e.g. taking into account positive results from corridor management services. For the Rhine region soft components are relevant that address information technology for corridor management to increase short and reliable overall journey times for vessels.

5.4.3 Views from the central European region

In the Central European region national regulations determine varying targets depending on the particular waterway. Rivers with specific attention are the Elbe and the Oder as they are free flowing and the dimensions are not reaching the 2.5 metre requirement. A link shall be made to the Elbe masterplan.

Furthermore the German canal network may benefit from more bridge clearance and enhanced reliability of locks.

In particular for the Polish waterway network there are plans for upgrading the waterway network to accommodate passenger and freight traffic. These upgrading plans shall be taken into account.

5.4.4 Views from the Danube region

Nine out of 10 Danube riparian states have acceded the AGN (Germany is the only exception for the Danube area). A central value in the recommendations of the Danube Commission is 2.50m draught, which should be available on minimum 343 days per year. Minimum fairway widths ranging between 50-180m are prescribed for different sections of the Danube. However, on crucial parts of the Danube these targets are not reached causing severe limitations for transport operations and even complete closures of waterway sections because of low water situations, related to maintenance issues and limited budgets.

The problems of the Danube region are assessed to be rather basic compared to other river corridors (reaching agreed minimum fairway parameter values such as the available draught). Not all topics (soft elements) are considered as particularly relevant on the Danube. Therefore, it is clear that for the time being new targets shall be developed as in some areas reaching even the existing targets is quite problematic. Legally adopted standards on local level shall be used as targeted minimum standards and shall be pursued in the first place.

As specific issue for the Danube is also the requirements for the operation of the passenger fleet (cruise vessels) on the Danube. Moreover, the non EU countries (e.g. Serbia) must be taken into account in the GNS development process.

6 Towards indicators and targets for GNS

From the analyses by means of desk research, survey, workshops and bilateral discussions with the experts it became clear that the GNS concept shall focus on:

- Optimised dimensions, capacity and reliability of the waterway network for navigation of the vessels
- Focus on monitoring the waterway network status, by means of quantitative data, allowing a SMART approach
- Provide a concept in the framework of TEN-T, therefore a European scope.

Various studies and cost-benefit analyses have shown the strong relation between parameter values for the waterway dimensions and the sustainability, efficiency and reliability of inland waterway transport (IWT). The sustainability, efficiency and reliability are decisive for the attractiveness of IWT and therefore are essential for the modal share of IWT and generating benefits for society. Targets shall be set for indicators based on such CBA assessments, taking into account the specific circumstances and potential of inland waterway transport.

More specifically, for highly efficient transport by inland waterways to reach economies of scale, there is a need to be able to execute transport using the maximum load capacity of the vessel/convoy. The payload shall be as high as safely possible, navigating from origin to destination without delays (no waiting times) while taking into account the fuel consumption (speed/power profile depending on the waterway conditions on the section). Moreover, depending on the size of the transport volume, there can be a socio-economic rationale based on Cost Benefit Analyses to increase the waterway dimensions available for inland navigation and to increase the reliability and productivity (for example expansion of service times and capacity of locks and by minimising closure times of links and objects).

The load can be defined in terms of tons (weight) but also in volume (e.g. m^3 or number of containers/TEUs). Therefore, the following waterway parameters provide the foundation for the definition and evaluation to indicate if a section is reaching a good navigation status:

- Possible **draught** of the vessel, the minimum **depth** on a stretch of the waterway
- The possible **beam** of the vessel, the **width** of the waterway and the curve radius
- Possible **height** of the vessel, the **air clearance** under bridges and other infrastructure
- Possible **length** of a vessel, depending on the curve radius and size of locks

In order to allow higher efficiencies, the waterways in Europe and beyond have been classified according to standards. We refer in this respect to the measurement of dimensions according to the ECMT classification table[4] which serves as the main reference in the TEN-T guidelines and also AGN as this is setting the basic principles in waterway design and maintenance for the parameter values to be reached.

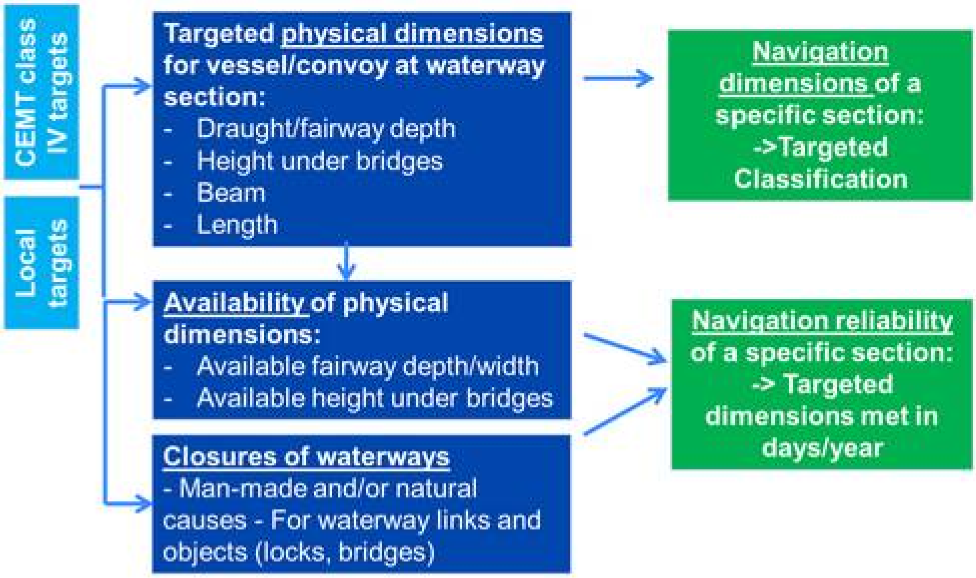
[4] ECMT RESOLUTION No. 92/2 ON NEW CLASSIFICATION OF INLAND WATERWAYS, see http://www.itf-oecd.org/sites/default/files/docs/wat19922e.pdf

However, it is not only about the static values of parameters for the targeted dimensions of waterways, but into large extent the efficiency and **reliability of inland navigation depends on dynamic factors** such as the actual available depth and **waiting times for vessels.** It is important to have a reliable and efficient journey time which might be influenced by waiting times caused by capacity restrictions at locks and bridges and ports. **The 'time' dimension is quite relevant**.

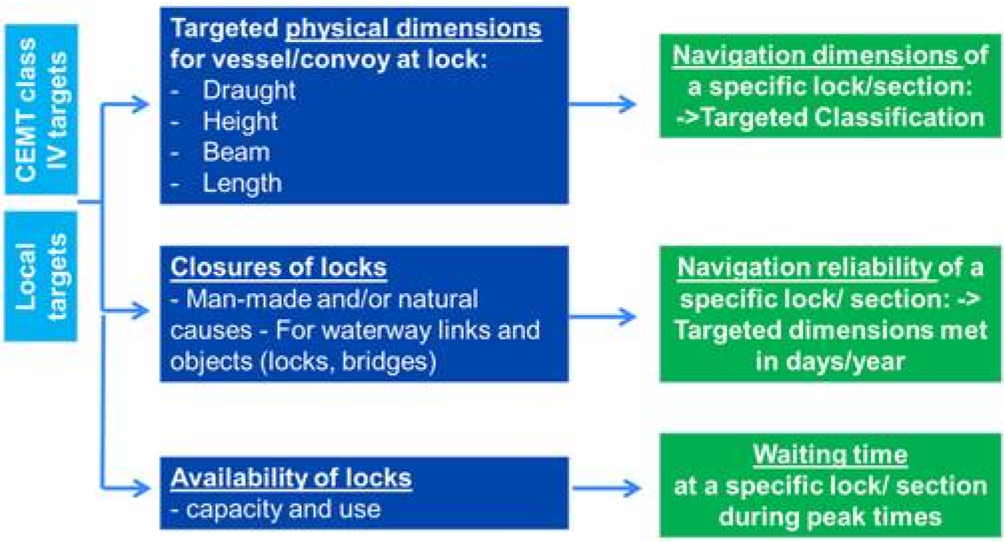
Based on the scores on the parameters (the actual day-to-day values) the navigation reliability can be estimated. **The navigation reliability is a KPI for the hard component of GNS. Another KPI is the waiting times at objects in the waterway network**, depending on the traffic intensity in relation to the capacity of waterways (including locks, bridges, lifts).

The next two figures present both KPIs and their relation to parameters for the hard components of GNS.

Scheme for waterway sections (links):



Scheme for locks in the inland waterway network:



Navigation Reliability
The journeys on the inland waterways are covering multiple sections of the waterway network. From the viewpoint of efficiency the section with the smallest value on the waterway parameters is decisive for the type of vessel and the dimensions and the load (draught, height).

The values for the parameters need to be made visible for various sections, in particular at sections where bottlenecks can occur and where water levels are dynamic and can be critical in terms of low depth on the fairway channel that may restrict the draught of the available vessels. It shall be monitored on day-to day basis into what extent the parameter values on the sections of the waterways are available and/or affected. Moreover, it is recommended to identify the reasons for not achieving the targeted values. In this respect natural factors can be distinguished such as low water discharge, ice and floods but also man-made reasons that can cause reduced availability of the section such as maintenance works and accidents that may block the waterway or reduce the capacity. Based on the situation and potential, targets shall be set as regards the reliability. For example achieving the targeted dimensions on 95% of the days (347 days per year). However, this reliability target will also depend on the hydrological circumstances (e.g. free flowing sections) and the related cos-benefits to achieve and maintain the target value.

Waiting times
Furthermore there can be specific locations in the network where waiting times occur. Reliable and predictable transport is a strong requirement by the users, notably shippers. The **KPI** which is strongly demanded by the transport industry is the **waiting time during peak times at locks and bridges**. However, for waiting times there is no common European definition and data is scattered. Information on underlying factors (e.g. service times of locks/bridges, physical characteristics like number and dimensions of lock chambers) is available in better quality. Furthermore, alternatives may be used, such as the average number of vessels waiting at the lock or the intensity of chamber utilisation. Moreover, in case of state-of-the-art corridor management applications, it may be the situation that vessels will get a predesignated slot for the passage of a lock or bridge with the effect that skippers arrive just-in-time at the lock to reduce speed in order to save fuel. In this situation the waiting time is not seen, however there may still be a capacity issue causing a longer overall journey time. Consequently, it may be desirable to develop a KPI to monitor the overall journey times, e.g. based on AIS tracking.

For the moment available waiting times shall be the starting point and this KPI is suggested for the first approach.

Since data for parameters and KPIs shall be available across Europe on section level and shall lead to meaningful and comparable information, there is a limitation to the range of KPIs that can be applied. Building upon work carried out by a group of experts under PLATINA II[5], in which data availability was screened, a revision was made on the OMC Glossary for TENtec taking into account the first results of the GNS study. After a screening and filtering process a list of parameters was prepared to describe the situation for the hard components in a quantitative way using parameters. The monitoring of values for these parameters shall take place by means of TENtec. The latest version of the updated Glossary for TENtec for the Inland Waterways is presented in the Annex of this Task 3 report. The parameters which are in particular relevant for output on the hard

[5] For more information on this extensive PLATINA II work, please see the downloads page of www.NAIADES.info:
http://www.naiades.info/repository/public/documents/Downloads/31_D4.2_Information%20Architecture_2015-04-22.pdf
http://www.naiades.info/repository/public/documents/Downloads/31_Platina_Glossary_30.xlsx

components of GNS are highlighted in yellow while the relevant KPIs for GNS are highlighted in green. Furthermore, for the dynamic parameters, their number is indicated in red colour.

Monitoring using TENtec

In particular the TENTec database for Inland Waterways infrastructure shall provide a complete database for the important IWT countries and waterways in Europe (countries and waterway sections with high tonkilometre performances), such as Germany, The Netherlands, Belgium, France, Romania, Bulgaria, Slovakia, Austria and rivers like the Rhine, Danube, and the canal networks in Western Europe.

Furthermore, as regards the reliability, particular attention shall be paid to provide a full database on the rivers, notably the free-flowing sections of the inland waterway network and also the performance of locks (closures).

First basic parameters relevant from the viewpoint of GNS are the **physical dimensions** of vessels that are targeted to navigate on a waterway link or an object such as a lock or bridge. These data are available, e.g. referring to ECMT classification. The parameter that represents the real **navigation reliability** of a waterway section (taking into account dynamic day-to-day values) is seen as a **core KPI building on the parameters for physical dimensions and availability.** In this indicator, several pieces of information come together as regards the achievement of the targeted physical dimensions over time (see parameter 26 and 27 in the Annex on the TENtec list). This is more challenging as it shall take into account the dynamics of water levels and riverbed morphology as well as closures of waterway links and objects such as locks and bridges. This is especially relevant for free-flowing river sections as they are often very dynamic as regards their depth and width.

Within the framework of data collection for TENtec, data will be collected for the defined parameters in the Annex for the various TENtec sections of the inland waterway network. This data provides the basis for monitoring the Good Navigation Status as regards the hard components. The latest version of the Glossary contains four categories for data to be collected:

- Waterways links: 35 parameters, of which 20 parameters are considered static
- Lock complexes: 8 parameters, of which 2 are considered to be static
- Lock chambers: 9 parameters, of which 8 are considered to be static
- Bridges: 6 parameters, all considered to be static

These 58 parameters contain a number of parameters that are considered as KPIs for Good Navigation Status. Basically all relevant GNS parameters are captured for the monitoring purposes in the revised TENtec glossary as regards waterway dimensions, their dynamic performance during the year (reference water levels) and also closures and waiting times (parameters to describe elements for capacity and intensity).

It shall be kept in mind that the efforts to collect the data shall not be too high. In this respect, it shall be remarked that the number of parameters for which the value will change is limited. Out of 58 parameters there are 22 dynamic parameters while 36 are considered to be static and are not expected to change on a year-by-year basis. Furthermore, it is taken into account that the data for these parameters shall be already available in a digital way, therefore reducing the efforts to collect and process the data for the TENtec database on Inland Waterways.

The TENtec data collection work started in June and shall be finished by October 2016 (carried out by another consortium). It is planned to develop a first network assessment for GNS based on the collected data from TENtec. Further data collections for TENtec are planned for 2017 and the data shall be updated each year. Data to be collected in 2017 is expected to cover also parameters about port related issues and facilities along waterways.

Based on the current parameter values also a discussion can start between stakeholders about the actual values in relation to standards and targets for these parameters on the level of sections. For example:

- Minimum draught to be achieved as target: e.g. 3.5 metres
- % navigation reliability: e.g. on at least 350 days per year reaching at least 2.8 metre depth of the navigation channel at reference water low level
- Bridge clearance: e.g. 12.0 metres, allowing 4 layers of high cube containers
- Maximum times for closures per year.

Furthermore, the basic requirements from TEN-T regulations such as minimum Class IV draught and height under bridges already provides a set of targets in case no higher targets are feasible according the GNS development process. However, in particular the vertical dimensions and notaby the draught / depth targets for the free flowing sections need attention and also the target for the number of closures and the duration of closures on the network.

Annex: TENtec Glossary for Inland Waterways – version 4 July 2016

Waterways

New ID	TENtec Technical Parameter Name	Definition	Data type	Remarks
1	Waterway name	Identifier for river or canal (Suggest to use the RIS-Index WWNAME)	string	
2	Fairway Section Code	RIS Index Fairway section code assigned by the national authorities. It represents the coding of a waterway section within a national network and is only unique in combination with the country code. Cross references to RIS implementation tables. e.g. DE-00700 for the Elbe River in Germany	string	
3	Waterway type	1) Free flowing river section, 2) Impounded river section, 3) Canal, 4) Lake or 5) Estuary with tidal influence (sea level).	enumeration	See PLATINA II Manual on Waterway Maintenance, p. 10 for the definition of free flowing river section. A canal has a flat bed. Water levels can fluctuate. An impounded section has no flat bed, but a bed that can change morphology and also fairway depth. But not as much as a free flowing section. It is the same as an impounded section, but water levels and riverbed morphology vary much, much more. If it is a mixed section, then record the type that is prevailing on that section.

4	Active	Whether stretch is open/operational.	boolean	Allows inclusion of planned infrastructure within the network if it is included already in the TEN-T maps (1315/2013 EC) and definition of TEN-T core network and/or included as a planned project in the Corridor Work Plans.
5	Water flow direction	"Yes" - for the sections where the direction of the section in GIS layer corresponds to the water flow "No" -for the sections where the direction of the section in GIS layer does not correspond to the water flow For a canal this sequence will follow the distance marks defined by the waterway authority.	boolean	General remark: if a section is longer and comprises several values for the parameter, the prevailing one shall be given
6	CEMT class	Lowest categories of navigable inland waterways on the section : Class (length/beam) I to III, IV, V a, V b, VI a, VI b, VI c, VII According to the definition in 1992: see also http://www.itf-oecd.org/resolution-no-922-new-classification-inland-waterways	enumeration	
7	Zone	I, II, III, IV, R (Directive 2006/87/EC)	enumeration	
8	Local Knowledge Requirements	Whether local knowledge requirements (LKR) are applicable on this stretch, normally due to difficult nautical conditions. Refer to: http://www.unece.org/fileadmin/DAM/trans/doc/2010/sc3wp3/ECE-TRANS-SC3-2010-12e.pdf http://www.unece.org/fileadmin/DAM/trans/doc/2014/sc3wp3/ECE-TRANS-SC3-2010-12-c1e.pdf	boolean	

9	Maximum length of vessel/convoy	Maximum allowed vessel/convoy size in length for the width defined in Parameter 10. Please encode 999 for "no limit". A default value is provided based on the CEMT classification (Parameter 6).	double	This parameter shall be adapted if the allowed dimensions based on national legislation for the waterway (Police Regulations, e.g. Binnenvaartpolitiereglement in The Netherlands and Chapter 11 of the Police Regulations for the Navigation of the Rhine (RPNR)) differ from the dimensions based on the CEMT class. This shall not take into account special (oversized) transports that require special permits. Note: the maximum length needs to be filled in an then the maximum width for a vessel with the indicated maximum length may be completed
10	Maximum width of vessel/convoy	Maximum allowed vessel/convoy size in width for maximum length defined in Parameter 9. Please encode 999 for "no limit". A default value is provided based on the CEMT classification (Parameter 6).	double	This parameter shall be adapted if the allowed dimensions based on national legislation for the waterway (Police Regulations, e.g. Binnenvaartpolitiereglement in The Netherlands and Chapter 11 of the Police Regulations for the Navigation of the Rhine (RPNR)) differ from the dimensions based on the CEMT class. This shall not take into account special (oversized) transports that require special permits. Note: the maximum length needs to be filled in an then the maximum width for a vessel with the indicated maximum length may be completed
11	Maximum draught of vessel/convoy	Maximum allowed vessel/convoy size in draught at reference water level. Please encode 999 for "no limit". A default value is provided based on the CEMT classification (Parameter 6).	double	This parameter shall be adapted if the allowed dimensions based on national legislation for the waterway (Police Regulations, e.g. Binnenvaartpolitiereglement in The Netherlands and Chapter 11 of the Police Regulations for the Navigation of the Rhine (RPNR)) differ from the dimensions based on the CEMT class. This shall not take into account special (oversized) transports that require special permits.
12	Minimum bridge clearance	Minimum height under bridges on the section at reference high water level available for vessel/convoy to pass the section. Please encode 999 for "no limit". A default value is provided based on the CEMT classification (Parameter 6).	double	This parameter shall be adapted if the allowed dimensions based on national legislation for the waterway (Police Regulations, e.g. Binnenvaartpolitiereglement in The Netherlands and Chapter 11 of the Police Regulations for the Navigation of the Rhine (RPNR)) differ from the dimensions based on the CEMT class. This shall not take into account special (oversized) transports that require special permits. Furthermore, there is a direct relation with Parameter 3 of the BRIDGES layer ("Passage height limit (meters)")). Possibly there is more than one bridge on the section. Therefore the parameter shall take the smallest value of the bridge height limit.

13	Maintenance target: Fairway width	Minimum targeted width of the fairway bottom in the section for the targeted minimum fairway depth (Parameter 14) This value will be collected especially if there is no direct value for the maximum allowed width of the vessel (Parameter 10: Maximum width of vessel/convoy). This is also related to the maximum width at specific points of the fairway to pass bridges. The cell will be left blank if no additional targets apply. This shall allow potentially different targets compared to standards for CEMT IV waterways width.	double	
14	Maintenance target: Fairway depth	Minimum targeted depth of the fairway bottom in the section for the fairway width specified in Parameter 13. This value will be collected especially if there is no direct value for the maximum allowed draughtof the vessel (Parameter 11: Maximum draught of vessel/convoy).This shall allow potentially different targets compared to standards for CEMT IV waterways depth. The cell will be left blank if no additional targets apply.	double	

15	Reference Low Water Level	State the applicable reference gauging station, the type of minimum water level value (e.g. GIW, RNW, MLW, NAP, Adriatic Sea) and the value for the Pegel that is decisive for the TENtec section as regards the available depth / possible draught of the vessel. (e.g. 'Maxau/GIW/369')	string	The actual water levels alone (pegel values) do not provide information on the actual fairway depth and available air clearance (container layers). The water levels needs to be provided at a statistical reference water level, such as GIW (Gleichwertiger Wasserstand, Rhine) or RNW (Regulated Niedrigwasserstand, Danube) in order to calculate the actual fairway depth. Parameter 15 is needed to correctly interpret Parameter 17 and Parameter 18. Also for canals reference values are commonly used. However, a split needs to be made between reference (low) water levels for the depth and related targets for maintenance and between the reference (high) water level used for the air clearance of the waterway (e.g. bridges). Furthermore it is recommended to add as well the relevant gauging station along the waterway which serves as the reference point for the reference water level. Examples are: http://www.platformzeroincidents.nl/wp-content/uploads/2016/01/Calculation-navigational-depth-R0.pdf, http://www.viadonau.org/en/business/online-services/calculating-loading-capacities/
16	Reference High Water Level	State the applicable reference gauging station, the type of high water level value (e.g. HSW, HNWL, MHW, NAP) and the value	string	See also the regulation on Notices to Skippers (416-2007) a table that provides already a list of gauging stations and references: see the PDF of the regulation, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007R0416&from=EN , => page 98 onwards. For an example of head room for a bridge based on the reference high water value, see page 98 of next PDF: https://staticresources.rijkswaterstaat.nl/binaries/Waterway%20guidelines%202011_tcm224-320740_tcm21-37559.pdf
17	Number of days below reference low water level	The number of days per year at which the recorded water level is below the relevant reference low water level (stated in Parameter 15).	integer	
18	Number of days below regulation CEMT class IV draught	The number of days per year at which 2.5m draught was not reached with a safety margin of at least 20cm	integer	This value is specifically aimed on the compliance to the TEN-T regulation 1315/2013 and needs to be considered in relation to Parameter 17

19	Number of days below targeted depth according to waterway manager	The number of days per year at the targeted depth (as specified in Parameter 14) is not achieved.	integer	
20	Number of days above reference high water level	Number of days above reference high water level (see Parameter 16) in the last year	integer	
21	Number of days below regulation CEMT class IV air clearance	The number of days per year at which 5.25m air clearance is not achieved. This value is specifically aimed on the compliance to the TEN-T regulation 1315/2013 and already includes a safety margin of 30 cm according to the CEMT agreement (1992).	integer	
22	Waterway closure manmade-planned	Total number of days when the waterway section is closed for a period longer than 24 hours due to manmade reasons which were planned and announced at least 12 weeks in advance for waterway users	integer	The minimum notification time of at least 12 weeks is based on the RWS guidelines, page 154, link to document: https://staticresources.rijkswaterstaat.nl/binaries/Waterway%20guidelines%202011_tcm224-320740_tcm21-37559.pdf
23	Waterway closure manmade- not planned	Total number of days when the waterway section is closed for a period longer than 24 hours due manmade reasons which were not planned	integer	Includes closures due to accidents.
24	Waterway closure natural events - ice	Total number of days the waterway section was closed for a period longer than 24 hours due to ice	integer	

25	Waterway closure natural events – high water	Total number of days the waterway section was closed for a period longer than 24 hours due to high water	integer	
26	Navigation reliability (%)	Percentage based on the number of days per year, on which the waterway is available for navigation and meets the targeted requirements for fairway depth (specified in Parameter 14), width (specified in Parameter 13) and for height under bridges (as specified in Parameter 12). This parameter measures the combined score on targets that differ from CEMT class , including national applied targets and also uprated targets for the corridor and days of closure of the waterway	double	
27	Navigation reliability according to CEMT IV (%)	Percentage based on the number of days per year, on which the waterway is available for navigation and meets the targeted requirements as specified in 1315/2013 which specifies the minimum draught, width, length and height under bridges as specified according to CEMT IV. This parameter combines information on the score as regards reaching the CEMT IV vessel dimensions and the number of days of closures of the waterway section.	double	

28	Ship passages both directions	Total number of commercial ship passages (both directions), per year. Commercial is defined as registered as passenger or cargo ship according to regulation 2006/87, applying to vessels of a length of 20 metres or more and a volume of at least 100 m3. It also applies to floating equipment, tugs and pushers, and vessels intended for passenger transport carrying more than 12 passengers in addition to the crew. Convoys shall be counted as one unit. If alternative national definitions are used, these should be used instead.	integer	
29	Ship passages downstream	Number of commercial ship passages upstream, per year.	integer	For rivers, upstream and downstream refer to the natural direction of waterflow, not the way in which the link is directed in TENTEC. For canals, 'downstream' means following the ascending sequence of distance markers, and 'upstream' means following the descending sequence of distance markers.
30	Ship passages upstream	Number of commercial ship passages downstream, per year.	integer	For rivers, upstream and downstream refer to the natural direction of waterflow, not the way in which the link is directed in TENTEC. For canals, 'downstream' means following the ascending sequence of distance markers, and 'upstream' means following the descending sequence of distance markers.
31	Freight traffic flow (tonnes per year)	Tonnes transported on the section, per year.	double	
32	River Information Services	Are the minimum requirements set out by the RIS Directive met on this section?	boolean	

33	Hydrological services	Low water level forecast period (days) with accuracy of ± 10 cm independent from the restricted meteorological forecasts	integer	Probably different confidence intervals and number of days of forecasts are applied and provided by countries. Therefore it is suggested to apply a strict definition and test for feasibility of data collection.
34	Maximum sailing speed	Maximum allowed vessel/convoy speed relative to the ground (not water). In case of differentiated speed per draught, the speed of the maximum allowed vessel type to be filled in. The default value for no regulation is 99 (e.g .for the Rhine)	double	
35	Access charge	Whether distance based access charges are applied on this section: 1) free of charge 2) charge per km 3) charge per ton-km	enumeration	

Lock Complexes

	TENtec Technical Parameter Name	Definition	Data type	Remarks
1	Service times	Total operational hours per year / total hours in the year (%) "Operational" is defined as "non-closure", if 1 or 2 lock chambers are operated, the lock is operational	double	
2	Vessel Traffic	Number of (commercial) vessels through the lock system per year. Commercial is defined as registered as passenger or cargo ship according to regulation 2006/87, applying to vessels of a length of 20 metres or more and a volume of at least 100 m3. It also applies to floating equipment, tugs and pushers, and vessels intended for passenger transport carrying more than 12 passengers in addition to the crew. If alternative national definitions are used, these should be used instead.	integer	
3	Full Year Lock Operation?	Days per year when the doors of the chamber remain open and the vessels can pass the lock when no levelling of water takes place at the lock complex (e.g. in cases of (relatively) high water).	integer	

4	Average Waiting Time at Lock		integer	Record in the remarks at the data the local applied definition for the average waiting time at locks
5	Lock closure natural events - high water	Total number of days the waterway section was closed for a period longer than 24 hours due to high water	integer	
6	Lock closure natural events - ice	Total number of days the waterway section was closed for a period longer than 24 hours due to ice	integer	
7	Lock closure manmade-not planned	Total number of days when the waterway section is closed for a period longer than 24 hours due manmade reasons which were not planned	integer	
8	Lock closure manmade-planned	Total number of days when the waterway section is closed for a period longer than 24 hours due manmade reasons which were planned and announced in advance at least 12 weeks in advance to waterway users	integer	The minimum notification time of at least 12 weeks is based on the RWS guidelines, page 154, link to document: https://staticresources.rijkswaterstaat.nl/binaries/Waterway%20guidelines%202011_tcm224-320740_tcm21-37559.pdf

Lock Chambers

	TENtec Technical Parameter Name	Definition	Data type	Remarks
1	Chamber Configuration	Dropdown List: Single, Double, Three or more	enumeration	
2	Chamber lock width	Width (metres) inside chamber	double	
3	Chamber lock length	Length (metres) inside chamber	double	
4	Chamber lock depth	Depth of water at lock (centimetres) entrance/exit	double	The sill depth at the reference low water level (MLW). (Rijkswaterstaat, 2011, Waterway guidelines, P61) link to guideline document: https://staticresources.rijkswaterstaat.nl/binaries/Waterway%20guidelines%202011_tcm224-320740_tcm21-37559.pdf
5	Chamber lock height	Air-draft Restriction (centimetres) if applicable	double	The headroom under the lift gates and any bridges over the lock. (Rijkswaterstaat, 2011, Waterway guidelines, P61) link to guideline document: https://staticresources.rijkswaterstaat.nl/binaries/Waterway%20guidelines%202011_tcm224-320740_tcm21-37559.pdf
6	Width of lock bay	Minimum Width (metres) of Lock Gates (at entrance or exit)	double	
7	Average operation time	Length of time in minutes to operate one lock cycle, this shall be strictly the lock cycle, excluding transition time of the vessel.	integer	
8	Average chamber utilisation	Total hours per year in which chamber is operational and occupied by one or more vessels / total operational hours of the year (%)	integer	
9	Maximum lock lift capacity	Maximum difference in water level that the lock can handle between the connecting sections (centimetres)	Double	

Bridges

	TENtec Technical Parameter Name	Definition	Data type	Remarks
1	Movable bridge	Whether bridge is moveable (to allow ships to pass)	boolean	
2	Full span of fairway	Does bridge cover the full span of the fairway?	boolean	Reasoning: the objective is to be able to determine whether the bridge is a bottleneck (in terms of bridge clearance, width limit, etc.). Another parameter 'Bridges'/'Passage width limit' captures 'only' the bottleneck in terms of width, so these two parameters are not interchangeable. In addition, in some cases, eg. if there is an island in the middle of the river and both branches of the river form a single waterway section, the parameter 'Bridges'/'Full span of fairway' is useful for both the bridge clearance and width limit for the entire section (meaning for both river branches).
3	Passage height limit	Height limit (centimetres) above reference high water level for fixed bridges, closed moveable bridges, or other overhead structures.	double	
4	Movable bridge passage height (raised/open)	Height limit (centimetres) above reference high water level, for moveable bridge when raised/open (if applicable).	double	
5	Passage width limit.	Width limit (metres) through bridge or equivalent overhead structures measured at reference low water level.	double	
6	Movable bridge service times	Number of hours per year that movable bridge service is available / total hours in the year (%)	double	