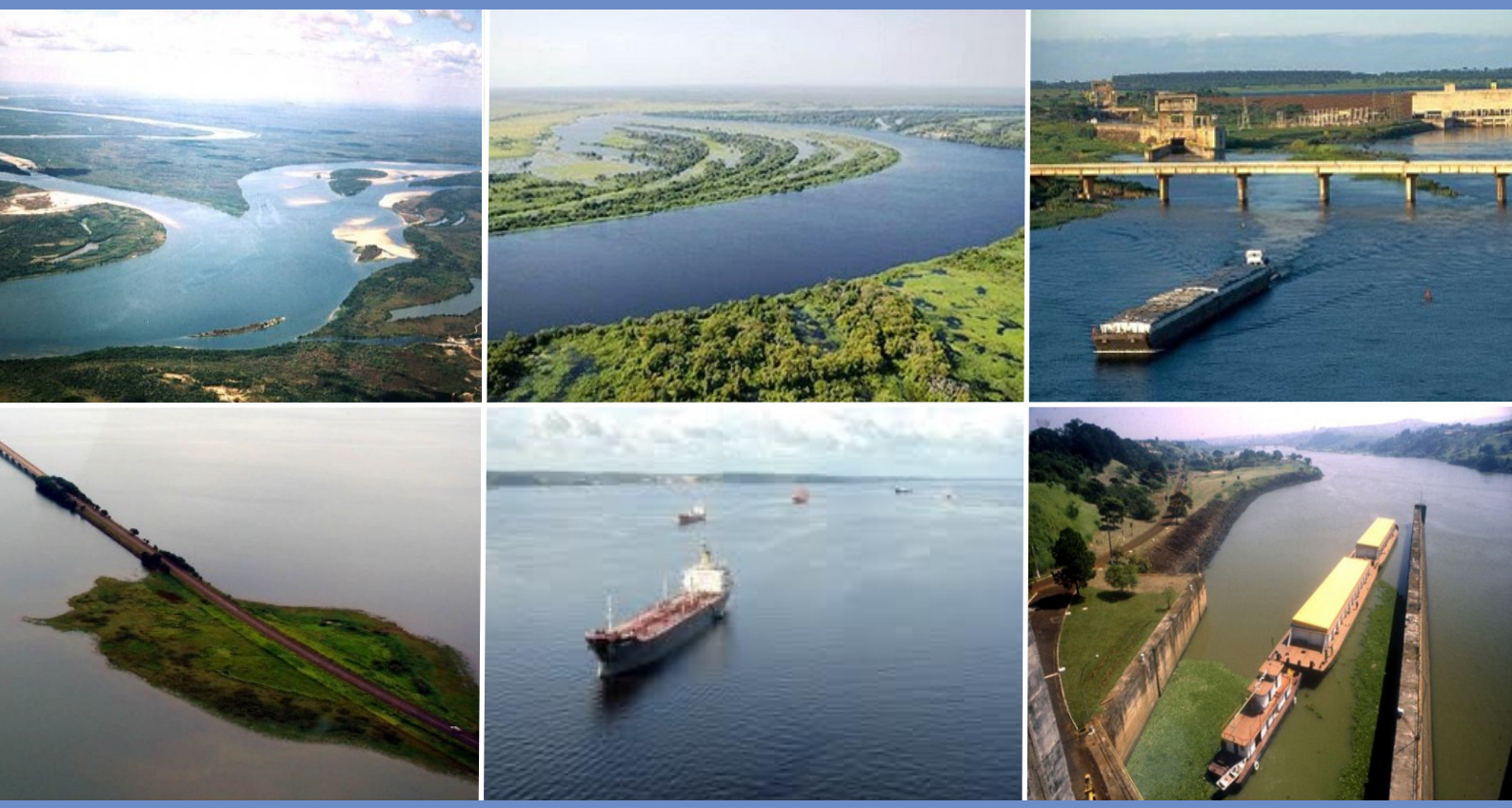
Ministério dos Transportes

PHE

Plano Hidroviário Estratégico

Inland Waterways Strategic Plan



Relatório do Plano

Plan Report

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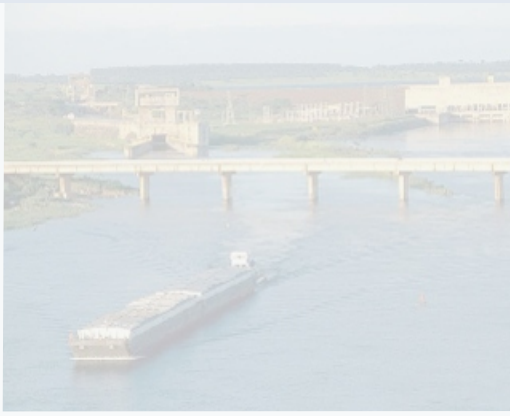


Relatório do Plano

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English Version

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ABBREVIATIONS

WA – Waterway Administration

AHIMOC- Administração das Hidrovias da Amazônia Ocidental

AHIMOR – Administração das Hidrovias da Amazônia Oriental

AHINOR – Administração das Hidrovias do Nordeste

AHIPAR – Administração da Hidrovia do Paraguai

AHRANA – Administração da Hidrovia do Paraná

AHSFRA – Administração das Hidrovias do São Francisco

AHSUL – Administração das Hidrovias do Sul

ANA – Agência nacional de Aguas

ANEEL – Agência Nacional de Energia Elétrica

ANTAQ – Agencia Nacional de Transportes Aquaviários

ANTT – Agência Nacional de Transportes Terrestres

RBC – River Basin Comittee

CODOMAR – Companhia Docas do Maranhão

COSIPLAN – Conselho Sul-Americano de Planejamento e Infraestrutura

DAQ – Departamento Aquaviário

DNIT – Departamento Nacional de Infraestrutura de Transportes

EIA/RIMA – Estudo de Impacto Ambiental/ Relatório de Impacto Ambiental

EPL – Empresa de Planejamento e Logística

EVTEA - Estudo de Viabilidade Técnica Econômica e Ambiental

RDG – Regional Development Group

WG – Working Group

IBAMA - Instituto Brasileiro do Meio Ambiente

IIRSA – Iniciativa para a Integração da Infraestrutura Regional Sul-americana

MT – Ministry of Transport

OTCA – Organização do Tratado de Cooperação Amazônica

PHE – Inland Waterways Strategic Plan

PNIH – Plano Nacional de Integração Hidroviária

PNLP – Plano Nacional de Logística Portuária

PNLT – Plano Nacional de Logística e Transportes

PNV – Plano Nacional de Viação

SEP – Secretaria Especial de Portos

IWT – Inland Waterway Transport

UNASUL – União das Nações Sul-americanas

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1 INTRODUCTION

1.1 MOTIVATION

Brazil has an extensive network of rivers and lakes, approximately 63.000 km in length, distributed over twelve river basins. Despite the availability of this network, currently only about 21.000 km[1] of the 29.000 km of navigable rivers are part of the logistic system. The waterways are currently used to transport 25 million tons of cargo and 6 million passengers per year. This participation reflects a very modest share of Inland Waterway Transport (IWT) in the current cargo transport; about 5% when compared with the rail (30%) and road (52%). In passenger transport IWT also holds a limited share compared to road and air traffic.

The Brazilian Federal Government intends to enhance the IWT sector and consequently contribute to the sustainable development of the country's economy. Therefore, the Ministry of Transport (MT) started the "Inland Waterways Strategic Plan" project in July 2012. The Plan's aim is to increase the amount of cargo that is transported on the Brazilian waterways. This Inland Waterways Strategic Plan contains recommendations for the development of a successful IWT system.

1.2 VISION

The economy of Brazil is growing fast. This growth is mainly due to export of commodities/basic products and, aiming at facilitating this growth, the country needs an excellent transport system, in which all the modalities are well maintained, efficiently managed and strongly linked. Inland Waterway Transport (IWT) needs to be supported to become a serious alternative mode of transport in the Brazilian transportation network.

Waterway transport should be the most interesting mode for long distance transport. It is cheap, energy efficient and environmental friendly and safe and reliable transport to transport large amounts of goods. The railway is also a good alternative for certain connections, but this mode is less easy to access for new users, or requires large investments to build the connection. Road transport is interesting for short distances, less than 250km, on those routes with lack of waterway or railway connection nearby. The waterway should be used as much as possible, if available.

Essential elements for a successful inland waterway transport worldwide are a well maintained waterway, sufficient cargo that is suitable to be transported by barges, a supportive government system and a well-organized, safe and up to standard transport system, within a supportive social and environmental framework.

This Strategic Plan is based on four elements of the following vision:

1. Strengthen the IWT to consolidate the economy of Brazil

Improvement of the system will contribute to the competitiveness of Brazilian products on the world market. Due to the lack of an effective and reliable IWT system, many commodities are

[1] ANTAQ, NAVEGAÇÃO INTERIOR, SUPERINTENDÊNCIA DE NAVEGAÇÃO INTERIOR – SNI 3º TRIM/2012

currently transported mainly by road and rail, while waterway transport could be more efficient (cheaper) and more sustainable. In addition, an efficient IWT system will improve the passenger transport service as a whole. The Brazilian transport sector has to deal with an increasing demand to transport bulk cargo for large distances, mainly to be exported via sea ports. This cargo should ideally be transported via inland waterways. Agricultural products (soy, wood, pulp), iron ore, ethanol are to some extent already being transported by barge in Brazil. Improving the IWT for these cargo types forms a basis for a solid inland waterway system. Furthermore, waterways users group could be enlarged by transporters of regional cargo and passenger transport. An example is container transport, ro-ro transport, or a more intensive passenger transportation network.

2. Start from a basis of current users

Facilitate and encourage the current users that can be the pioneers for larger scale IWT in Brazil. These current users form the basis for the strategic plan. They are the transporters of the rapidly growing flows of agricultural products (soy, wood, pulp), iron ore, ethanol that need to be transported on large distances to sea ports for export. Producers and shippers of these commodities have the best fitting demands in terms of speed, reliability and costs. These companies can set an inspiring example for other long distance or regional based cargo flows. Concerning passenger transport, improvement of the IWT transport system should start with current operators, inclined to lead the way.

A list of commodities, current and future, that could be transported by inland waterways in Brazil is:

- Agricultural products: soy, soymeal, corn, sugarcane, sugar, ethanol, cotton, fertilizers;
- Wood and pulp;
- Chemical and oil products;
- Iron ore, manganese, steel and coal;
- Building materials and sand;
- Containers and Ro-Ro trailers.

The commodities in this list are to a large extend the same commodities as transported in Europe or the United States. The difference is in the amounts transported. In Europe the transport of containers is far more important for inland navigation compared to Brazil. Other products, like ethanol, are transported more in Brazil.

3. Build the network step by step

This navigability improvement should start with the rivers that are most urgently needed to be developed for the launching customers. By providing reliable transport conditions on the existing waterways, the mode gains credibility among the potential users and can further obtain cargo flows. Once the use of waterways has become common practice, other rivers can be added to the network. The navigability of the selected waterways needs to be improved by several measures, like dredging, building or expanding locks and rock demolition. The priority

of these measures is determined by willingness and opportunities at the regional level and the demand for cargo transport.

4. Build the network together

The waterway is part of a logistic and institutional system in which many stakeholders play their role. Therefore, the implementation of the plan should be a joined effort of all stakeholders involved. Most stakeholders have a positive attitude towards the initiative of the Ministry of Transport (MT) to develop a strategy for IWT, which at several levels should be used to reach a joined vision. Stakeholder engagement is considered very important for the development of the IWT and the successful implementation of the Inland Waterways Strategic Plan. Therefore, the development of this Plan considered stakeholder engagement throughout its strategy.

CARTOGRAPHIC ITEMS

- State Capital
- Borders
- Rivers Studied
- Water Surface
- Seaport
- IWT Terminal
- Main Highways
- Existent Railroads
- IWT in Current Operation

REFERENCES

Sources:
- Integrated Cartographic Base from Brazil - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA
0 162,5 325 650 km
GEOGRAPHIC COORDINATE SYSTEM, HORIZONTAL DATUM: SAD69

LOCATION

MINISTRY OF TRANSPORT

ARCADIS logos

INLAND WATERWAYS STRATEGIC PLAN

IWT IN CURRENT OPERATION

EXECUTED BY:	SCALE:	SHEET:	DATE:
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1.3 SCOPE

This Inland Waterways Strategic Plan (IWSP) was prepared in one year and provides a starting point for lift off the IWT. The analysis on the Brazilian IWT elements was done by desk research (assessment and diagnosis) and stakeholder consultations. The implementation process of this plan will provide confirmation and detailing of the recommendations.

This IWSP was prepared on national and regional levels. In the implementation phase of the IWSP details like the exact location of terminals, the selection of project partners and stakeholder and cost estimates need to be elaborated in more detail.

During the plan development the Ministry of Transport (MT) was closely involved by participating in workshops with the ARCADIS team and commenting the products.

The research topics and the geographical scope, considered in the development process of this plan, are presented in this chapter.

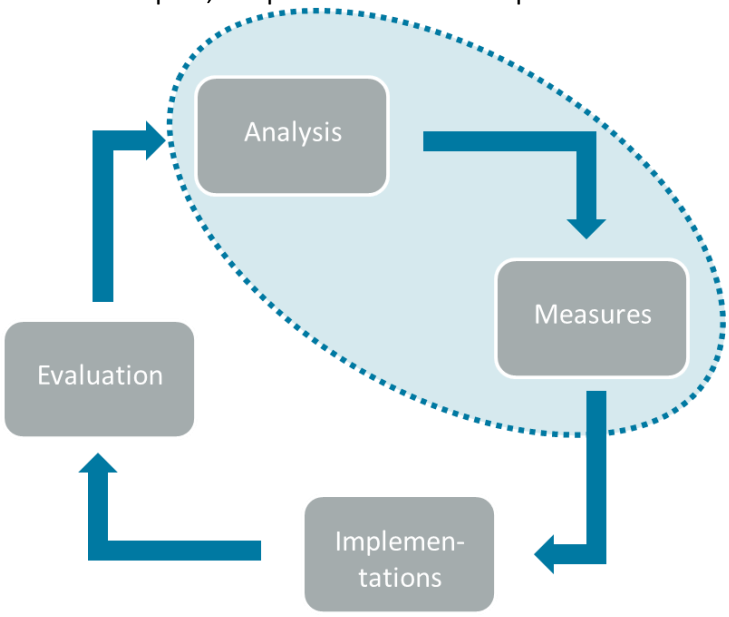

Figure 1.1: Scope of the project (two steps of policy cycle)

1.3.1 Main research topics

From the assessment and diagnoses of the current IWT system, it was possible to identify strengths and weaknesses of the current IWT sector and the opportunities and threats for future development. These served as the basis for defining the goal and strategies (main actions / guidelines) of the plan presented in this document.

During the analyses of the Brazilian IWT, several studies were done and reported. Previous reports are:

1. Work Plan Report;
2. Public Consultation report: Stakeholder Consultation;
3. Report on Diagnosis and Evaluation;
4. Report on Elaboration and Evaluation of Strategies.

As the starting point of the process of developing this plan a participatory diagnosis was conducted through interviews with some selected groups of stakeholders, which resulted in the Stakeholder Consultation report. The interests of different groups were considered for the characterization of the current IWT system, combined with a more detailed analysis and diagnoses of the themes.

The IWT system in Brazil was analyzed during the Diagnoses and Evaluation phase in two levels, the macro and regional levels, and considered the following elements: physical river system, environment and social aspects; economic aspects, transport system and governance & institutions.

1. The physical river system and environmental and social diagnoses analyzed the main impedances related to navigability conditions that hinder the use of a waterway or obstruct navigation on certain stretches of the river. The environmental characteristics that may, to some extent, increase the level of complexity of the licensing process required for the implementation or expansion of waterways were also described.

2. The economic aspects were essential to identify the main IWT commodities and passengers flows and consequently determine potential future flows by the year 2031.

3. The transportation system addressed the components of IWT (fleet, costs, crew, etc.) in order to assess competitiveness with the road and rail modes in terms of costs, accessibility to the IWT market and system reliability.

4. The governance and institutions research made it possible to understand the legal and institutional framework in which IWT operates and portrays governance in Brazilian waterways and, consequently, identify bottlenecks and strategic points which should be targeted for specific actions.

A benchmark was carried out as a part of the assessment and diagnoses phase. This was also based to the elements mentioned above, enabling a direct link with the Brazil´s system. In order to gather inspiration for the development of this plan, the inland waterway transport (IWT) in Europe (EU) and the United States (US) were chosen as a benchmark for Brazil, due to their well-developed IWT system.

The Strategies Report elaborates and compares several options for the future development of inland waterway transport in 2031.

1.3.2 Geographical scope: Selection of rivers

The selection of the river sections with potential for commercial navigation was carried out in several stages of the elaboration of this plan. The selection process aimed to define the river sections that should receive more attention in the diagnosis and evaluation of the current system and in the strategy elaboration.

First, a preliminary assessment of the national waterway system was conducted based on the rivers presented in the technical proposal, which are: Amazonas / Solimões - main channel and tributaries, Madeira, Tapajós, Juruena and Teles Pires, Tocantins and Araguaia, São Francisco, Parnaíba, Tietê and Paraná, Paraguay, and Mirim and dos Patos Lagoons.

A preliminary list of river basins and rivers to be studied was prepared. It was then made compatible with the river sections that DNIT/DAQ, together with Waterway Administrations, also considered relevant for the study. This list was submitted to the Ministry of Transport, who had requested the inclusion of the Uruguay River. The final list of river includes eight of the twelve Brazilian hydrographic regions, where 63 rivers and one canal were analyzed, covering about 35,000 km of rivers.

It is worth mentioning that in this work fourteen rivers listed in the National Transport Plan of 1973 (PNV 1973), four of which are federal, have not been addressed. The potential for commercial navigation and passenger transport were not identified in those rivers that could justify their inclusion in the analysis, with reference to the horizon of the study the year 2031.

Figure 1.2 explains the difference between selection of waterway stretches in the PHE and other studies. The total length of waterways in Brazil is 42.000 km. Only half of it (21.000 km) is currently used for inland waterway transport. This includes very small rivers with limited transport (e.g providing remote villages in the Amazon region with food and other supplies). About 1/3 of the used waterways (6.500 km) is considered in PHE as principle waterways for commercial inland waterway transport. If the proposed strategy is effectuated, the length of principle waterways is extended to 9.500 km. Part of this extension is outside the currently used 21.000 km.

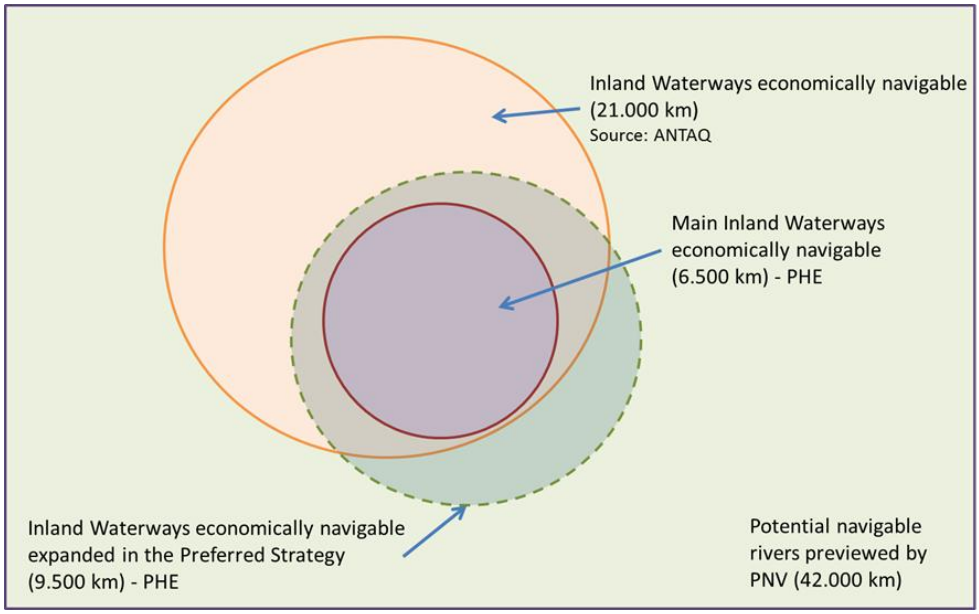

Figure 1.2: Explanation of the difference between selection of waterway stretch in the PHE and other studies

1.4 CONTEXT AND RELATION TO OTHER PLANS

1.4.1 Relation to other plans

In Brazil navigation had an exploratory purpose until the 50s. With the development of settlements along the rivers, the inland waterway transport focused more and more on the

small trade and passenger transport between cities along rivers. This was observed in rivers such as the Amazon River, Tocantins, Madeira, Paraná, Paraguay and Parnaíba.

Even with significant potential for expansion of commercial navigation, the Brazilian economy is still very dependent on roads. The continental dimension of the country suggests that greater relevance should be given to more efficient transport modes that would enable to overcome long distances with lower average costs, such as railways and waterways. Much of the public investments are still in favor of improvements in the road infrastructure, although in recent years major investments are aimed at expanding and modernizing the railways.

Although the Federal Government initiatives such as the National Transport Plan (Plano Nacional de Viação) and the National Plan for Internal Navigable Waterways (Plano Nacional das Vias Navegáveis Interiores), little investments in waterways were observed between the 80s and 90s.

In 1973 the National Transport Plan (PNV - Law no. 5,917) was presented and it aimed to "enable the establishment of an integrated road system infrastructure, as the basis for global transportation plans that meet, for the lowest cost, the needs of the nation, under the economic, social, political and military aspects."

With a focus on inland waterway transport, the Ministry of Transport developed the National Plan for Internal Navigable Waterways in 1989, which briefly detailed the potential of the waterways presented in the PNV 1973. This plan comprised approximately 44,000 km of navigable rivers.

Despite these initiatives, the 80s and 90s witnessed a reduction of the technicians working with transport planning and low levels of investment in transport infrastructure. This stagnation is visible even today in the development of inland waterway transport, despite increasing public investment in this transport mode in the last years.[2] The government has invested, for example, 965.5 million dollars in the construction of locks for the Tucuruí complex. In addition, agreements on long-standing cooperation for sharing knowledge with other countries, such as the Netherlands and Belgium, were signed.

Aiming at improving the logistics system of the country, the Federal Government has been making efforts, through the Ministry of Transport, to provide the transportation sector with a strategic vision.

The PNLT, National Plan for Logistics and Transports, elaborated in its first version in 2007, is considered a milestone in the retaking of strategic sectorial planning. The plan guides the implementation of public and private actions in the transport sector to meet political demands for integration, development and overcoming inequalities.[3]

[2] An example of this consists on the investment of $ 965.5 million, from the federal government, in the construction of the Tucuruí locks, in Tocantins River. Moreover, long-term agreements of cooperation were established with countries like Holland and Belgium, for the transfer of knowledge about the inland waterway transport.

[3] PNLT, 2011, página 1

Within the goal of the Ministry of Transport to increase participation of the inland waterway transport in the transport matrix, the document Guidelines for the National Waterways Transport was released in 2010, which provides general guidelines for the promotion of inland waterway transport in Brazil. The document was prepared based on the goals of the National Plan for Logistics and Transport – PNLT, in alignment with the National Plan on Climate Change and in harmony with the multiple uses of water and the integrated planning of water resources. Guidelines for the National Waterways Transport establishes a portfolio of priority locks and proposes actions to remove some obstacles that hinder the development of IWT in Brazil.

ANTAQ recently released the National Plan for Waterway´s Integration - PNIH that aims at selecting potential locations for inland waterways terminals, developing a terminal database and software for ANTAQ usage, identifying the current and future main routes and transported cargo. However, the IWSP has a wider scope, in which institutional, economic, physical river system and transport legislation analysis were carried out.

The development of this Inland Waterway Strategic Plan is part of the recent strategy of the Ministry of Transport to increase the participation of the waterway in an integrated transport matrix by means of establishing guidelines for the development of the sector, based on the PNLT.

1.4.2 International context

The IWSP study focused on the waterways in Brazil and this means that river border crossings between Brazil and the neighboring countries were not taken into account. The analysis of these river crossings requires a separate study, which should consider, for example, the comparison of laws and regulations of different countries. However, it is important to mention that inland waterways can play an important role in the integration of the countries by means of encouraging not only cross-border economic integration, but also tourism and people integration. This will become particularly important as international trade is growing and MERCOSUR[4] will become stronger.

Brazil has three important hydrographic regions which connects Brazil to the neighboring countries: the Amazon, in the north, the Paraguay-Paraná-Uruguay (that compose the so-called Plata Basin) and Atlântico Sul, in the south. These basins are briefly described below from an international IWT perspective.

1.4.2.1 Amazon Region

Important international initiatives have been developed aimed at providing more integration to this region, such as: ACTO, UNASUR and IIRSA.

Eight countries connected to this region - Brazil, Bolivia, Peru, Ecuador, Guyana, Suriname, Colombia, Venezuela - signed an International Cooperation Treaty in 1978 and take part (through the Ministry of Foreign Relations of each country) on the Amazon Cooperation Treaty

[4] MERCOSUR is a common market (Southern Common Market) based on the Treaty of Asuncion signed by four countries Argentina, Brazil, Paraguay, and Uruguay on March 26, 1991. It aims at promoting free trade of goods, services, and production inputs.

Organization (ACTO), which coordinates studies and projects in the region, mainly in areas like infrastructure, transport and communications.

Also, UNASUR, created in 2008, aims at integrating 12[5] participant countries and 2 observers in the following aspects: energy, education, health, environment, infrastructure, safety and democracy.

IIRSA – an initiative to integrate infrastructure within South America that has been promoted by COSIPLAN (South American Council for Planning and Infrastructure for the UNASUR countries) – has organized seven Working groups to address specific Amazon waterways (Putumayo, Napo, Huellaga, Ucayali, Solimões, Amazonas and Morona-Marañón).

The main future transport connection to the north is between Manaus, on the Brazilian side, and Peru and Colombia upstream. Several projects have been carried out to analyze the feasibility of IWT between Peru / Colombia and Brazil. Currently, the transport volume is very low; in 2010 no international transport was registered by ANTAQ.

1.4.2.2 Plata Basin

The IWT along Paraguay River is already important for Brazil as well as for other countries, like Paraguay, Uruguay and Argentina. Iron ore and manganese are shipped by IWT from the Corumbá mines in Brazil to the seaports at the Plata River in Argentina / Uruguay. These flows are expected to increase steadily according to the PHE forecasts (based on Plano Nacional de Mineração, 2010)

The Paraná River runs along the border between Brazil and Paraguay for about 200 kilometers. Border crossing transport on the Paraná River occurs, but not to a large extent. In the Paraná-Tietê waterway, international transport takes place exclusively between the terminal Santa Helena (PR) and terminals in Paraguay (Puerto Itaipú Pora and others), by crossing the lake of Itaipú (total distance 30 km). The total amount transported (both directions together) was about 250.000 tons in 2010. The stretch Santa Helena - Puerto Itaipu Pora was used only for export (just over 59.000 tons), mainly fertilizers. The cargo imported by Brazil (190.000 tons) was predominantly corn, wheat and cassava.

Also, considering the short distance (on average 30 km), total international IWT transport performance in this region is still rather limited.

The absence of a lock in Itaipú dam prevents the full integration of the so-called MERCOSUR waterway that would enable connection between Tietê-Paraná and Paraguay/Plata-Paraná waterways, intensifying commuting and economic flows within Paraguay, Argentina, Uruguay, Brazil and Bolivia.

Back in 1969, when the Plata Basin Treaty was signed, it was defined that once a year the Ministry of Foreign Relations from the five aforementioned countries should meet to promote the regional integration. Enabling better navigation conditions between the countries were already considered relevant at that time.

[5] Participant countries: Argentina, Bolívia, Brazil, Colombia, Chile, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay and Venezuela. Observers: Mexico and Panamá.

Currently, under UNASUR and COSIPLAN, the Initiative to Integrate South American's Infrastructure (IIRSA) has been developing studies for the "Paraguay-Paraná Waterway Axis". As the construction of the lock might not be implemented on the short and medium terms, an analysis is being conducted, to propose ways to provide better navigation conditions and implementing better transshipment structure for cargo transport. There is cargo transport crossing the boarder between Brazil and Paraguay through Itaipu's lake.

1.4.2.3 Atlântico Sul H. R.

The Atlantico Sul hydrographic region connects - through Jaguarão River, Lagoa Mirim, São Gonçalo channel, Lagoa dos Patos and Miguel da Cunha channel – Uruguay and Brazil, enabling an fluvial export exit through the Atlantic Ocean.

In a presentation6 about the future of Inland waterway Transport in Rio Grande do Sul, Lagoa Mirim is considered to be an area with a medium to long term potential to strengthen the relation between Brazil and Uruguay. Lagoa Mirim is about 174 km long and 10 to 35 km wide, more irregular in outline than the Lagoa dos Patos, and discharges into the latter through São Gonçalo Channel, which is navigable by small boats. Lagoa Mirim has no direct connection to the Atlantic Ocean, but the Miguel da Cunha Channel, a tidal channel about 39 km long, which connects Lagoa dos Patos to the Atlantic Ocean, affords the access to the navigable inland waters of both lagoons and several small ports. The southern part of the lake lies in Uruguayan territory, but its navigation, as determined by a treaty, belongs exclusively to Brazil.

Also, it is currently an IIRSA initiative to promote the "MERCOSUR-Chile axis" and within this axis, a working group named "Porto Alegre – Argentina/Uruguay Limits – Buenos Aires" has been studying ways of adjusting and strengthening multimodal transport between Lagoa Mirim and Lagoa dos Patos.

1.5 CONTENT OF THIS DOCUMENT

This Inland Waterways Strategic Plan contains the strategy and recommendations to reach the main goal: the development of a successful IWT. The plan has the following elements:

- Development goals on the focus areas;
  - A short, medium and long term action plan for interventions in infrastructure
  - Governmental/organizational/legal recommendations.
- Publicizing plan;
- Monitoring plan;
- Investment plan
- Database.

[6] Inland Waterways Development in Rio Grande do Sul, W. Ruijgh (Amports) and H. de Leijer (NEA), November 9th 2010.

2 GENERAL CONTEXT

The IWSP aims to approach the issues that restrain the development of IWT and take advantage of the opportunities that will occur in the future. This chapter provides a summary of the main issues and opportunities identified in the assessment and diagnosis phase of this plan and mentioned in the interviews with stakeholders.

2.1 CARGO TRANSPORT

About 25 million tons was transported on inland waterways in Brazil in 2011. This cargo flow was distributed over a limited number of waterways and the majority was transported over long distances (over 500 km). Given the potential of commodities suited for the transport on inland waterways in Brazil (large volumes of bulk cargo over long distances) many opportunities were identified for the development of IWT.

Exports of Brazil have grown considerably in the last decade and almost all exports use seaports to reach the main importing countries, like China and western European countries. The transport on inland waterways of the main agricultural products like soy, soymeal and corn was exclusively export orientated and this was also true for iron ore and manganese, two other important commodities for inland waterways. The most important domestic flows are the chemical products and oil on the Amazon. In the Amazon region no consistent alternative for inland waterway transport is structured, therefore, almost all transport is based on waterways.

When the forecasts for production and exports of important commodities are considered, the prospects for inland waterways in Brazil are very good.

The agricultural production of soy and corn, the two main crops in Brazil, will continue to expand until 2031, the forecast horizon. For example, in Mato Grosso, where the export of soy, soymeal and corn currently experiences problems, especially in the harvest season in the transport to ports like Santos and Paranagua due to heavy traffic congestion and capacity problems in the port (waiting times can be as long as 30 days), but the export of Mato Grosso is still predicted to increase 67% by 2031 (FIESP_ARCADIS forecasts). This illustrates highlight the necessity of taking drastic measures. One of these measures is increasing the share of IWT by improving existing routes and creating new ones, not only for Mato Grosso, but also for other main producing areas in the south and new producing areas in the Northeast (MATOPIBA).

Import of commodities will increase as well, again based on FIESP forecasts. An example is the transport of fertilizers, which are important for agriculture and are mainly imported. Although the share of domestic production of fertilizer is predicted to grow to about 50% of domestic use (FIESP), imports will also still grow and inland waterway transport can play a role in the cargo transport from seaports to the hinterland.

The Amazon River and the Lagoa dos Patos in the south play an important role in short sea transport (between ports in Brazil through a sea route). The Amazon River up to Itacoatiara is even used for deep sea vessels.

CARTOGRAPHIC ITEMS

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REFERENCES

Sources:
- Integrated Cartographic Base from Brazil - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA
0 162,5 325 650 km
GEOGRAPHIC COORDINATE SYSTEM, HORIZONTAL DATUM: SAD69

LOCATION

MINISTRY OF TRANSPORT

ARCADIS logos

INLAND WATERWAYS STRATEGIC PLAN

IWT IN CURRENT OPERATION

EXECUTED BY:	SCALE:	SHEET:	DATE:
ARCADIS logos	1:17.000.000	- BRASIL -	2013

Current Inland waterway transport of chemical products, oil and coal and Ro-Ro transport will steadily increase. The production of oil and chemical products will grow at approximately the growth of GDP (5% until 2022 and 3% afterwards till 2031). For the forecasts it is assumed that the growth rate will be 5% till 2023 and 3% from 2023 to 2031. Iron ore and other ores (mainly manganese) also show growing exports (mainly to China). The export of iron ore, for example, is expected to grow from 330 million tons in 2011 to 829 million tons in 2031 (source PNM). Especially the transport on the Paraguay River could profit from growing production and other rivers like the Tocantins River can function as an additional export route, beside the Carajás rail track.

Another potential projects for developing inland waterway transport is the construction of new plants and systems that will be built near waterways to profit from a cheaper and reliable transport mode. In most cases this will not be a gradual growth, like in the agriculture sector, but once a plant is ready for production, the maximum production capacity will soon be reached. It is important to point out that these investments mostly generate big flows. Key examples are the steel plant in Marabá, the pulp factories in Três Lagoas and Guaíba and the ethanol system in the states of Sao Paulo and Mato Grosso do Sul. This will increase waterway transport on respectively the Tocantins River, the Paraná – Tietê Rivers and the Lagoa dos Patos significantly. It is likely that, once these investments in plants are realized other companies may follow. Therefore, the waterways should be improved “just in time” to accommodate the new demand for waterway transport.

2.2 PASSENGER TRANSPORT

Passenger transport on inland waterways in most parts of Brazil only occurs under special conditions being, for example, an alternative transport mode in some cities to overcome traffic congestion in rush hours.

In the Amazon region, however, passenger transport on waterways is very important, with currently 6 million long distance passengers and an expected growth of 40% up till 2031 (Report on Diagnosis and Evaluation). Also short distance (ferry) services are important is this area, with an equal amount of passengers. The main reasons for this particularity in this region are its extensive river system and the limited number of roads in this vast area. For a large number of destinations transport on waterways is the only means of transport.

Inland waterway passenger transport should be safe, reliable and comfortable and in order to improve the level of service, renewal of the fleet and terminals for passenger transport are urgently required.

Concerning the fleet renewal, it is observed that due to the low fare levels and the high costs of renewal, investment capacity of the private transport operators is falling short. As inland waterway passenger transport in the Amazon region can be considered as a public service from a socio economic point of view, the improvement of the service level can be seen as a case for public intervention. This service could be given in concession to private companies though. Fiscal or other financial instruments (e.g. tax cuts for investments in fleet) could boast investments in fleet renewal and other service improvements, by private transport operators, especially in the dominant IWT region, the Amazon.

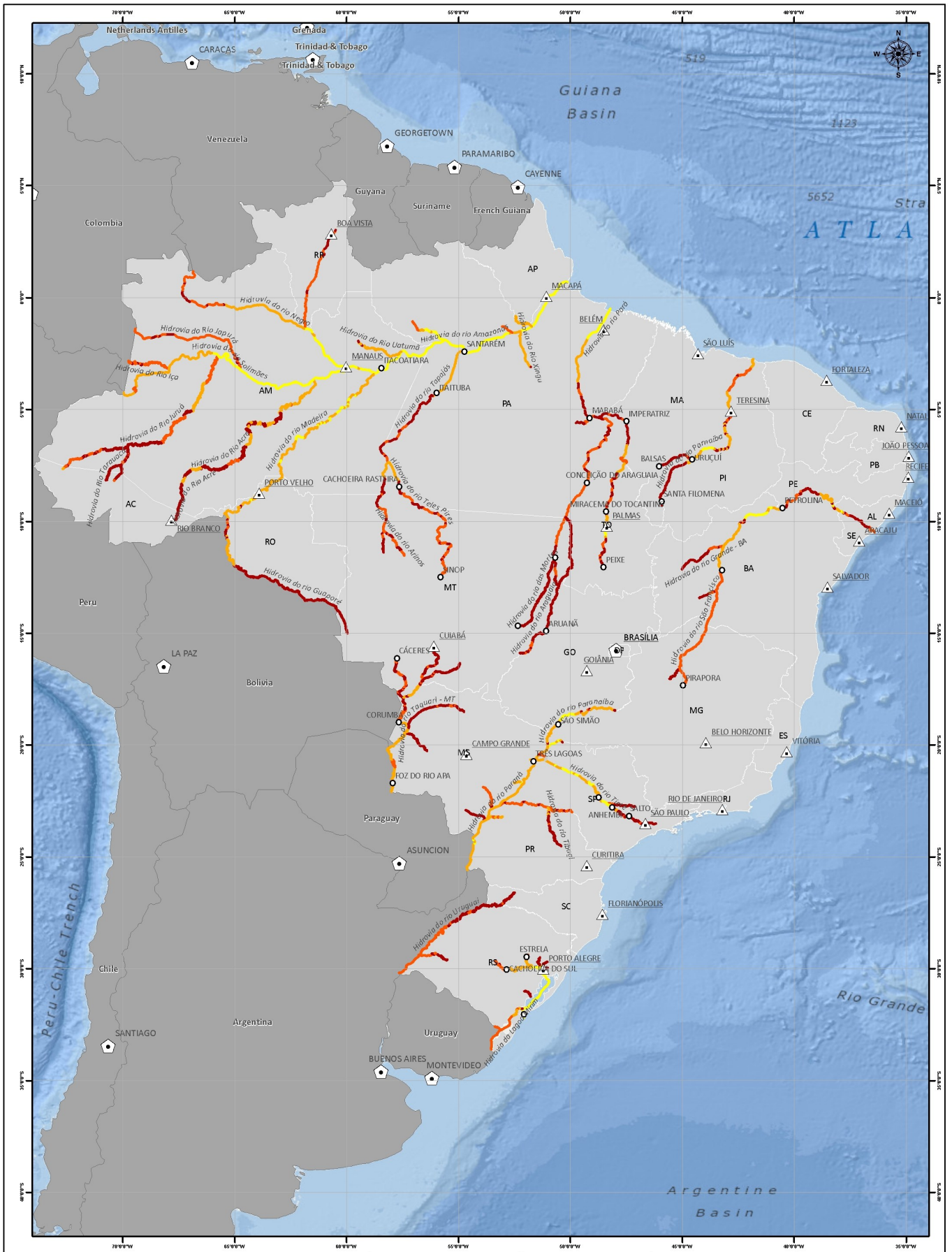
2.3 NAVIGABILITY CONDITIONS

The Brazilian rivers studied in this plan have distinct characteristics in terms of their physical conditions of navigability and this is the result of different topographical, geomorphologic and hydro-meteorological characteristics along the river basins.

The most favorable rivers for navigation are generally those with features of lower course or lowlands, characterized by a gentle slope and are fairly regular and large. Their main obstacles are areas with sand banks. Within the national scenario, the main rivers of lowlands that have extensive stretches with favorable characteristics for navigation, and without the need for major interventions, are the Amazon, Solimões, Trombetas, Madeira, Paraguay and Jacuí Rivers, Lagoa dos Patos, and the downstream sections of Tocantins and Tapajós rivers. All these rivers already have commercial navigation in varying levels of intensity.

There are also the rivers of tableland or in upland, which have more restrictive conditions for navigation, featuring sections with natural obstacles such as leaps, rapids, rocky indents and outcrops and shallow depths stretches, and also sections with more satisfying navigability conditions. In the river sections with these characteristics commercial navigation is possible in most cases during the flood season, when the water levels are higher. During droughts, however, the navigation conditions are too restrictive, when natural bottlenecks emerge in the river bed. In these rivers the necessary hydraulic works and interventions involve considerable investments.

The main upland rivers that have navigable stretches are: Paraná, Tietê and São Francisco. Several interventions have already been made to allow the current navigability conditions. Besides the rivers mentioned above, the rivers with more potential for the development of waterways are the Tocantins, Araguaia, Tapajos, Teles Pires, Parnaíba and Uruguay. To be able to navigate at a reasonable scale these waterways need engineering works (mainly dams).



CARTOGRAPHIC CONVENTIONS

Locational References

- National Capital
- State Capital
- City
- State Boundary
- National Boundary

Weighting scale of the themes

1 - 5 (Low - High)

- IN - Insignificant
- LO - Low
- AV - Average
- HI - High
- VH - Very high

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ESCALA GRÁFICA

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL SAD69

MAIN LOCATION

MINISTÉRIO DOS TRANSPORTES

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PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

NAVEGABILITY CONDITIONS

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
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2.4 SOCIAL AND ENVIRONMENTAL ASPECTS

The waterway transport is the most suitable for more sensitive areas, because of its lower impact on the environment when compared to roads and railways. Even though it is necessary that the planning of the engineering works, needed for making the development of this mode, is done with the minimum impact on the environment. In the case of the Paraguay, Uruguay, Amazon and Madeira waterway systems the planning of works must also consider the interests of neighboring countries.

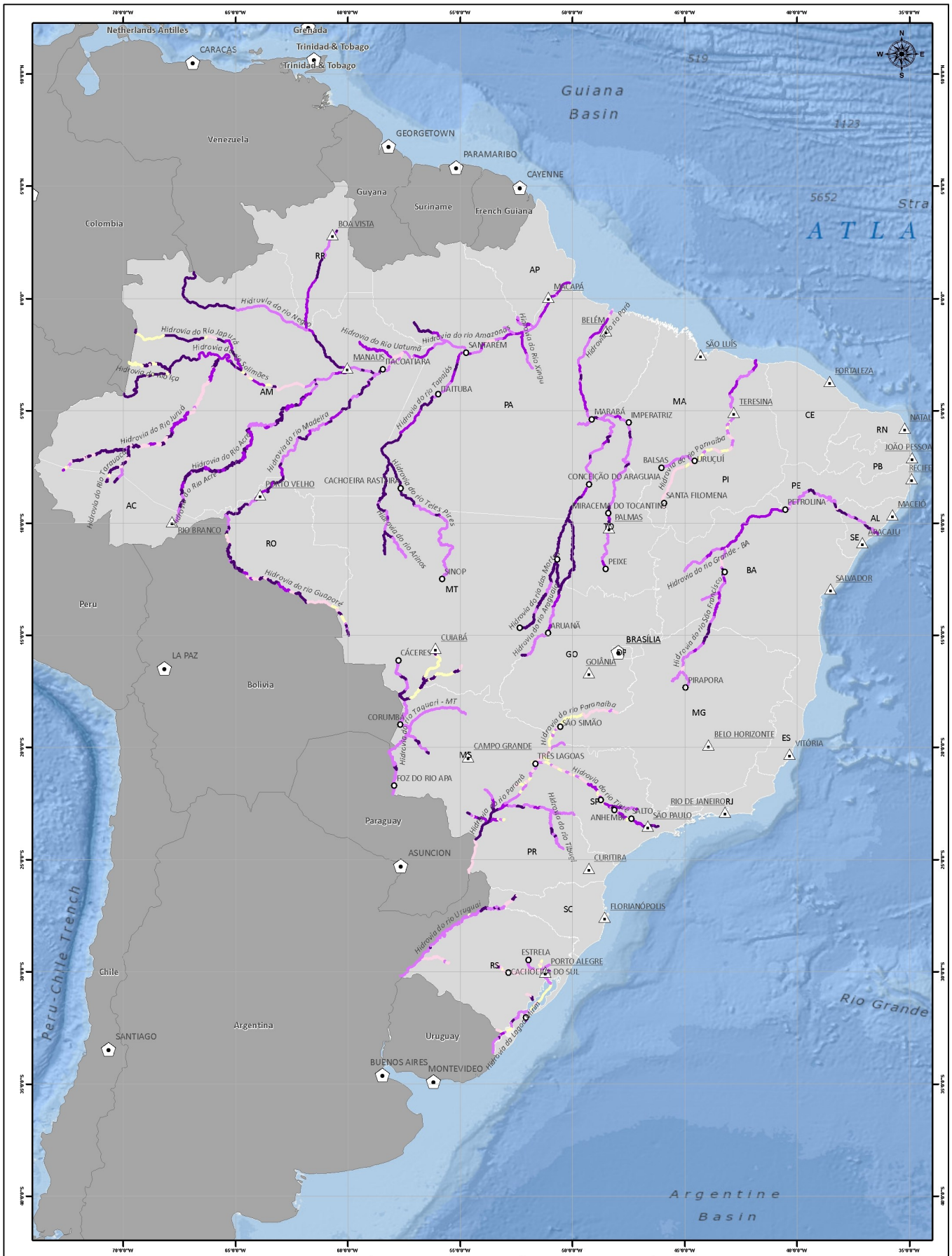
Rivers located in areas of particular importance to biodiversity conservation, such as the Amazon biome (Amazonas, Solimões, Trombetas and Madeira Rivers) and wetland (Paraguay River) are already used for the transport between local communities and even for the cargo transport.

Although already used for commercial navigation nowadays, Amazon and Madeira waterway systems have in their surroundings legally protected areas, where the presence of indigenous lands and protected areas and other areas of conservation interest are highlighted. A similar situation is observed in the Paraguay system, located in an area of importance for biodiversity conservation (Pantanal Biome). And, although Teles Pires-Tapajós waterway system is not yet used for commercial navigation, it crosses an important conservation area not only for biodiversity preservation purposes, but also due to traditional communities living close to the rivers (Munduruku, Apiacás and Kayabi Indigenous communities, among others); mainly on the area that surrounds the confluence of Juruena and Teles Pires rivers. It is important to emphasize that all future interventions to provide additional capacity for navigation purposes to these rivers needs to take these protected areas into account while planning to avoid/minimize potential social and environmental impacts.

In the Tocantins-Araguaia waterway system the presence of Bananal Island needs special attention. This island is the largest river island in the world and delimits two arms of the Araguaia, being the smaller arm known as Javaés River. This island, the transition zone between the Amazon and the Cerrado biome, concentrates great biodiversity and legally protected areas, indigenous land (Karajá, Javaé and Xambioá Indigenous Reserves, among others), and was established by UNESCO as a Biosphere Reserve.

The rivers included in the semi-arid region (São Francisco and Parnaíba Rivers) deserve special attention. Dams and projects for flow adjustments, necessary to ensure the viability of the waterway, need to be evaluated together with the other uses of water resources to ensure that the development of waterways do not impact the water availability in nearby regions.

Waterway systems on the southern region (South, Uruguay and Tietê-Paraná) are located at a more anthropized area and environmental and social vulnerable areas are less spread. Worth mentioning on Paraná river are two important national parks (Parque Nacional do Iguaçu and Parque Nacional Ilha Grande), that are conservancy areas of integral protection (legally protected areas). The lakes in the South waterway system (Lagoa Mirim and Lagoa dos Patos) have a great importance for biodiversity conservation.



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ESCALA GRÁFICA

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL SAD69

MAIN LOCATION

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

ENVIRONMENTAL VULNERABILITY

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1:17.000.000	- BRASIL -	AGO/2013

2.5 ADVANTAGES OF INLAND WATERWAYS TRANSPORT

Inland waterway transport has many advantages over other modalities. This mode is considered to be energy efficient and environmental friendly.

Although marine engines are usually a bit bigger than lorry engines, vessels carry much more cargo at once. Per ton, vessels will show a lower fuel consumption and environmental impact.

Table 2.1: Emission indices for road, rail and IWT (2011)[7]

	Road	Rail	IWT
CO2	100	11	6
Nox	100	86	29
SO2	100	25	31
PM10	100	78	71

In Table 2.1 the emission of different modes is compared for a truck (23 tons), a train (2.500 tons) and a convoy (12.000 tons), excluding pre-haulage and end-haulage. The figures favor rail and IWT transport.

In the future all modes of transport will be more environmentally friendly due to better engines. For road this is especially the case for NO_x and PM_{10}. The fuel use will not go down drastically. This implies that CO_2 emission will be at the same level as currently. For IWT the possibilities will be especially in lower fuel use (less CO_2).

Regarding social opportunities, this mode is considered to safe, reliable and less expensive. Congestion on the roads is a major concern in certain regions, especially close to big cities, and has its impact on the reliability of the road transport. Inland waterway transport is a reliable way of transport. In Europe whether for reliability, on-time delivery or customer friendliness, inland navigation is always awarded high if not the highest of all the modes of transport[8].

Table 2.2: Cost comparison in R$ per ton and indices (road transport = 100%)

km	Road	Rail	IWT	Road	Rail	IWT
	R$ per ton			Indices		
100	49.46	13.0	5.04	100	26	10
250	73.42	25.5	9.50	100	35	13
500	113.36	43.0	16.94	100	38	15
1000	193.23	72.0	31.81	100	37	16
2000	353.31	120.0	61.56	100	34	17

[7] Source Stream 2.0 (CE 2008)
[8] The power of inland navigation, the future of freight transport and inland navigation in Europe 2013 – 2014 (page 24)

In Table 2.2 a cost comparison[9] is given for different modes for a number of distances (in km). Comparing transport costs is not straightforward because all modes have their own characteristics. The costs are for bulk transport in trucks, bulk trains and 2x2 convoys (with four locks in the waterway for all distances). According to the cost models, IWT cost is about 10 to 17% of road costs. This does not include transshipment costs[10]. Rail transport is about twice as expensive as waterway transport.

2.6 INSTITUTIONAL FRAMEWORK

The legal-institutional framework was analyzed in the diagnosis phase with a focus on the following topics: the constitutional principles of the Brazilian environmental law, the national environmental policy, the national policy on water resources, a historical approach of the port sector, a historical approach of the waterway sector important aspects regarding international rivers.

It was observed that the structure of the waterway management is inefficient, because of:

- The separation of the management of ports and waterways;
  - Organization of the waterways managements mainly under DNIT's structure, a department notably focused on the road management;
  - The fragility of the instrument (agreement) that ties the Waterways Administrations to DNIT / DAQ via CODOMAR;
  - Recent changes in ANTAQ's role, that moved from the Ministry of Transport to SEP;
  - Concerning passenger transport, regulators (DNIT/ANTAQ/SETRAN/CPH) overlap.
- The multiple uses of water resources are not managed centrally;
- The investments in waterways in Brazil have a low priority;
- There is a need to differentiate among licensing process for engineering works required to enable a waterway and for maritime structures;
- Participation of EPL with regard to the planning of integrated logistics for the country is yet new and;
- CONIT could give further support in integrating actions among different interests associated to the waterways feasibility.

[9] The sources fort his comparison are the cost models from the University of Sao Paulo (road + IWT) and PNLT (rail).

[10] For more complex routes including more than one mode of transport, transshipment costs and the costs of pre-haulage and/or end haulage have to be included. The transshipment costs have been estimated as R$ 5 per transshipment.

2.7 REGULATORY ASPECTS

IWT regulations were identified as relevant when related to the following aspects: ship building, crew, taxes and terminals.

It has been pointed by some stakeholders that there are no big ship building players on the inland shipyards market, which may lead to difficulties in expanding their production when higher demands are expected. It has also been stated that the problem is not related to the shipyards themselves, but to the financial agents that spend more than a year to approve the projects, expiring the credit.

Another point of attention to the inland navigation regards the crew. The shipping companies are already experiencing a lack of qualified personnel in this area, mainly due to the competition with the offshore market, which also undergoes the same problem. It has been mentioned that there are initiatives to set up courses for training people to this activity (as the law allows courses outside the Navy, but with their approval), however, it has been proved to be difficult to establish them.

The Brazilian fiscal system was also stressed as a problem to develop the IWT by some stakeholders, as in some cases the taxation process leads to additional costs to IWT transport (e.g. in the case of transshipment between modes), but this might not be a general problem. Some problems in the inland terminals were also pointed out. The need for new terminals have been identified by some stakeholders, but the former process to obtain authorization for private terminals was rather slow, with a lot of requirements to be met. Because the new ports legislation is not yet regulated, some projects are delayed. Although this ports/terminals issue is highly important for the IWT development, measures for improving ports and terminals is not within the scope of this project.

2.8 WATERWAY MANAGEMENT SYSTEM (OPERATION)

The information systems related to the waterways are often not available, and in general, not concentrated into one authority or well connected.

In the Tietê-Paraná waterway the information system is more organized. Data regarding the waterway situation is provided by the hydro-power plant operator, the DH (Departamento Hidroviário) and the Navy. The shipping companies must also supply several authorities (Navy, Power Plant operator, ANTAQ, and others) with data that concerns their voyage, but not in a centralized and electronic way. Comparing the Brazilian and European/American situation, it has become clear that this type of process in Brazil is not very efficient.

2.9 INTERMODALITY

It is expected that the importance of intermodal transport chains, that include IWT, will increase in the near future. The most important reason is the expected cost increase of road transport. With that, it can also be expected that long distance road transport will decrease gradually encouraging a growth path for integrated transport chains.

Increased use of intermodal transport with IWT has a number of implications for the cooperation between modalities. In the first place the costs of transshipment will decrease. In the calculations R$ five (5) per ton is used for transshipment.[11]

Most of the potential commodities to be transported on waterways have an overseas final destination, which makes the export port the final point. The choice of a deep sea port defines the route that will be used to transport the cargo, and therefore the logistics chain.

In general, the pre-haulage is done by means of trucks that often used roads under bad traffic conditions (not paved, with several holes), increasing transit time and therefore the total cost.

Besides that, transshipment increases the total cost, as not all the waterways reach the deep sea ports, so not only the pre-haulage is necessary, but also an end-haulage. In some cases, specifically, the Tietê-Paraná waterway, an additional tax is charged over this operation, due to the change of the transport mode.

[11] Information from the interviews done in the Stakeholders step.

3 MAIN GOAL AND SUB-GOALS

3.1 MAIN GOAL

The main goal for this Inland Waterways Strategic Plan is formulated as follows:

Accommodate 120 million tons of cargo by inland waterway transport in 2031.

This goal is deemed both ambitious and realistic because:

- It is 4 to 5 times the current inland water cargo flow;
- It is based on realistic forecasts for commodities suited for IWT (large bulk flows (agricultural, ores), long distance);
- The production areas for those commodities are within limited distance to inland waterways.

Three important assumptions that support the expected growth and are related to the commodity segments and their own characteristics are:

a) Autonomous growth of existing IWT flows in no or restricted competition with other transport modes.

b) Additional IWT flows resulting from investments in processing plants and logistic systems, which will use waterways.

c) Current and additional IWT flows in heavy competition with other transport modes and chains.

A modal share can be calculated for competing markets. This calculation illustrates the relative increase of importance that is aimed for. The current modal share of IWT for the main relevant commodities (soy, soy meal, corn and fertilizers) is approximately 9% in terms of ton-kilometers (taking into account both volume and distance). For 2031 the modal share is expected to grow towards 38-39% for these commodities in ton-kilometers, more than four times the current share.

Improving the situation of IWT for the most promising cargo types forms a basis for the development of the inland waterway system and this could result in lower logistic costs and higher competitiveness for the Brazilian products in the international markets.

In addition, waterway's users group can be enlarged by including some shippers of regional cargo and passenger transport. Passenger transport by inland waterways is also expected to increase, especially in the Amazon Region, due to the economic and population growth of the region and the investments in waterways by the Brazilian Government.

3.1.1 Sub-goals

The Inland Waterways Strategic Plan contains a strategy that should accommodate the growth of inland waterway transport by facilitating the capacity and the quality of the inland

waterway's network. The axes for this strategy are two sub-goals, both equally important to reach the main goal.

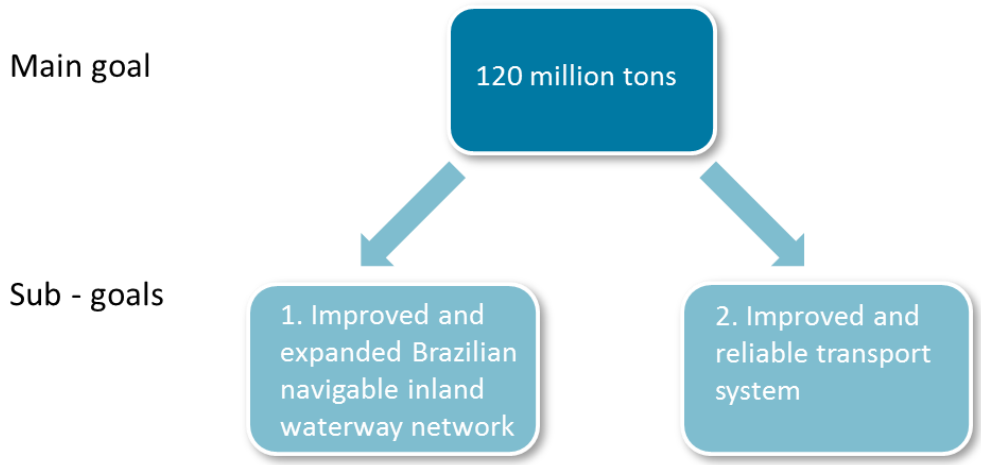


Figure 3.1: Main and sub goals

The first sub-goal is formulated as follows:

Improved and expanded Brazilian navigable inland waterway network.

Brazil currently has an extensive network of navigable rivers or with the potential to become navigable. The goal of MT is to improve the quality and expand the waterways network of Brazil in order to optimize its commercial potential and, therefore, more rivers should be navigable and the currently navigable rivers should be improved.

The potential waterway net estimated by "Plano Nacional de Viação" - PNV is about 42,000 km. From that ANTAQ estimated that only 21.000[12] corresponds to currently economically navigable routes, based on the records of the use of the waterways by Empresa Brasileira de Navegação, in the provision of cargo transport services and inland waterway passenger and mixed (passenger and cargo).

The PHE (Plano Hidroviário Estratégico) focuses on the rivers that can facilitate / optimize the logistics of the Brazilian economy for the cargo that is most suitable for inland waterway transport. These commodities require the waterways that connect the inland to the main ports, since it is mostly import and export of major commodities and passenger based on the values of current and future production/transport. Thus, from the count held by ANTAQ only 6,500 kilometers of rivers are considered relevant and currently used for such cargo flows.

To be able to use the waterway network to its full commercial potential, more rivers should be navigable and currently navigable rivers should be improved. The main existing waterways should be improved and the waterway network should be expanded with more than 3.000 km (46% of increase compared to the relevant by stretches of rivers, which are not yet used for this large scale transport of cargo.

[12] ANTAQ, NAVEGAÇÃO INTERIOR, SUPERINTENDÊNCIA DE NAVEGAÇÃO INTERIOR – SNI 3º TRIM/2012

The waterways should have a basic navigability condition and this means that, in most cases, a convoy of 2x2 barges should be able to use the waterway. For a number of waterways this is not the case in the current situation.

The second sub-goal is formulated as follows:

Improved and reliable transport system.

In addition to physical improvements in the waterways, it is of equal importance to increase the reliability of the transport system. An effective and efficient system demands guaranteeing that the necessary maintenance work is regularly done, adequate river information is provided and the other elements of the transport chain are upgraded to support the expected growth. This leads to the second sub-goal: "An improved and reliable transport system to accommodate the increase in transport volume and the expected increase in passenger transport by IWT in 2031."

To increase the quality and reliability of the transport system the following demands must be met:

- The transport chain for both cargo and passengers must have sufficient capacity and all the elements of the transport system must be reliable and of high quality. In addition, passenger transport must be safe and comfortable. Encouraging IWT should ideally be done using the latest technology, research and innovations of the shipbuilding industry.
- The institutional framework must be improved in order to ensure the required support, provide incentives, and encourage environmental sustainability and integration of the system.

4 STRATEGY OF INLAND WATERWAY TRANSPORT

4.1 THE BASIS FOR STRATEGY DEVELOPMENT

IWT can only be developed if all stakeholders work closely together to reach the same goal in an integrated approach. To reach the goals of Chapter 3, the main challenges of Chapter 2 needed to be overcome, but also the opportunities of Chapter 2 needed to be incorporated. This IWSP presents an integrated and complete strategy from physical measures to implementation by a National Task Force and Regional Development Groups, to publicizing and monitoring closing this circle. Main challenges were defining a procedure to select the rivers and finding the most promising river sections to enhance IWT. This chapter presents a sustainable way to improve the IWT that would guarantee navigability conditions for the future.

The main and two sub goals form the basis of a strategy that is aimed to improve the inland waterway transport in an integrated way. In this chapter the strategy is elaborated, with the goals as guidance. The content of this chapter is:

- Improved and expanded Brazilian navigable inland waterway network: selection of the waterways strategy development and strategy description
- Improved and reliable transport system: definition of the transport system and the supply chain, strategy description and the cooperation model for implementation strategy

4.2 STRATEGIES TO ACHIEVE THE GOAL

4.2.1 Improved and Expanded Brazilian Navigable Inland Waterway Network

In order to increase the yearly cargo load by inland waterways, the network of navigable waterway needs to be improved and expanded. The navigable extension of the rivers needs to be expanded, but also, in some cases, the capacity of the waterways needs to increase to be better suited for larger vessel size/larger convoys. The dimensions (depth, width, and radius) of the waterway need to be sufficient to navigate with commercial sized vessels/convoys. Stream velocities and seasonal variations of water levels must be within acceptable limits. The waterways must be free of obstacles such as dams without locks/sluices, rocks and sand banks. Bridges and power lines must be high enough for the vessels to navigate underneath. This requires large investments. Before deciding in which part of the waterway network should be invested, a careful selection process was done. In this paragraph this selection process and the results for waterway selection are described.

4.2.1.1 Selection process of waterways and physical measures

More rivers should be navigable and currently navigable rivers should be improved. The selected waterway should have a basic navigability – where at least a convoy of 2x2 barges is able to use the waterway. For a number of waterways this is not the case in the current situation. This section describes how the strategy in this Inland Waterway Strategic Plan was elaborated and calculated (see Figure 4.1).

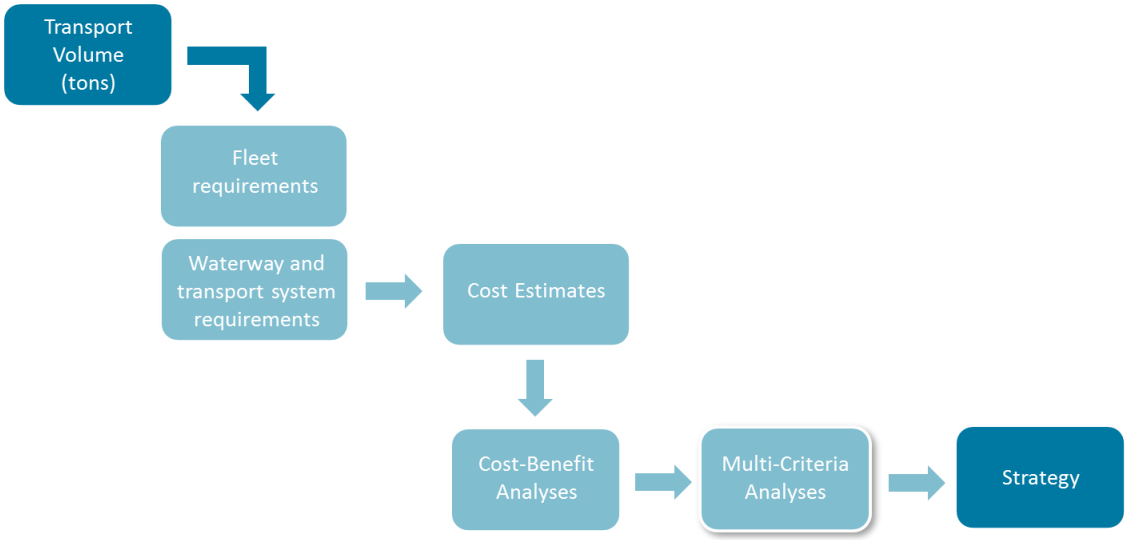


Figure 4.1: Methodology to elaborate and calculate the Strategy

First, the most feasible commodities to be transported were selected[13] and the transport volumes for 2031 were calculated[14]. This amount of cargo needs to be transported by a suitable fleet. Therefore, fleet requirements were defined. The fleet requirements give rise to physical measures to the waterways and the transport system. The costs of these measures (investment costs, transport costs and maintenance costs) were determined for several strategies (which contained combinations of measures). These strategies were then compared in a Cost-Benefit Analysis (CBA) and a Multi-Criteria Analysis (MCA), which provided sufficient information to select the strategy for this Inland Waterway Strategic Plan.

The CBA had two purposes: to determine whether a proposed project is a good investment/decision (justification/feasibility) and to provide a basis for comparing and ranking strategies. The total expected costs of each option were compared with total expected benefits, to determine whether the benefits outweigh the costs, and by how much.

Although a key aspect, recommended public policies should not be solely based on investment and transport costs, but also on a broader set of objectives. In addition to the transport cost savings other types of benefits are relevant for evaluating the IWT strategies. The results of the Cost Benefit Analysis were therefore included in a Multi-Criteria Analysis (MCA). The MCA was structured in four dimensions: Economic Sustainability, Institutional Cohesion, Environmental

[13] Agricultural products (soy, soy meal, corn, sugarcane, sugar, ethanol, cotton, fertilizers), wood and pulp, chemicals and petroleum, iron ore, manganese, coal and steel, building materials, sand and container trailers - Ro-Ro.

[14] The forecasts were made per commodity relevant for IWT, per state. For each commodity forecasts were made for the period 2011 – 2031 for total production, imports and exports. After that routes (transport chains) and modal split were determined simultaneously per micro-region for commodities with heavy modal competition like soy, corn and fertilizers. The route choice selection is based on the transport costs. Depending on the available transport chains transport cost will vary. Depending on the strategy, transport chains were included or excluded. In this way the optimal combination of transport chains has been determined.
This calculation also provides the basis for transport costs in different strategies and the necessary investments.

Sustainability and Social Sustainability. For each dimension objectives and criteria were developed[15].

The output of the MCA was a ranking of the alternatives. This ranking provides the elements and analytics necessary in order to support the decision over which strategy to choose. Both analytical tools combined yield solid results that provide for a complete set of support for the decision making process. To choose the most efficient waterway network a baseline situation and several options for improvement were defined. The baseline situation was defined as one in which the investments and maintenance costs for inland waterways in Brazil have been reduced to a minimum, assuming that if an inland waterway policy will not be implemented in the current political setting, the attention for waterways will decrease and the situation will even worsen. With very modest maintenance costs (only for the Paraná – Tietê maintenance is anticipated) total transport volume in the Baseline will be about 57 million tons.

Passenger transport by inland waterways is expected to increase, especially in the Amazon Region. A growth between 2011 and 2031 of 2.2 million passengers (40%) travelling long distance IWT is expected. The baseline situation was compared with the several options for improvement. The options for improvement vary, based on two elements: river sections selection and waterway improvement measures to meet the convoy sizes.

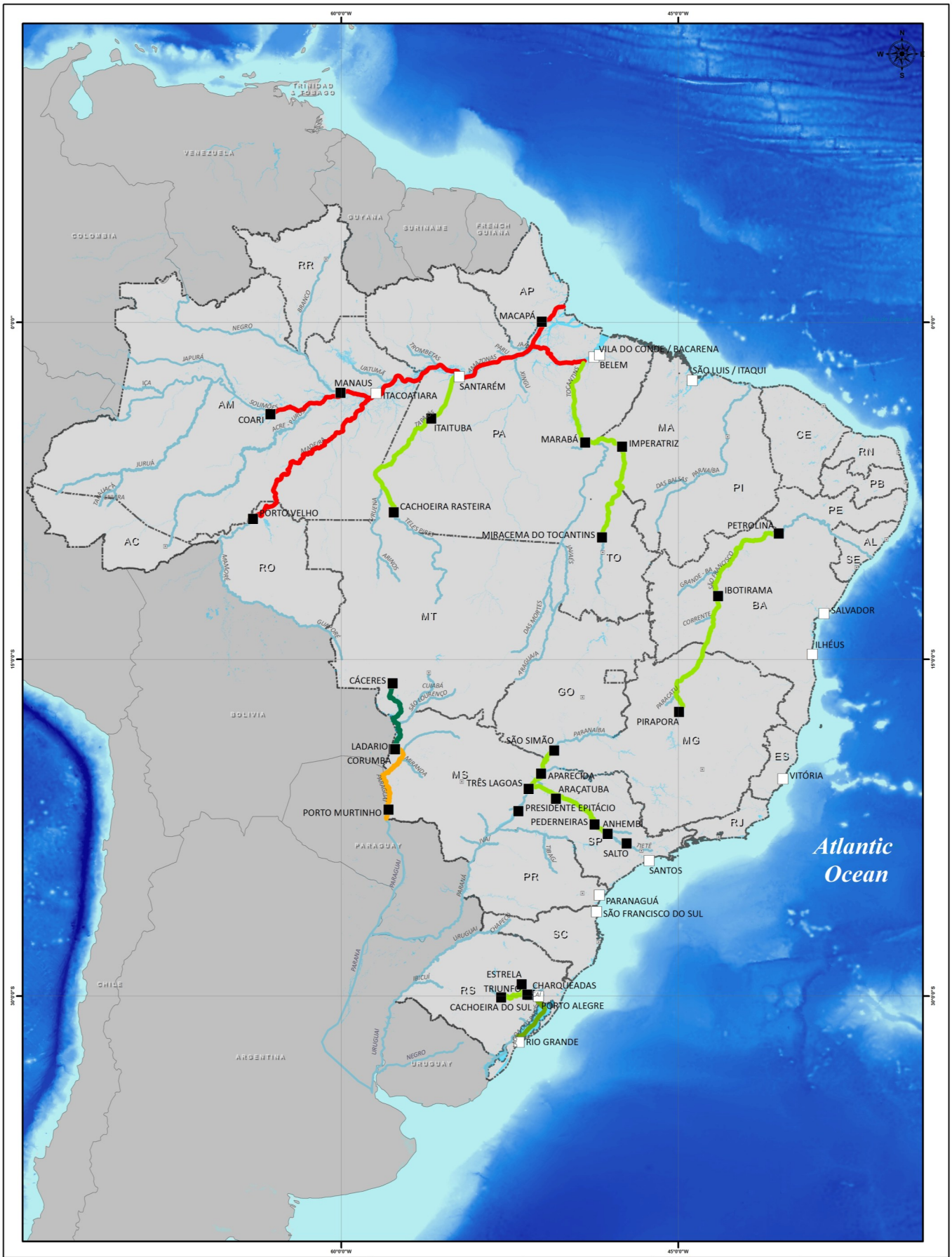
The figure below explains the elements of the cost estimate and shows the relation between cargo flows, convoy sizes and waterway requirements. Cargo type and amount is described in Chapters 2 and 3. To determine the required waterway improvement works the size of the vessels that will navigate on the waterway in the future (normative convoy size) had to be selected. Based on the normative convoy sizes the required dimensions of the waterway and the locks were determined.

Figure 4.2: Explanation of the cost estimate and the relation between cargo flows, convoy sizes and waterway requirements

Table 4.1 gives an overview of the normative convoy sizes that were the basis for estimating the waterway requirements. The waterway requirements are a certain depth, width, radius, etc., for the normative convoy size to navigate. The expert team was then able to propose physical measures, such as dredging, removal of rocks, adjusting locks and sluices, etc. All of these physical measures were assessed in the CBA and MCA in order to select the best combinations of rivers and physical measures to improve the navigability.

Map **4.1** shows the convoy sizes per waterway that indicates an overview of one of the elements: the waterway requirements. It forms the basis for the required investments.

[15] Report Development and Elaboration of Strategies



CARTOGRAPHIC ITEMS

- State Capital
- Borders
- Rivers Studied
- Water Surface
- Seaport
- IWT Terminal

PHE - Convoy Size

- 2x2 Barges
- Self propelled
- 3x2 Barges
- 4x4 Barges
- 4x5 Barges

REFERENCES

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ESCALA GRÁFICA
0 162,5 325 650 km
GEOGRAPHIC COORDINATE SYSTEM, HORIZONTAL DATUM: SAD69

LOCATION

MINISTRY OF TRANSPORT

ARCADIS logos

INLAND WATERWAYS STRATEGIC PLAN

PHE - CONVOY SIZE

EXECUTED BY:	SCALE:	SHEET:	DATE:
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4.2.1.2 *The main waterways to improve and expand*

The MCA results showed which waterways had most potential to enhance the transport systems in Brazil. These waterways will form the basis of the inland waterway network in 2031. Other waterways can be added later, and will be used in the meantime for the local transport at shorter distances.

Table 4.1: Overview of selected rivers and river sections with their normative convoy sizes

River-systems	River-sections	Normative convoy sizes
Amazonas e Solimões	Santarém - Manaus - Coari	4x5
	Santarém – Almeirim	4x5
	Almeirim – Santana	4x5
	Almeirim - Rio Tocantins	4x5
Madeira	Itacoatiara - Porto Velho	4x5
Tapajós e Teles Pires	Santarém – Itaituba	2x2
	Itaituba - Cachoeira Rasteira	2x2
Tocantins	Vila do Conde - Marabá	2x2
	Marabá – Miracema	2x2
São Francisco	Petrolina – Ibotirama	2x2
	Ibotirama – Pirapora	2x2
Paraguai	Foz rio Apa – Corumbá	4x4
	Corumbá – Cáceres	3x2
Paraná e Tietê	Três Lagoas - Pereira Barreto	2x2
	São Simão - Pereira Barreto	2x2
	Pereira Barreto - Anhembi	2x2
Hidrovia do Sul	Rio Grande - Porto Alegre	SP
	Porto Alegre - Triunfo	SP
	Triunfo - Cachoeira do Sul	2x2
	Triunfo - Estrela	2x2

Notes:

1) SP: self-propelled barges.

The selection of the main waterways is illustrated in Map 4.2.


60°0'0"W
45°0'0"W
TRINIDAD & TOBAGO
VENEZUELA
GUYANA
SURINAME
FRENCH GUIANA
COLOMBIA
RR
AP
MACAPÁ
VILA DO CONDE / BACARENA
BELEM
SÃO LUIS / ITAQUI
MANAUS
ITACOATIARA
SANTARÉM
AM
COARI
ITAITUBA
PA
MARABÁ
IMPERATRIZ
MA
CE
RN
PB
PE
AL
SE
PI
PETROLINA
CACHOEIRA RASTEIRA
PORTO VELHO
MIRACEMA DO TOCANTINS
AC
RO
TO
IBOTIRAMA
BA
SALVADOR
ILHÉUS
MT
CÁCERES
GO
BOLIVIA
PIRAPORA
MG
CORUMBÁ
LADARIO
SÃO SIMÃO
ES
VITÓRIA
MS
TRÊS LAGOAS
APARECIDA
ARAÇATUBA
PRESIDENTE EPITÁCIO
PORTO MURTINHO
PEDERNEIRAS
ANHEMBI
RJ
SP
SALTO
SANTOS
Atlantic Ocean
PARAGUAY
PR
PARANAGUÁ
SÃO FRANCISCO DO SUL
SC
CHILE
ESTRELA
TRIUNFO
CHARQUEADAS
RS
CACHOEIRA DO SUL
PORTO ALEGRE
RIO GRANDE
ARGENTINA
URUGUAY
CARTOGRAPHIC ITEMS
State Capital
Borders
Rivers Studied
Water Surface
Seaport
IWT Terminal
Main Highways
Existent Railroads
PHE - Selected Waterways
REFERENCES
Sources:
- Integrated Cartographic Base from Brazil - IBGE, 2010
- ANA, 2010
- PNTL, 2010
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DATE: 2013

When all these rivers are upgraded to a proper level of quality, they can accommodate more cargo. This will help to increase the total cargo flow for inland waterways transport. If new rivers are added to the system, this will cause a shift of cargo transport between the waterways. This leads to the forecast until 2031 as illustrated in Table 4.2. Note that this table is a result of modeling based on cost and distance calculations. Actual flows can vary, if companies decide to combine flows to one waterway, instead of spreading, or if the upgrading process of some waterways takes more time then was assumed.

Table 4.2: Cargo forecast IWT Brazil 2031, per waterway and commodity (in million tons)

Transport flow	flows without modal competition	Flows from investments in plants and logistic systems	Agricultural flows (soy, corn) with heavy modal competition	Total
Amazon	11.5			11.5
Madeira	2.2		2.5	4.7
Tapajós			9.7	9.7
Tocantins		32.5	8.6	41.1
Sao Francisco	0.1		2.6	2.7
Paraná – Tietê		16.0	4.8	20.8
Rio do Sul	3.9	3.0	2.5	9.4
Paraguay River	14.9		5.5	20.4
Total	**32.5**	**51.5**	**36.3**	**120.2**

The forecast for Inland Waterway Transport for 2031 are determined by the following developments:

1. The Tocantins, Tietê and Paraguay River show a big increase in flows. In the case of Tocantins and Tietê this is mainly due to investments in plants and systems (steel, ethanol, wood + pulp). The Paraguay River will transport mainly iron ore and, to a lesser extent, agricultural commodities;

2. Transport on the Tapajós will be agricultural commodities from Mato Grosso. The transport on the Tapajós will go at the expense of transport on the Madeira River. The remaining transportation on the Madeira River is mainly to and from Rondônia;

3. The transport on the Amazon River is growing because of the growth of the related industries (oil, chemical products and roll-on and roll-off (Ro-Ro) transport);

4. In the South the growth is moderate. The main growth comes from pulp, containers and the chemical industry.Some regional developments (like the pulp plants in Três Lagoas and Guaíba) have been incorporated.

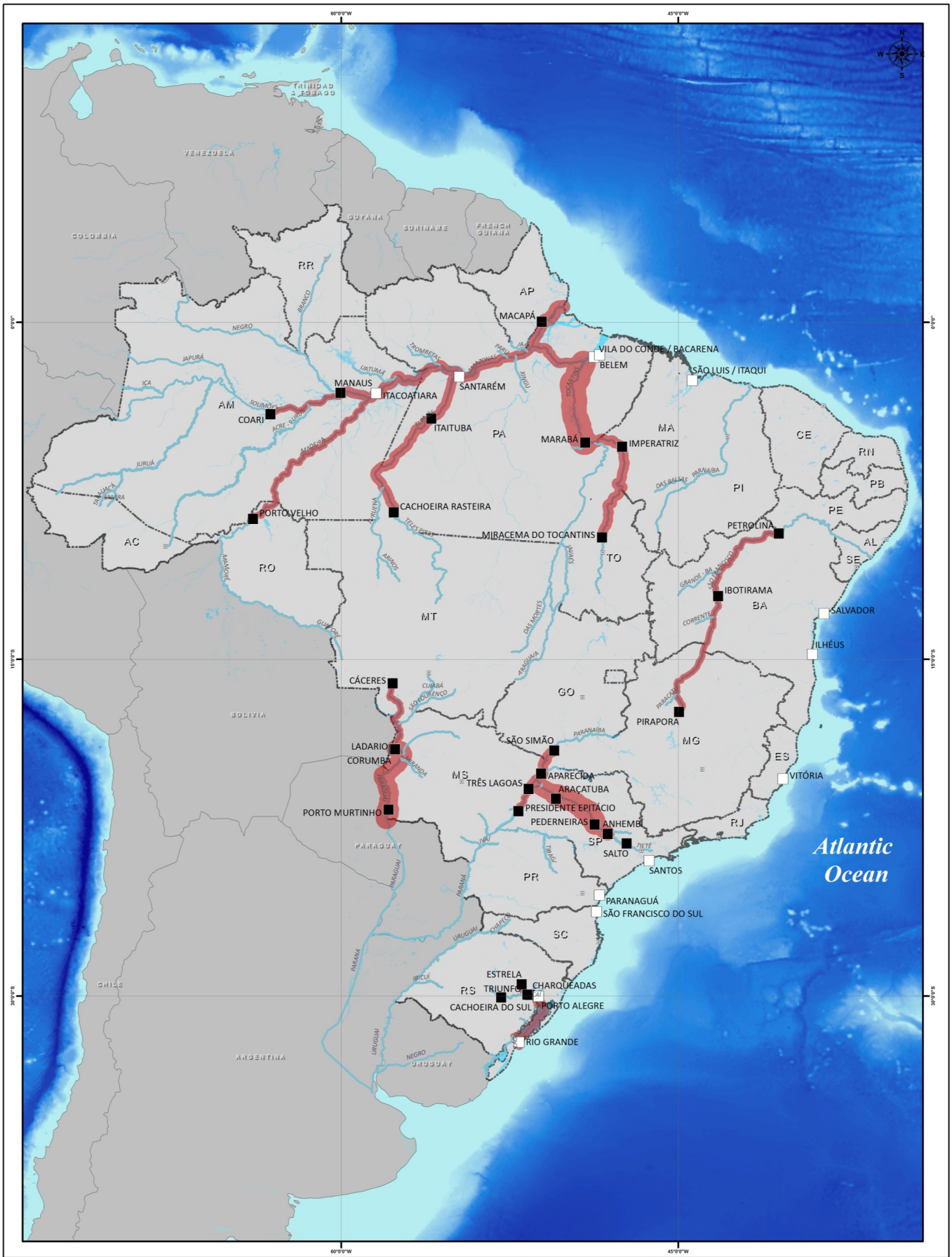
The forecast flows at very short distances (e.g. oil flows in ports like Manaus or Rio Grande or sand between locks on the Tietê) have been excluded. In total this is about 5 million tons of the 25 million ton transported in 2011. Short distance flows are also important in some cases. The river crossing transport of sugarcane on the Tietê e.g. can save a lot of road transport. Another example is the regional, border crossing, transport between Brazil and Paraguay on the Paraná River. These flows are very variable on an annual basis. Therefore, it is difficult to predict the actual size.

Regional investments in plants will benefit from improvements in waterways. Improving waterways alone will in general not be enough to trigger regional development, other measures are necessary as well. If the planned investments lead to the forecasted 120 million tons, other inland waterway flows will increase as well. Many new commercial and social opportunities will arise for both cargo and passenger transport.

The Araguaia and the Parnaíba were not selected for the ISWP. The models show that the Araguaia can be a good alternative for other mode if the improvements are stretched to Aruana (GO). In this case the Araguaia could serve as an important transport route for Goiás and parts of Mato Grosso. The investments costs of this extension are high, so the Benefit / Cost ratio of this investment is less than one. An extension to Conceição do Araguaia (PA) would be less costly, but will have a far smaller transport potential for large export orientated flows. The Parnaíba competes with the Tocantins and to a lesser extend with the Sao Francisco for export flows from the fast growing Matopiba region. If the Tocantins is extended and the navigability of the Sao Francisco is improved, the added value of the Parnaíba is limited. This is even more the case because the Parnaíba has no direct access to a seaport.

The cargo flows, as calculated are visualized by Map 4.3.

The map shows the calculation of the cargo flows for the commodities, transported on the waterways in 2031, if all the waterways are upgraded. This calculation is based upon assumptions on cost of transport and destination. It is important to add to this picture that the waterways are a system, in which a number of waterways are interesting for transportation from the same regions, these waterways are competing for the same cargo. The two most obvious examples are the Madeira River versus the Tapajós River in the Amazon region and the Tocantins – Parnaíba in the North East.



CARTOGRAPHIC ITEMS

- State Capital
- Borders
- Rivers Studied
- Water Surface
- Seaport
- IWT Terminal

PHE - Cargo Flows

- 0
- 0 - 5.000
- 5.001 - 10.000
- 10.001 - 15.000
- 15.001 - 20.000
- 20.001 - 25.000
- 25.001 - 50.000

*(tons per year) * 1.000*

REFERENCES

Sources:
- Integrated Cartographic Base from Brazil - IBGE, 2010
- ANA, 2010
- PNTL, 2010

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MINISTRY OF TRANSPORT

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INLAND WATERWAYS STRATEGIC PLAN

PHE - CARGO FLOWS
(TONS PER YEAR) * 1.000

EXECUTED BY:	SCALE:	SHEET:	DATE:
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The Madeira River is important for imports to and exports from Rondônia and for imports to and exports from Mato Grosso (especially the northern micro-regions of Mato Grosso). The Tapajós River is important for the same micro-regions in Mato Grosso too. The main difference is that the location of the Tapajós for exports from important production regions in Mato Grosso (like Alto Teles Pires with Sorriso as the center) is far better. In other words: transport costs from Sorriso to Santarém (and from there to destinations like China and Europe) are lower than the route via the Madeira. If both the Madeira and the Tapajós will have improved navigability, the majority of the cargo from Mato Grosso will use the Tapajós. The cargo to and from Rondonia will still use the Madeira river. This is, despite the growth of the flows to and from Rondônia, less than the shift to the Tapajós River. This explains the decline in the volume on the Madeira. However, as long as the Tapajós is under construction, the Madeira River will be a very important alternative for the growing export flows from Mato Grosso.

The same counts for the Tocantins River and the Parnaíba. In this case the location of the Tocantins is not an advantage, but the Parnaíba suffers from a lack of access to a seaport. Extra transshipment will be necessary as long as the Parnaíba does not have this access. This has extra costs and time loss as a consequence.

The Benefit/Cost ratio of the strategy is explained in Table 4.3:

Table 4.3: Discounted cost and benefits investment strategy

	Transport benefits	Costs	B/C ratio	Volume
	R$ * million	R$* million	#	Million ton
Baseline	0	0	-	57
Preferred strategy	13.536	14.455	0,94	120

The b/c ratio of the preferred strategy is just below one (0.94). In an international perspective, the calculated b/c score is remarkably good for IWT investments. In e.g. The Netherlands, an acclaimed IWT country, such ratios seldom surpass 0.4.

The selected strategy presented a well-performing score under the economic dimension and also a high-scoring strategy under the institutional dimension, but not the highest. Under the environmental and social sustainability dimensions the strategy also scored well, but never the highest. Overall, it ranked first because it provides a clear balance between the dimensions involved in the decision-making process. In chapter 6 the measures per waterway are explained.

4.2.2 Improved and reliable transport System

To achieve an improved and reliable transport system effort and commitment are required from all involved. Above that, the measures will affect the interests of all parties involved. At some points even a discussion about changes in the institutional structure is needed. The first key element for reaching an improved and reliable transport system is integration. Since the situation is very complex, and many private and public organizations are involved, it is important to cooperate closely on the same goal at all levels. A cooperation model is proposed

for this. The second key element is a step wise approach that starts with improvements on the short term, while all involved will follow the same route towards long term improvement. Major points of improvements (long term improvement) and pilot projects (short term improvement) are selected. By working with all parties involved during the implementation of the Inland Waterway Strategic Plan on the selected topics, the implementation of the plan will lead to integration of actions and improvement of the transport system elements.

The strategy to reach the improved and reliable transport system has a technical component, and an evenly important organizational component. In this chapter the strategy to improve the situation on the two elements (transport chain and institutional framework) is elaborated. It contains the following elements:

- Improvement of transport chain elements;
- Improving of the institutional framework at the national and regional level.

4.2.2.1 Improving the Transport Chain

Bringing cargo from one place to another must be seen as a logistic chain, where every element affects another: the total chain is as strong as its weakest link. For example, a delay during navigation in the river due to lack of information about its conditions will affect the logistics (loading and unloading) at the terminal. With a longer waiting time and higher costs as a consequence.

In the IWT chain, between origin (production area of the cargo) and destination (in the present case, the destination is generally the sea port where the cargo is loaded in a sea-going vessel) the following activities or chain steps can be distinguished:

- Pre-haulage from the origin to the inland terminal;
- Storage of the cargo at the inland terminal;
- Loading of the barges;
- Transport by barge to the sea terminal;
- Unloading of the barges at the sea terminal;
- Storage of the cargo at the sea terminal.

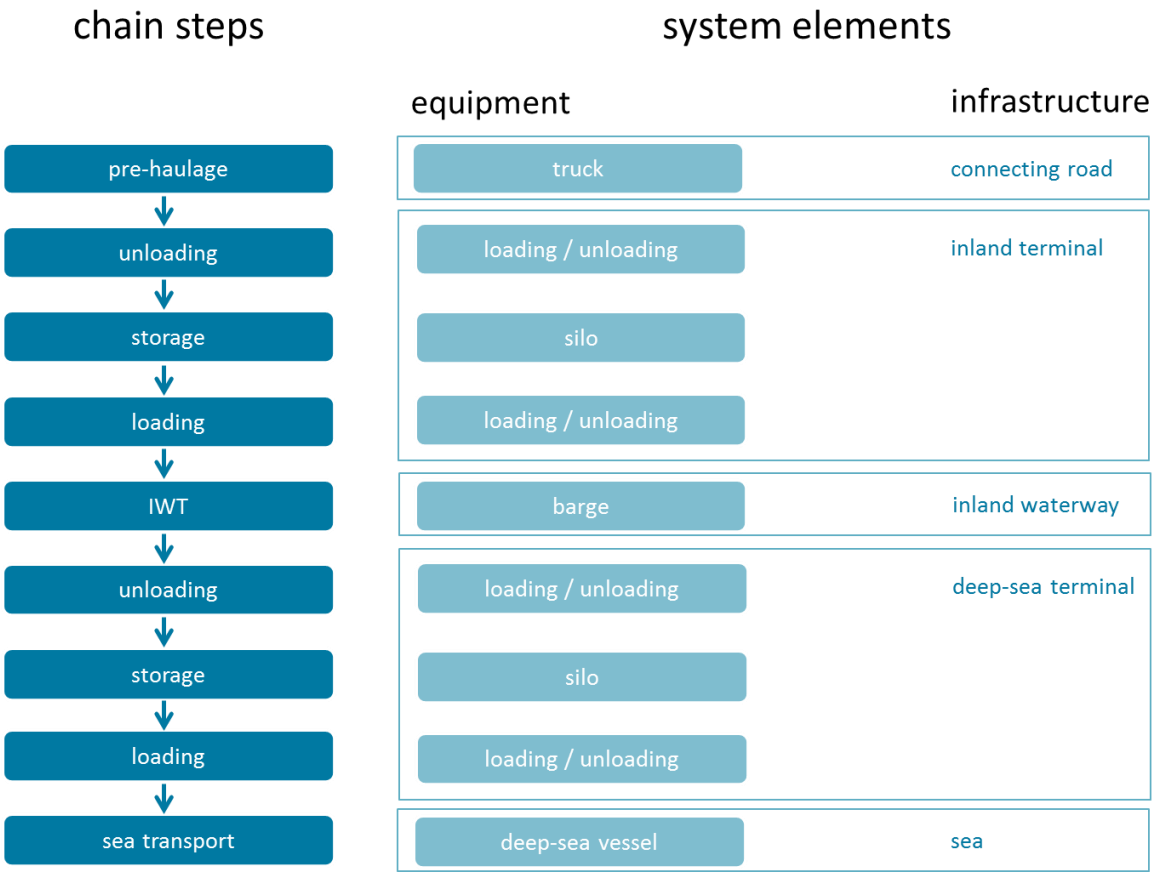


Figure 4.3: Inland Waterway Transport Chain between Origin (Production Area of the Cargo) and Destination.

The transport system elements are required to execute the different chain steps and can roughly be divided into:

- Equipment (trucks, loading and unloading equipment, silo's, barges and deep-sea vessels) and;
- Infrastructure (connecting roads between production area and inland port, inland terminals, inland waterways, deep-sea terminals and sea-ways).

A more efficient transshipment would have a positive effect on costs. To achieve that, the whole chain needs to be improved and connecting infrastructure needs to be provided to support the potential volume increase. With good connections, companies can make the most optimal choices for their transportation needs. At the connection points, clusters of companies can be developed. The connections between road and waterways should be improved, especially between agricultural producing areas (soy, corn) and waterway terminals in the North (e.g. Cachoeira Rasteira and Miracema do Tocantins).

4.2.2.2 Arranging Public Private Partnerships

A close co-operation between the public and the private sector is essential for a successful development of inland waterway transport. This co-operation can take place on a number of different topics and levels. In general there is a clear division of responsibilities between public

and private in inland waterway transport. In general the role of the public sector is characterized by the following responsibilities:

- Investments in waterway infrastructure;
- Management and maintenance of the waterways;
- Setting of rules on waterway management, safety, environment, permits, taxes and incentives on a national level.

While the private sector:

- Invests in quays, ships, terminals, superstructures and equipment;
- And operates the transport chain.

Taking this traditional division of responsibilities as a starting point (public sector waterway infrastructure investments/private sector transport system investments) the analysis executed within the framework of this study indicates that the private investments related to the development of IWT in Brazil are of the same order of magnitude as the public investments. Both parties are more or less equally involved in financial terms.

It is crucial for a successful development of IWT that the implementation of the improvement works by public and private parties are being coordinated. It is useless to invest on the improvement of the navigability of a specific waterway if the private parties are not investing simultaneously in fleet expansion and terminal development along this river. If the public parties invest in waterway improvement to support the development of a specific industry, they will have to be sure that the private parties will actually develop the industrial site. To prevent the ineffective spending of large amounts of public and private money both parties will have to tune their mutual investments constantly. The lack of this type of coordination has resulted in projects that did not bring the expected improvement of inland waterway transport. It has been assumed that investments in quays, ships, terminals, superstructures and equipment (the private investments) and those in dredging, waterway improvement, locks, dams, connecting road and rail infrastructure (the public investments) will be coordinated: if a waterway is being developed, connecting infrastructure will be constructed and terminal and fleet expansion will be effectuated.

A close cooperation between the public and private parties is required to achieve this coordinated approach that reduces the financial risks that both public and private parties take in case of IWT development. The cooperation will also lead to an exchange of demands and design specifications for the development of waterway improvement works and inland barges and push-boats. Waterway as well as fleet management can be optimized by means of this exchange.

As a first step for establishing partnership, the public sector consults the private sector (shipping companies, other transport companies, main commodities producers and also other users) to enable a better understanding of their demands for navigation purposes. Currently, these kinds of consultations between the public and the private sector do take place, they should however be intensified. In a more extended cooperation, government allows the

private sector to discuss and provide input in the development process of inland waterway transport in Brazil.

In the development of inland waterway transport the private sector could play an even more prominent role. The public sector has long used available funding methods, such as user fees, taxes, and municipal bonds to manage the costs of infrastructure assets. More recently governments are also embracing concessions and other forms of Public Private Partnerships to help turn a significant short-term financial cost into a long-term financial proposition for sponsors. Under such deals, a private sector provider commonly designs, builds, finances, and operates an asset, receiving payment on the basis of the availability of the facilities or use of the facility. These contractual relations between public and private entities involve aligning a significant investment of private capital, transferring some risk to the private sector, and increasing the public benefit. Also if the private sector, depending on navigation like shippers, will have enough return on investment they might be interested to invest in waterway improvements.

Two major private groups were considered as potentially interested in developing PPP for waterways: trading and production companies, and construction companies. The benefits that they can obtain in cooperating are better described below.

Trading and production companies

River development is related to the development of agricultural production and of the sea-port, as figure 4.4 shows:

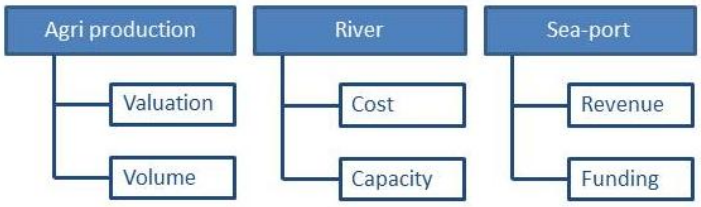


Figure 4.4: Relation between development of agricultural production, the sea-port and River development

The trading companies developing the production of soy and corn play a very important role in the river development, because they drive to a large extent the future transported volumes and thus the feasibility of the river project. The development of the production areas may be delayed because of the issue with the valuation: what is the value of the projects? This value depends for a large part on the road and river transport costs (however the river is not yet developed). The capital dredging of the river might require funding from the trading companies. The problem is in the dependency of river and production areas: without the river there is no valuation, and without the new production areas there is not sufficient funding. The sea-ports also benefit significantly from the river transport as their volumes will increase. They also have to share a part of their profits to fund the project.

The direct benefits for the trading companies, as has been demonstrated in the Cost-Benefit Analysis, are that the introduction of inland waterway transport substantially lowers the

transportation cost of the export commodities from the production areas to the seaport. As most of these export products are relatively low-value commodities, the transport cost do constitute a significant part of the final price of the product on the world market. Investing in waterway infrastructure will improve the competitive position of these trading companies.

A further enticement to invest is the fact that the trading companies are not convinced that purely public projects will materialize in time. Co-investing provides the companies with a power to actually speed up the construction of the infrastructure in order to tune the development of the waterway and the development of terminals, ports and a fleet. A big private port in Europe, for instance, co-invests a substantial amount in a new railway line. To keep control over the timely delivery of the rail connection, the co-investment contract stipulates that the investment contribution will decrease by 5% for every month of delay in the delivery of the line.

Construction companies

The traditional implementation approach (contract form) is that a contractor is hired for the dredging activities and is paid after the construction works have been executed.

Beside the traditional approach there are many other contract forms suitable for projects like this. One of the main variables is the financing. In Europe more and more DBFM contract form is used. This is a contract in which a private contractor has the right and obligation to:

- DB: Design and Build the waterway
- F: Finance the project cost upfront
- M: Maintain the river with maintenance the dredging for a long term period (10-20 or 30 years)

For this contract the contractor is paid an availability fee by the Government during the Maintenance period, compensating the contractor for all three above rights and obligations. The F (financing) means that the contractor will arrange required budget through a bank loan, and the contractor will repay the loan from the availability payment. The financial flows look like Figure 4.5.

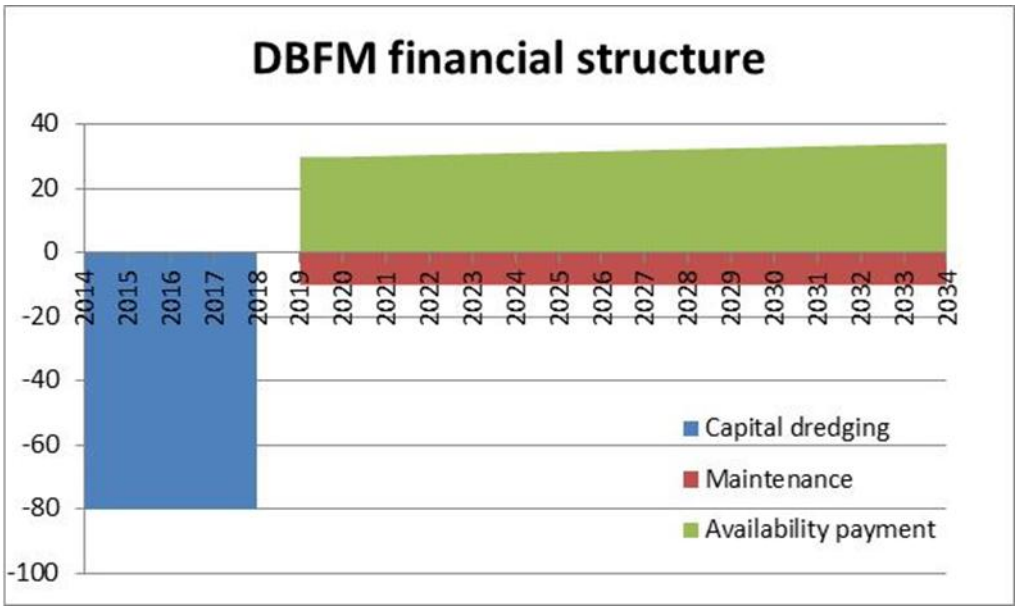


Figure 4.4: DBFM financial structure

The availability payment should be high enough so that the contractor makes a sufficient return. The public parties must assess this DBFM option in case the available budget is not sufficient to cover the total expenses for the river improvement projects.

4.2.2.2.1 Providing Skill Training and Education

Looking at the transport chain, it is also important to mention that sufficient qualified personnel are a prime requirement for any development in the sector. Qualified truck drivers, terminal operators and crews determine the efficiency and effectiveness of the transport chain.

Professional shipping needs a modernized education system to go along with new innovations in the ship building industry. Also sufficient personnel need to be educated to navigate the increasing fleet. And above that, these personnel needs to be educated for navigating the right rivers (since every river has its own specific characteristics) and deployed at the right rivers basins.

It was observed that a very limited amount of courses, studies and research attention have been given to waterways in Brazil. In this sense, the waterway sector cannot rely on sufficient highly educated qualified and experienced professionals to supply actual and future demands. The innovation program that will be initiated by the Working Group may create a spin-off on the university level. The research that will inevitably result from the innovation projects will create scientific interest in the IWT sector. This will assist in increasing the availability of experts on the theme.

Manning and staffing problems may occur on the fleet, but also at the terminals, both inland and in sea ports and in the field of logistic service provision. Due attention must be given to sufficient education capacity and recruitment.

In view of the highly specialized profession of inland crew members, and pilots a specialized inland navigation education system will have to be developed. The curriculum for the

education of these professionals will be determined based on the demands and requirements of the employers of the crew, predominantly the barge operators, shipping lines, the terminal operators and the trading companies. Discussions with the public parties are essential at this stage as the public parties determine the manning requirements for inland shipping. The trade-off between the level of education and the manning requirements is obvious. It should be considered whether a specialized education of waterway authority employees could and should be incorporated in the specialized inland navigation education system.

Inland navigation education will be presented at different levels:

- Practical hands-on education for deck-hands and engine room assistants.
- A combination of practical and theoretical education combined with maneuvering simulator training for officers (captains, pilots, second officers and engine room officers.

The same kind of distinction between practical and practical/theoretical schooling can be made for the education of the terminal operators.

During the theoretical education of the crew, the terminal operators and the logistic service providers, attention must be paid to the following issues of general importance:

- Efficient intermodal network
- Policy and legislation
- Cargo Knowledge for inland shipping
- Chain Logistics for inland shipping
- Information services for traffic
- Terminal Management (port / hinterland port)
- Risk & Quality Management inland shipping
- Modern business inland shipping
- New markets in inland shipping

Curricula for the abovementioned schooling and courses have been developed in Europe. Possibilities for the exchange of this type of materials will have to be explored.

4.2.2.3 Improving the institutional framework

To provide a reliable and well maintained system, the institutional framework should provide adequate support and build up accordingly. In this sense, a cooperation model is presented to overcome the main bottlenecks as they depend on political support.

The cooperation model is based on two pillars:

- National level: A Task Force IWT Development
- Regional level: Regional Development Group

By introducing a National Task Force IWT Development and Regional Development Group the cooperation will start on a regular basis. At the start of the task force, a mutual goal is being defined and all parties will share their own specific benefits and demands in the development of inland waterway transport. The Inland Waterways Strategic Plan will be used as a basis for discussion on prioritization of the development as well as a common reference for the (economical and other) effects of the different improvement projects.

The Task Force IWT Development will create the conditions for the implementation of the Master Plan for the development of IWT in Brazil as defined by the present study. Within the Task Force separate Working Groups can be formed to decide about relevant topics in more detail.

The Regional Development Group will coordinate the efforts for the development of IWT for a specific waterway.

Once the Task Force is actually functioning, an integrated government planning is being achieved through the participation of all relevant government agencies. The participation of the private stakeholders provides the basis for a lasting public-private partnership. The Task Force is a temporary organization. Once the waterway improvement have been achieved (expected to be so in 2024) and the institutional changes have been carried through, the Task Force will be evaluated and participants will decide in which structure and with which aim the Task Force should (if it should) go on.

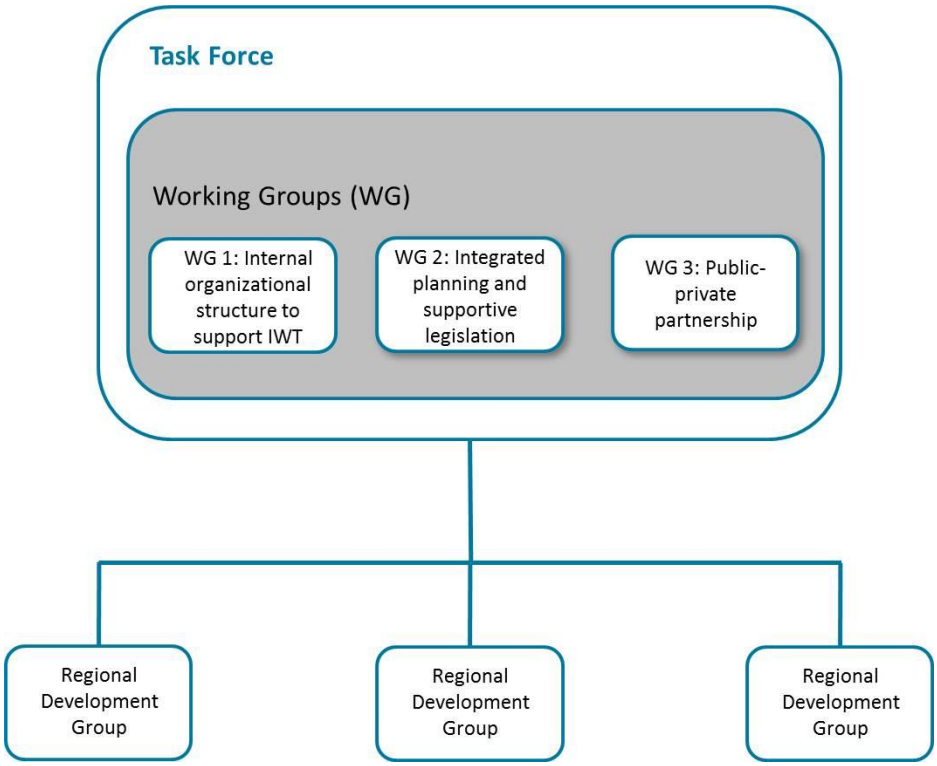


Figure 4.5: Cooperation model proposed

4.2.2.4 Regional Development Group (RDG)

A Regional Development Group (RDG) will be installed for each waterway. The RDG is the platform to execute the improvements in the waterway in an integrated way. The primary responsibility for the implementation of a specific development project in the river will be with the Waterway Administration of that specific waterway. They will lead the group. But besides the actual waterway improvements; in most cases the IWT development requires the coordinated development of a number of other elements in the transport system. Not only dredging works, dams and locks, but the simultaneous development of connecting road infrastructure, terminals and fleet expansion is needed. The Regional Development Group should assure that all relevant plans and policies that regard its jurisdiction are harmonized, resulting in a consciousness use of public resources and also stimulating IWT initiatives to be implemented.

The members of the Development Group will assist the Waterway Administration in implementing the projects and sharing the intention to reach their common goals, confirming and guarding the timeframe, discussing problems and celebrating the reached milestones. In this way the integrated government planning process and the public-private partnerships will further be strengthened on the practical level of the waterway improvement project.

The Regional Development Group reports the progress of implementation to the national Task Force IWT Development.

5 ACTION PLAN FOR DEVELOPING IWT SYSTEM AT THE NATIONAL LEVEL

5.1 TASK FORCE PARTICIPANTS

This Task Force will have to represent the main relevant stakeholders and as a consequence the following parties and agencies should participate:

- CONIT (chaired and represented by the Minister of State for Transport, which has as members the Ministry of ”Casa Civil”; Finance; Planning, Budget and Management; Development, Industry, and Trade, Agriculture, Livestock and Supplies; and the Secretary of Port as well as of Civil Aviation, besides some civil society representatives),
- Waterway Administrations,
- SEGES,
- EPL,
- DNIT
- ANTT
- ANTAQ
- Ministry of Energy
- Ministry of Defense (Navy)
- Ministry of Environment
- National Water Agency (ANA)
- Ministry of Foreign Relations
- Cargo owners (trading companies)
- Shipping lines
- Terminal operators

The cooperation of all required stakeholders need to be organized by the Ministry of Transport, led by SNPT. Each stakeholder must be able to see how their contribution will be valued and what the rewards are for active participation in the plan’s implementation. The plan will not succeed if team members are not committed to overcoming obstacles on the path to the plan implementation. The benefits that each stakeholder can achieve by participating in the Task Force are listed below:

- A more successful development of IWT through coordinated government planning and coordinated development of all elements in the transport system is the major benefit for all parties. Coordinated development will result in balanced public and private investment and, as a consequence, to increased financial efficiency for all parties involved.

- Reduction in transport cost is the most important benefit for the major private stakeholders; the trading companies.
- Increased volumes and, consequently, increased turnover and profits will constitute the major benefits for the other private parties, the shipping companies and the terminal operators
- Cost efficiency and increased effectiveness of the development processes will be the major driver for strengthening the various agencies of the Ministry of Transport.
- If the private parties of the transport sector participate in the investments of the waterway improvements, especially in the construction of locks, either budget reduction or optimized phasing (resulting in earlier start of construction than planned) of a dam construction, for example, might be a benefit for the hydropower sector.
- As far as environmental issues are concerned, the increase in IWT should result in green-house gas emissions decrease and also has less impact that building roads and rails, because it is a natural route.

5.2 AGENDA FOR THE TASK FORCE

The Task Force will be leading the development of the Inland Waterways at the National level. They will meet four times per year; in January and August at the opening and the closing of the budget and two other suitable dates. These meetings will be held according to the following agenda:

- First meeting
  - Confirmation of the IWSP and its strategy: The selected development route will have to be validated by the members to guarantee a smooth development process.
  - Validation of the project list: The strategy has been translated into an action list of projects to be executed. This list will be approved and prioritized and budgets will be allocated within the various organizations.
  - Make sure that the plan´s objectives are clear to each team member in order to establish and maintain a clear focus throughout the process and help each participant to take ownership of the plan.
  - Nominate the representatives of the institutions that will participate in the Working Groups.
  - Selection of a limited number of pilot projects in specific waterways: The development of the selected strategy starts by agreeing upon a number of pilot projects from the action list, which also encourage learning on improvements/innovations.

- Second meeting:
  - Confirm the Monitoring Plan to keep track of the implementation process: The implementation process will be monitored and, where (and if) required, the Task Force will define and allocate budget for it. This will be developed in such way that in the future, when the Task Force is not in place anymore, the performance of the waterway transport – is regularly monitored and evaluated, so that adjustments can be made quicker to guarantee the reliability of the waterways for its customers.
- Third meeting:
  - Progress discussion of the implementation in general: identify successes experiences and the issues that hamper achieving the objectives, such as inadequate resources and lack of qualified people. After every possible difficulty has been identified, the resources should be gathered to meet each challenge.
  - Installing Working Groups (see next paragraph).
- Fourth meeting:
  - Evaluation of the first year. Define starting point for monitoring.
  - Discuss first results of the Working Groups.

The second year can start with an update of the strategy, when things go too slow, or when new developments demand it.

5.3 WORKING GROUPS TO PREPARE DECISIONS ABOUT SPECIFIC IMPROVEMENTS

After the proposed agenda has been finalized, the Task Force can be instrumental to create a number of other conditions that, according to the benchmarks, are required for successful development of IWT. This additional National agenda could cover the following subjects:

- Internal organizational structure to support IWT: The internal organization of the Ministry of Transport will have to be optimized to further support the development of IWT on the Brazilian waterways.
- Integrated planning: The different government stakeholders involved in IWT will have to integrate the planning of their activities.
- Public-private partnerships: Implement cooperation between public and private parties on a number of relevant items.

The most effective way to bring these subjects further will be to install a specific working group for each topic. The Working Groups will prepare the decisions for the Task Force. The members of the working group will consist of the most relevant stakeholders related to each specific subject:

1. The first working group will consist of representatives of DNIT, DAQ, Waterway Administrations, SNPT, SEGES, EPL, and also the participation of SEP, ANTAQ, ANA, Navy and Port Authorities should be considered.

2. The second working group will consist of representatives of the different Ministries: Ministry of Energy, Ministry of Defense (Navy), Ministry of Environment, Ministry of Foreign Relations, SEP, Ministry of Transport, Ministry of Planning, Ministry of Finance, ANA.

3. The third working group will consist of public and private representatives: Ministry of Transport, Waterway Administrations, SEP, representatives of Contractors, Cargo owners (trading companies), Shipping companies, Terminal operators).

All Working Groups will report to the Task Force for IWT Development. The figure 5.1 Illustrates the participants of the different Working Groups and their interactions.

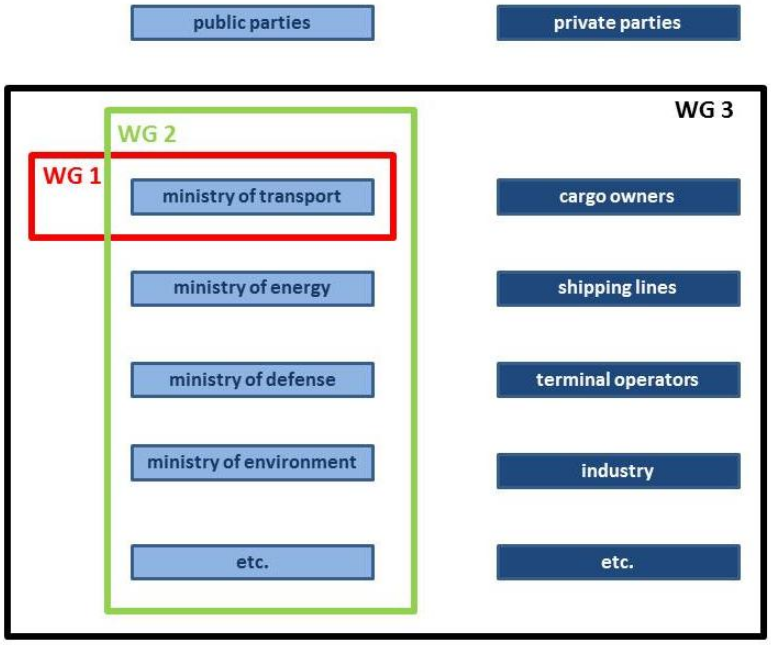


Figure 5.1: Set-up of the Task Force IWT Development

To contribute to this, the Inland Waterways Strategic Plan presents sets of recommendations that should be evaluated and elaborated within each working group, as presented below.

5.3.1 Working group 1: Internal organizational structure to support IWT

The current waterway management structure should be more effective and efficient to support the IWT. Change of this structure will only be possible if there is political support for it. Therefore working group 1 will be established to discuss and implement the required changes within the internal organizational structure of the MT responsible for managing the waterways.

Changes in the organizational structure can vary from changes with significant impact to changes with low impact. These changes will only happen when they are embedded with

political support and when assigned with enough budgets to implement the work. The following changes need to be implemented:

- Balance attention among different modes of transport;
- Improve and clarify the framework and organizational embedment for the Waterway Administrations;
- Better arrange the geographical spread of the Waterway Administrations (WA's);
- Develop guidelines for the WAs to follow;
- Develop a classification and information system.

These required changes are elaborated below.

1. Balance attention among different modes of transport

Currently, the road mode receives a higher attention within the MT. To encourage the development of IWT, more attention needs to be given to that mode at all levels. In order to provide more attention to IWT some initiatives can be taken. Within the working group the following topic should be discussed:

Improve the balance within DNIT structure by:

- Giving DAQ special attention for some years, or moving the waterway management out of DNIT's structure having a proportional position inside the MT. This second option is preferable.

2. Improve and clarify the organizational framework for the Waterway Administrations

The actual framework that connects the Waterway Administrations to the MT's structure is established through an agreement between DNIT/DAQ and CODOMAR, that links all the WAs to CODOMAR at the same agreement, and CODOMAR to DNIT/DAQ. This agreement establishes that when there is any issues on the expenses report of one of the WAs, next exercise's budget will not be delivered to any of the WAs. This type of agreement proved not to be effective. The agreement made between DNIT/DAQ and CODOMAR is a fragile instrument for the public administration and keeps the decentralized offices (WAs) far from where the decisions are taken.

This same framework inhibits the WAs to establish partnership with private parties to deliver a higher quality service for the waterway users.

The options for improvement that can be discussed in the working group one can be:

- Review the institutional framework that is provided for the Waterway Administrations; and

- Consult the Waterway Administrations in the strategic discussions, considering they have the best knowledge of the local situation;

- Connect the WAs directly to DAQ without CODOMAR as an intermediate. This would solve two issues: it would shorten the distance between the decentralized offices and the decision makers, but also allow each WA to manage their budgets independently (nowadays, if one WA has its expense report reproved or does not deliver it, all WAs cannot access their budgets until the matter is solved). Set up a clear responsibility system for all involved institutions for:

  a) Investments in and Maintenance of Waterways and Superstructure (Terminals and Jetties),

  b) Inspection of Fleet and Equipment,

  c) Safety and Security for Navigating on Rivers.

3. Better arrange the geographic spread of the WAs

Currently, the WAs have a geographic spread that often does not coincide with the border of the waterway systems and also often differs from the geographic spread of the river basin committees. For example, Tocantins waterway has two WAs and, as a consequence, a fragmented responsibility. To facilitate and integrate the structure of the WA, there should not be fragmentation in the organization. Therefore, the following topics are suggested:

- Reorganize the geographic division of the WAs to follow the river basin borders so, for instance, there is one waterway administration for the Tocantins River. This would make it easier to implement integrated planning and it would create an easier connection to the River Basins Committees, where the multiple usages of the hydric resources are planned.

- Consult the Waterway Administrations on international issues: Whenever a waterway system exceeds the country limits, the Ministry of Foreign Relations needs to participate in the discussions on the river basin (together with the other countries representatives). It is important that the WAs are consulted or participate on those discussions as they have a expert local knowledge on the relevant aspects and interests for navigation.

- Establish a supranational committee based on the river basin for those river basins that cover several countries. A good example is the Central Committee for the Navigation of the Rhine or The Danube Committee. The Committee deals with freedom of navigation, maintenance and safety standards etc.

4. Develop guidelines for WAs to follow

Waterway Administrations need to have a clear definition of mission, objectives, roles and a set of basic activities that should be performed throughout the year.

- It is therefore recommended to establish guidelines for the WAs. These should state clearly what is expected from them and how their performance should be evaluated.
- It is essential to define the minimum maintenance standard that would have to be guaranteed by the WAs. The guidelines should include indicators to evaluate their level of efficiency. It should also describe how to plan the interventions and provide the required resources (financial, physical and human) for them to execute it.
- Safety should be a priority in these guidelines.

5. Develop a classification and information system

The Brazilian waterway classification and information system is still underdeveloped. Waterways users and planners do not receive reliable information, like updated electronic nautical charts, water level predictions and transport statistics. The Navy is updating their river nautical charts, so in some waterways there is data regarding the historical traffic figures. However, information that concerns the inland navigation is still scarce and spread, which hinders the planning activities, reliability of the navigation, as well as the increase of this transport mode usage.

Developing a classification of the waterway system connected to a River Information System is elementary. A pilot is proposed to develop the River Information System in Brazil. This could be linked with the classification system that will be developed in this working group. In chapter 5 the starting point for this is presented. This makes it possible to look at the waterway system as a network and, consequently, will lead to optimization in IWT planning and increased safety as it will become clear which vessels can navigate where.

5.3.2 Working group 2: Integrated planning and supportive legislation

A major bottleneck that impedes the inland waterway transport development is that inland navigation has not been consistently part of the government planning and policies agenda. In the Task Force the various planning processes and policies can be tuned. Working group two is recommended to prepare proposals for integrated planning and supportive legislation to boost inland navigation.

The energy sector is very important to work more closely with, in order to align the planning of interventions on rivers. The benefits of integrating planning can be even greater by including more related sectors. This concerns the governmental sectors, such as ports, energy, waste water management, environment, water management, navy, roads and rails. Government sectors should integrate or align their policies and legislations.

For supportive policies and integrated planning the following items must be addressed.

1. Integration of water management issues in the development of a long term IWT infrastructure in order to address the demands of the different users;
2. Provide intermodality conditions to support waterways through supportive legislation.
3. Stimulate and integrate passenger transport.

1. Integration of water management issues in the development of a long term IWT infrastructure in order to address the demands of the different users

Waterway planning needs to be closely connected to the energy sector, irrigation, ports and many other water users. The Task Force is the platform to share policies at an early stage to be able to integrate the water management issues and develop policies that address and respect the demands of the different users. For example, although currently ports and waterways are split into two different institutions, they need to work closely together, since there is no waterway without port or inland port without a navigable waterway. Another example is the construction of dams without locks and as a result a missed opportunity to improve the navigability of a river. Areas of interest to integrate water management issues are:

- Integration should first be provided at the local level through the Regional Development Group, where all the institutions interested in hydric resources develop the river basin together. The WAs could lead the development processes that are under their area of jurisdiction and provide the navigation demands on the river, together with other state or local government's representatives.

- Coordinating the plans of the energy sector and the necessary improvements of the IWT is essential. The energy sector can be a great partner for navigation as some stretches of the rivers might only become navigable if dams will be constructed. In Europe many good examples of this can be found.

- Discuss with the Ministry of Environment the options for a clearer and faster procedure for environmental permits for waterway interventions. Dredging a port, for instance, normally has a higher environmental and social impact than dredging a river. Stakeholders complained that the requirements and time to obtain a permit to dredge a river to maintain navigability conditions are the same as for dredging ports and therefore are taking too long.

- Addressing the strategy development and planning process with the following Ministries could lead to additional benefits:

  - Ministries of Justice (and FUNAI), of Rural Development (and INCRA), of Fishing (to evaluate the fisherman colonies), of Health, of Social Development, of Environment, of Cities, of Culture (and IPHAN) and of Planning (among others) can help planning interventions in order to generate the minimum possible impact on environment and on people.

  - Ministries of Agriculture, of Industrial Development, of Energy (Oil and Mining) of Treasury (among others) can help addressing major private interests that represent demands for inland waterway navigation.

  - Ministries of Foreign Relations (which participate in international negotiation on waterways), of Defense (as the Navy plays a very important role on waterways),

Ports Secretary, of Energy and of Fishing can collaborate to obtain better solutions on the water usages together with the Regulatory Agencies (ANA, ANTAQ, ANEEL).

- Ministries of Education, of Science and Technology and of Defense (Navy) can implement and improve qualification courses to train personnel to work either as crew or in the waterway management/maintenance.

2. Provide intermodality conditions to support waterways through supportive legislation.

The Ministry of Transport needs to provide intermodal conditions for the users to reach the waterways and to transport the cargo to its final destination. Not only waterway transportation will benefit from focusing on intermodal connections, also railway and road transport can benefit from integrating the total transport chain: intermodal chains. Recently, several plans related to logistics planning have been carried out: PNLT, PNIH, PNLP and the PHE. The PNLT was a mark in the restart of the Brazilian Logistic Planning and takes the broad approach in studying all transportation modes; the PNLP is focused on the Maritime Port sector; the PNIH results are related to potential locations of inland terminals. All of those plans used the PNLT as basis, but the output might be quite different, resulting in diffuse investments that might not be connected. For this reason, EPL is developing the PNLI ("Plano Nacional da Logística Integrada"). Bearing in mind the importance of this type of planning, it is strongly recommended that it continues to be part of the Government agenda. Recommendations for improvement are:

- Regularly update strategic planning on transport taking all the modes into account in order to provide subsidies for updating strategic plans of the different transport modes in the coming years.
- Develop a strategy for supporting clustering of cargo to main seaports and inland ports. In Europe the focus on developing several main sea ports for large amounts of cargo worked well. Especially for containers, since significant volumes are needed to make IWT affordable. It is important to stimulate the development of hubs by geographically clustering the terminals and the cargo flows. In a cluster more facilities can be offered for a relatively low price. Related companies can cluster around it as well and strengthen the cluster. It offers more opportunities for inter-modality rail-water connections, since it is easier to construct a railway to one port than to several terminals at different locations.
- Combine regional development and multimodal systems. The WAs are decentralized institutions connected to the federal level of government, but states and municipalities have their own institutions that manage transport in general (some have specific institutions that aims at managing the waterways). They should plan interventions and develop policies together. The pilot on Intra-modal transport as part of regional development can be followed for that purpose especially.

- The MT and its WAs can join into discussions for tax reductions on intermodality, to bring even more advantages in terms of cost reductions. This should be a joined effort, because if the MT is trying to stimulate IWT and local authorities raise taxes, it can reduce the effectiveness of the measure of the MT.

3. Stimulate and integrate passenger transport

Passenger transport plays an important role in the Amazon Region. There are several terminals located in that area and most of them do not satisfy some basic requirements, which ranges from accessibility (in terms of specific areas for taxi or bus stop, bus lines that connect to the terminal and others) to availability of facilities and services (police office, medical assistance and others). It is necessary to develop a Master Plan (Plano Diretor) based on the ANTAQ[16] study ("Caracterização da Oferta e da Demanda do Transporte Fluvial de Passageiros na Região Amazônica") to determine expansion and improvement plans for the Inland Terminals dedicated to Passenger transport, as well as its integration with the existing urban infrastructure. It is suggested that this Master Plan starts focusing on the busiest ones.

5.3.3 Working group 3: Public-private partnership

Defining the configuration of the public-private partnership is a relevant aspect to help improving the transport system. In working group 3 the private and the public sector bring their expertise together. The private sector could help the public sector to develop ways to improve technical aspects of the system. These aspects are for instance waterway maintenance, rules and regulations and stimulation of private initiatives that are innovative. for the inland waterway transport. The working group can also discuss ways to improve the transparency and efficiency rules for licencing, which was mentioned as problem for the private initiatives.

It is important that the private sector is actively involved as an advisor in designing these policies and rules. With the practical experience of the private sector, the public sector can solve bottlenecks for development more effectively. Together they can improve the system and encourage new users to enter the waterways. In a joined effort this working group should therefore investigate and develop the following topics:

- Develop Design, Build, Financing, Maintenance contacts
- Encourage innovation on ship building
- Incentives to encourage the waterway transport
- Promote the Waterway Transport to new users
- Develop crew requirements

[16] Caracterização da Oferta e da Demanda em Transporte Fluvial de Passageiros na Região Amazônica (ANTAQ, 2012).

1. Develop Design, Build, Financing, Maintenance contracts

The working group should stimulate a new division of responsibilities in which private parties will cooperate in development and maintenance of the waterway infrastructure. They can create a friendly environment in which this type of partnership can be tested, before enrolling it on a larger scale.

It is recommended that this part of the Public-Private Partnership is tested as a Pilot Project at the regional level. To enable to start the Pilot Project, the working group needs to select the type of companies that can act as potential co-operators or co-investors, as well as the main outline for the contract form and the division of responsibilities.

Two types of private parties can be regarded as potential cooperators or co-investors:

- The trading and production companies: the reliability on IWT can substantially lower the transportation cost of the export commodities from the production areas to the seaport. Co-investing provides the companies with a power to actually speed up the construction of the infrastructure in order to tune the development of the waterway and the development of terminals, ports and a fleet.
- The construction companies: the traditional contract form is that a contractor is hired for the dredging activities and is paid after the construction works have been executed. Other forms of contract can be used, as for instance, DBFM (Design, Build, Finance and Maintain).

The new contract form could hand over the following responsibilities to the private sector: Design, Build, Finance and/or Maintenance (DBFM). The following issues arise with the DBFM approach:

- Which financing period (M) can be applied in the Brazilian context? If banks of contractors only accept a relative short M period, the availability fee must be higher to repay the loan.
- If financing (F) can reduce the funding by milestone payments of the government. For example 65% of the required budget is financed by the public parties and paid to the contractor at the end of the capital dredging scheme, and the remaining 35% is financed by the contractor, this reduces the availability fee significant.
- Are there any third parties willing to fund a part of the capital dredging if the public parties and the contractor cannot fund the total project? The total required capital might be so high that project users shall have to take part in the funding, this can be the trading companies, the sea-ports and or other river users.
- How well can the maintenance costs be estimated? The more volatile the river and its costs are the more complex it is to prepare a good offer. The downside risk should be insured and the upside potential can be shared between both parties.

2. Encourage innovation on ship building

Innovation in ship building, can make the waterway sector even more competitive. The Working Group should define upon the most promising innovations that can be implemented for the waterways. This innovation could be in the ship building, by means of introduction of new technologies and facilities.

Knowledge institutes can work together with the government and the private sector, to join forces in research on the most interesting innovations:

- By introducing facilities for the **collection of ship waste** (including oil residues of the engine, bilge water, materials containing oil etc.) in all relevant inland ports and terminals a huge increase in environmental performance can be achieved. The facilities consist of collection stations as well as collection barges that transport it to the processing facilities. In Europe this system works already for more than 10 years and it was initiated and paid by the private and public sector together.

- The environmental performance of truck transport is rapidly increasing. To stay ahead in sustainable transport terms the IWT sector should invest in e.g. **emission reduction and energy savings**. Innovative research in Europe focuses on alternative fuels (LNG, hybrid vessel drive, etc.)

- Research could be carried out for the development of an **innovative system for coupling of convoys**. The development and application of innovative coupling system the following objectives:

  - The realization of a substantial time savings in the coupling process;
  - The less physically strenuous making the pairing process;
  - Reducing risks to crew members during the pairing process.

- Some of the Brazilian waterway systems can be characterized as relatively shallow water. The development of **shallow draft barges and push-boats** for restricted water-depth situations can increase the efficiency of IWT as these vessels will have a larger capacity than the normal barges and push-boats.

- The increased volume of liquid and chemical cargo will lead to an increase of dangerous cargoes on the Brazilian waterways. Use of **double hull tank vessels** could be encouraged to increase the safety level.

- Brazilian companies control more than 80% of international trade in orange juice. The juice is mainly transported by truck. An alternative is to **increase the transport of juice by barge**. A Juice Barge (a specially designed loading system designed for the transport of fruit juices) is being developed in Europe. This development is based on independent build "module", consisting of a stainless steel tank with process systems,

in an isolated "box" with cooling, the module is suitable for approximately 600 tons of cargo and can be placed in ordinary dry cargo ship.

3. Incentives to encourage the waterway transport

A tool for the government to encourage the waterway transport is to provide incentives. The working group can select the main and most effective means of stimulation, from the following categories of incentives:

I. Incentives for better infrastructure, industrial estates with water access. This indirectly increases inland waterway transport because more companies will have direct access to waterways at industrial estates, thus increasing the share of inland waterway transport.

II. Incentives for investments in ships (including innovations). This is mainly done to improve the quality of the fleet e.g. make transport possible in low water conditions or use innovative loading and unloading techniques. More efficient engines can also improve energy efficiency and be more environmentally friendly.

III. Incentives for cleaner transport. This is directly aimed at lower energy use or decreasing emissions. A modern engine is important, but a higher average load factor can also increase efficiency.

IV. Fund organizations that promote inland shipping. These organizations can advise shippers and transport companies about the possibilities of inland shipping (see Inland Navigation Promotion in the Netherlands or Promotion Inland Navigation in Belgium).

Some examples of programs in Europe provide inspiration for this development:

- Quick wins: a program which finances 50% of the investment costs if the project is feasible according to a standardized cost benefit analyses. This program includes usually small scale investments in industrial estates (improving accessibility or reorganizing space), or adjustments to the waterway (Netherlands).
- Innovative ship building. Gives a grant of 20% for: new types of ships, new ship modules or new methods in ship building. The grant is 30% if the investment clearly contributes to environmental protection (Germany).
- Aid program for low-emission diesel engines for inland navigation vessels. Examples: Lower-emission diesel engines (for new and existing vessels), exchange of engine or installation of diesel particulate filter and nitrogen reduction systems. Grants 30 to 40% of investments. Small companies can get 40 – 50% of investments (Germany).
- Public-private partnership (PPP) for the construction of loading and unloading facilities. Construction of infrastructure for transshipment facilities in the form of PPPs: Fairway development, mooring and quays or earthworks to give a few examples. A maximum of 50% of the total costs of the facility, max. 80% of the infrastructure costs. The

amount of public investment is bound to the operation time of the facility and a tonnage guarantee over the first ten years (Belgium).

- Assistance plan for the modal split in inland waterway transport. This scheme helps to support the inland waterway transport sector in two ways: First, it encourages the adaption of the fleet to existing logistics, but also to meet environmental requirements. Secondly, it support actions trying to make this transportation mode more attractive and ensuring a renewal of its actors. Grant is 50% of investments (EU).

The priority in deciding about possible incentives could be the ship building, since innovation in ship building is an important topic and there is a lack of general agreement on the capacity of the ship yards. During the diagnoses phase, of this plan problems regarding the ship building capacity for inland shipping were indicated during some interviews. Inland shipyards may not be able to promptly fulfill the market with a large number of barges, as they do not have financial capacity to expand their production. On the other hand, the shipyards stated that this is caused by the delay in approving the investment projects. Identifying and solving the actual bottleneck demands a structural approach towards the problems of the ship building sector, and a focussed approach on possible measures.

During the diagnosis phase, an analysis on the FMM (Fundo de Marinha Mercante) investments was carried out. This funds aims at promoting, encouraging, modernizing and expanding the Brazilian fleet. Its resources are obtained from the AFRMM (Adicional de Frete da Marinha Mercante). During the period between 2006 and 2012, major part of these investments were set apart for Cabotage and Offshore navigation, and little for the IWT (average of 4,5% of the total investments per year). To give an impulse to the development of shipyards, this balance could be adapted. Other possible measures to enhance the performance of the ship yards can be investigated and even importing barges for a certain period, while the shipyards adjust their production process. A focused and detailed analyses of this market in combination with monitoring of the yards capacity is recommended. With this, it will be possible to evaluate whether the Brazilian shipyards can accordingly accomplish the demands or if the impact of not charging the AFRMM will be positive.

4. Promote the Waterway Transport to new users

The Inland Waterways Strategic Plan will be publicized among all companies and governmental organisations involved. To promote IWT on the long term, to a larger target audience, as a sustainable and competitive mode of transport, an IWT Promotion Agency should be created. This agency's target group should be: shipping companies and logistics service providers, as they determine the selection of the transport modality. In addition, the agency should consider secondary target groups: transport companies, terminal operators, industry associations, ports and governments as well as the general public.

Besides providing information and marketing on IWT, the following aspects can be considered to be part of the role of this agency:

- Disclosing information on freight transport by inland waterways

- Organizing communication between the demand and supply side in freight
- Identify needs on the demand side and supply-side bottlenecks
- Initiate and participate in research based on identified knowledge gaps.

The members of Working group 3 can define the exact aim, mission and ambition of this agency. The cost of the promotion agency should be borne by the public and private parties together as they would both benefit from its result.

5. Develop crew requirements

The Brazilian crew for inland waterways are trained according to navy regulations. A separate education system for IWT can provide staff that is trained for the specific needs of the smaller waters and the different vessel types. The Dutch inland fleet comprises more than 60% of the total European inland fleet. For that reason the Dutch education system serves as an example for the European IWT education and training requirements (EQF, European Qualification Framework). The Brazilian situation could be developed with inspiration of the European situation.

Within the Dutch and European system 4 levels are being distinguished:

- Level 4 - Diploma - Master Captain / Entrepreneur
- Level 3 - Diploma - Master Nautical
- Level 2 - Diploma - A / B
- Level 1 - Vocational - trainee

The set-up of the education programme is modular, each module expands upon the previous one. As a consequence the total duration of the education programme is 2 years for level 2, 3 years for level 3 and 4 years for level 4. Obviously the set-up for Brazilian conditions will have be tailor-made to tune to the overall national education programmes.

During the education general education is being presented and in addition the following specific IWT subjects are being treated (The Database provides more specific insight in the curricula of the different courses).

- Infrastructure IW
- Safety and Environment
- Ship Knowledge and Cargo Handling
- Management and IW Orientation
- Navigation, Ship handling and Simulator
- Marine Engineer (Electrical and Mechanical)

In addition to the education at the start of a career in IWT, specific short-term courses will have to be set up to keep IWT professionals up-to-date with respects to the newest developments in safety (dangerous goods), security, logistic developments etc.

5.4 SUMMARY OF THE TASK FORCE

In Table 5.1 the aim and suggested agenda of the Task Force is summarized.

Table 5.1: Summary of the Task Force

Aim of the Task Force
Create the conditions for the implementation of the Inland Waterway Strategic Plan for the development of IWT in Brazil.
Suggested Agenda
1. Confirmation of the Master Plan and its selection of preferred strategy. The selected development path will have to be validated by the stakeholders on a sufficiently high level to guarantee a smooth development process. 2. Validation of the project list The strategy has been translated in an action list of projects to be executed. This list will be approved and prioritized. 3.Organize the Working Groups Definition of main areas that would need policy revision/development or further planning The main expected result is to put together all interested stakeholders to enable solutions to be discussed and presented. Working Groups will be installed to tackle the (institutional) topics, and the task force will nominate the representatives. 4. Selection of a limited number of pilot projects The development of the selected strategy starts by agreeing upon a number of pilot projects from the action list to be executed 5. Monitoring of the development and results Defining upon a solid manner to monitor the progress of the implementation process: The implementation process will be monitored and, where (and if) required, the Task Force will adapt the action list and budget allocation. This should be developed in such way that in the future, when the Task Force is not in place anymore, the service level of the waterway administrations – supported by each Regional Development Group – is regularly monitored and evaluated, so that adjustments can be made quicker to guarantee the reliability of the waterways for its customers. 6. Promotion and communication about IWT The Task Force will initiate promotion and communication activities to increase the importance of IWT in the Brazilian transport system 7.Decision to end or continue the Task Force Once the required institutional changes have been carried out, the Task Force can terminate, guaranteeing that the structure is well functioning.

Table 5.2: Summary of the Task Force (continuation)

Responsible organization	Ministry of Transport
Participants involved	Public and private representatives: CONIT (chaired and represented by the Minister of State for Transport, that have as members the Ministry of "Casa Civil", Finance, Planning, Budget and Management, Development, Industry, and Trade, Agriculture, Livestock and Supplies; and the Secretary of Port as well as of Civil Aviation, besides some civil society representatives), Waterway Administrations, SEGES, EPL, DNIT, ANTT, ANTAQ, Ministry of Energy, Ministry of Defense (Navy), Ministry of Environment, National Water Agency (ANA), Ministry of Foreign Relations, Cargo owners (trading companies), Shipping lines, Terminal operators.
Timeframe for development	Coordination of the Task Force [December/2013] - [June / 2014]. Preparation and implementation of the Task Force [July/2014] - [December/2024]. In 2025 the Task Force will be evaluated and participants will decided if the system is functioning adequately so that the Task Force can be ended.
Budget	Coordination: 0.25 million R$ per year[17]. Government (internal) working hours are not separate taken into the cost estimate, the Task Force will be provided with a budget to cover the expenses of studies required for these additional tasks. According to the present estimate for the physical interventions 17 billion R$ will be spent on IWT improvement. A first estimate of the supporting study and preparation cost associated with the functioning of the Task Force is 1,5 % of the total development budget: 255 million R$.

[17] Assumption: Cost estimate for a (senior) coordinator (1 FTE) is 0.25 million R$ (per year).

6 ACTION PLAN FOR DEVELOPING IWT SYSTEM AT THE REGIONAL LEVEL

6.1 ORGANIZE ACTIONS BY A REGIONAL DEVELOPMENT GROUP

It is recommended that one RDG will be formed for each waterway system. This recommendation aims at providing a more effective management of the waterways on a regional level. The heads of the RDG should be the Waterway Administrations. The structure of the WAs might change according to the decisions of WG1 from the Task Force, but it is important to go ahead, and not wait with implementing these improvements. In some regions the River Basin Committee is very active and the establishment of an efficient communication channel between the RDG and this Committee could be the starting point for the RDG. In other regions a new group should be initiated.

The major public and private stakeholders on the river basin level will participate in the Group. The River Basin Committees can fulfil an important role in the Development Group as they integrate the users of water resources in the region, but it is also important to have other stakeholders interested in enabling a reliable navigation mode. The benefits to join the RDG are that, for a specific river basin, these stakeholders are much closer to the actual projects. They have common interests to develop the region and will benefit from working together. Per region it will be decided whether chambers/ associations on a higher level might participate as this would be an alternative not to have every individual company to participate.

The Task Force will be the focal point for balancing the work that is done at the regional level. Each waterway will be developed according to its own specific challenges and opportunities.

6.2 AGENDA OF THE RDGS

The agenda of the Development Group covers the life span of the improved waterway:

- Planning the required improvements in a coordinated way.
- Developing the waterway by improving the navigability on the river and creating the basic infrastructure, such as locks and terminals.
- Guaranteeing that the waterway will remain in good condition by means of management and maintenance throughout the life of the assets.
- Guaranteeing the usage of the waterway, so that the trade continues to flow and generate revenues for the maintenance and investment of the infrastructure.

The public/private character of the Development Group will enable the group to effectively assist in case of both public and private bottlenecks.

The following steps will be taken in the IWT development project: application of permits, contracting of the construction firms, financing of the project, concessions for private involvement and execution of the works.

Market study

On a more detailed scale than in the present IWSP study the forecast of the transport volumes will be reviewed and updated. The private parties represented in the Development Group can contribute with more accurate and detailed plans on the level of the specific waterway improvement project. The market study may be the basis of the concessions for private involvement.

Master plan

Based on the general outlines presented in the present IWSP study as well as on the detailed market study the Master plan for each waterway will be an in-depth study to determine the project specifications for the improvement of navigability by selecting the optimal combination of convoy size, lock and waterway dimensions as well as terminal dimensions and equipment. For some of the waterways proposed in this plan feasibility studies (EVTEA) are being elaborated which shall speed up the implementation of this plan.

Strategic Environmental Assessment (SEA) of the Waterways Systems Plans

The focus of the Inland Waterway Strategic Plan is to further develop IWT as a transport mode in order to decrease Brazilian logistic cost and put our products in a more competitive position on international markets. Multiple other projects, plans and programs were simultaneously developed with other focus, but shall impact the very same regions. These projects need to be analyzed on a coordinated/integrated manner in order to minimize potential environmental impacts and maximize its efficiency in terms of public spending. The strategic environmental assessment approach can help (i) identifying conflicting/redundant planning on a same region, (ii) analyzing their potential impact on the dynamic of the region (economic, environmental, besides others) and, more important, (iii) discussing integrated solutions to overcome the identified challenges before each project is subjected to the environmental permitting process.

Detailed design

Based on the design specifications presented in this Plan, design studies will be made for the construction works required for the improvement project. The construction works for connecting infrastructure will also be designed. These detailed designs will form the basis of cost estimates and project planning. The designs, the planning and the cost estimates are the basis for the negotiations with the constructing companies prior to the signing of the construction contract.

Business case

The business case combines the financial results of expenditure in project investments and operational cost with the income from concessions. Based on the outcome of the discussions about Public Private Partnerships a number of different funding options are available.

The optimal financing solution will have to be determined and concessions and contracts will have to be drawn up and signed.

Management and maintenance

Once the project has been finalized a proper management and maintenance department will have to be in operation. The management of the waterway is one of the main responsibilities of the Waterway Administration. During the implementation process of the waterway the Waterway Administration will have time to raise the management system up to the level required for an efficient operation. The Development Group will be instrumental in setting up the specifications for proper management and maintenance and will assist in implementing these specifications. The Development Group will be provided with a budget to cover the expenses of studies required for these additional tasks. The responsibility for the management and the maintenance will be with the Waterway Administration, but the RDG should provide support and help overcoming obstacles.

The Development Group will assist the Waterway Administration to guarantee that the waterway will remain in good condition by means of management and maintenance throughout the life of the assets. Efficiency and effectiveness indicators to evaluate the waterway management and operation will be formulated jointly and the possibilities for private involvement in waterway management and operation will be explored.

Continuous transport flows

On the one hand the Group can explore the possibilities of long term contracts to guarantee the continuity of the IWT transport flows.

On the other hand the Development Group, by its nature, can be very effective in promotion activities for IWT and in exploring new markets ready for the implementation of inland navigation in their logistic chains. Through the regional character and the public/private participation the Group will have a thorough market knowledge that can be used for these activities.

6.3 MANAGEMENT TOOL FOR THE REGIONAL DEVELOPMENT

The accomplishment of waterway related projects is very complex. Many stakeholders are involved: shipping line operators, terminal operators, infrastructure managers (waterways, but also roads and railroads), authorities, investors, urban planners and many more. All stakeholders have different interests and it is difficult to create a mutual vision for a project. The success of the Regional Development Group will strongly depend on its capability to interact effectively with the relevant stakeholders and its capability to build solid partnerships based on common goals.

From European experience an example can be extracted of effective traffic management measures implementation The Dutch National Government (Ministry of Infrastructure and Environment) elaborated a methodology exactly for this purpose. The name of this methodology is “Corridor gericht benutten” which means “Optimizing the use of the corridor”. The approach is completely stakeholder-driven and the main steps are illustrated in Table 6.1. Each step in the process is divided in sub steps and the methodology within each sub step has been described in detail. All relevant stakeholders are involved from the beginning and all their

specific interests are taken into account. The stakeholders remain involved during the process and they have the possibility to influence decisions.

Table 6.1: Process Management for Traffic Management on waterway corridors

Step	Main Step	Substep
1	Start and define the project	Involve the stakeholders and start the project as a group
2	Define the end situation "the ambition"	Formulate common objectives
3		Project objectives and preferred routes
4		Quantify the objectives
5	Define the existing situation	Make an inventory of the existing situation
6		Identify and analyse bottle-necks and opportunities
7	Define the solutions	Identify solutions
8		Determine the measures
9	Decide on the solutions	Decide together on the solutions
10	Implement the solutions	Develop scenarios
11		Implement measures
12		Evaluate the project

Such a process management methodology could help to standardize the project approach in which stakeholder interests are taken into account. This methodology is written for traffic management measures in a Dutch stakeholder-environment. It is advised to develop a similar methodology for the Brazilian situation. This new methodology should be suited for the realization of projects and should be based on the Brazilian stakeholder-environment. The Dutch methodology[18] could be used as a basic reference, but it will require major changes. Lessons learned during the pilots can be used for further improvement of the process methodology, so that it can be used as a basic process methodology for all national waterway related projects.

[18] "Stappenplan Corridor gericht Benutten", RWS (Dutch Infrastructure Manager), February 2007, http://www.rijkswaterstaat.nl/images/Stappenplan%20corridorgericht%20benutten_tcm174-331762.pdf

6.4 SUMMARY REGIONAL DEVELOPMENT GROUP (RDG)

Aim
Implement the required projects in a specific waterway together throughout the life span of the assets. All members add their own efforts to the Waterway Administration while implementing the improvement project for a specific waterway
Suggested Agenda
1. Formulate common goal For the development of a specific waterway a goal will be formulated that guarantees benefits for all stakeholders involved. **2. Market study, Design study and execution of the projects** Execute the required measures in a joint effort with all members, using the tool for regional development, while agreeing upon projects, planning, budget and responsibilities and, guarantee balanced set-up resulting in a design that optimally combines the public and private developments. **3. Permits, contracts, financing and concessions** Evaluate the best alternatives in terms of contracting agreements and partnership to build. Analyze the potential environmental impact of the panned activities and design alternatives to minimize them, through the conduction of Strategic Environmental Assessment (ESA). **4. Confirm and monitor timeframe** The timeframe will be set in such a way that a simultaneous development of all elements in the transport system results **5. Determine efficiency and effectiveness indicators to evaluate the waterway management and operation** **6. Promote long term transport contracts and new markets for IWT**

Responsible organization	Ministry of Transport
Participants involved	Public and private representatives to be determined specifically for each separate development project
Timeframe for development	Implementation of the RDG [November/2013] - onward. The RDG can be seen as a commission (e.g. Rhine commission) and will be permanent.
Budget	. 1.0 million R$ per year

6.5 REGIONAL DEVELOPMENT PROJECT LIST

At the regional level the stakeholders will work together to reach the necessary improvements. In this chapter the waterway systems are described. Per waterway is explained which opportunities and points of improvements were indicated. After that the needed investments in civil works, signaling and delayed maintenance are explained.

Investments in fleet and terminal expansion were considered to be performed by private parties (trading companies, shipping lines, terminal operators). To determine the order of magnitude of these investments two models have been developed to calculate the required number of terminals and barges and push-boats for each waterway, based on the trade forecasts. Standard prices for vessels and terminals were applied to determine the required investments. The models and assumptions are briefly described in the following paragraphs. The results are presented as the total number of vessels and berths required to handle and transport the forecasted flows in 2031. Although part of the present fleet and equipment will still be operational in 2031, investments have been calculated based on the assumption that everything will be newly constructed. In the database of the PHE the methodology for calculating the investments can be found.

6.5.1 RDG – Amazon Waterway System: Amazon, Solimões and Negro Rivers

Coari - Manaus - Almeirim - Santana / Tocantins River

6.5.1.1 Opportunities and points of improvement

The Amazon, Solimões and Negro Rivers are currently navigable for maritime vessels particularly in the section from Coari (AM), in Solimões River, and Manaus (AM), in Negro River, until Amazon River mouth, at the Atlantic Ocean.

The Solimões River has adequate depths for commercial navigation throughout the year in the section between the cities of Manaus (AM) and Coari (AM). However, in this section the presence of mobile sand banks may result in some depth limitations, just at the low tide, with a draft of up to 4.0 m.

The Negro River, from the Amazon River to Manaus, is navigable without significant restrictions. In Negro River mouth, where it meets Solimões River, the depths are around 100 meters and the high nautical traffic in this section requires extra attention.

The Amazon River is navigable throughout the year, with some navigation restrictions in the dry season, when restricted visibility - due to forest fires, heavy rain or fog - hinders the navigation. The average width of the Amazonas River is approximately 5 km. and minimum depths of approximately 30 m.

The Amazon River meets the Atlantic Ocean in a huge delta, downstream of Almeirim (PA), composed of hundreds of islands and channels. From Almeirim the vessels have two main routes to reach the Ocean: one that connects the Amazon River to Santana port (AP), north of Marajó Island; and other that connects the Amazon River to the city of Belém (PA), through the “Strait of Breves” and the Pará River, south of Marajó Island. The southern route, the shortest route to Belém (PA), has more restrictions for navigation, once it is characterized by

narrow passages and sharp bends that allow the navigation of only one vessel at a time in some sections. Particularly in the "Strait of Óbidos", the width decreases to 1.5 km and the depth reaches 100 m.

On the Amazon and its tributaries not only inland waterway transport is observed, but also short sea shipping and even deep sea vessels navigate on the Amazon up to Itacoatiara. The main commodities transported currently by IWT on the Amazon River are chemical products (between Coari and Manaus), oil products (between Manaus and a number of destinations in the Amazon region like Belem and Santarém). Ro-Ro transport is also especially important between Manaus and Belem. Other important routes are Manaus - Porto Velho and Manaus – Santarém. The total IWT in 2011 in the sections described above was about 5.8 million tons.

The IWT is expected to double in 2031 (11.5 million tons), mainly due to the growth of the transport of chemical products, oil products and ro-ro transport. These flows are all expected due to the growth of the Brazilian economy.

In the Amazon region (especially on the Amazon, Solimões and Negro Rivers) passenger transport by inland waterway is important. The majority of roads is in bad condition or not present at all. The distances are long and the vegetation is dense making road transport difficult. Passenger transport on inland waterways is in some cases the only alternative. At the moment around one million trips are made by inland waterways every month. Not only for local transport, but also for long distance travels by tourists. It is expected that the number of passengers will go up by 40% until 2031 because new roads will have a (negative) impact on the environment. Besides that the touristic sector will gain more importance in the Amazon region and travelling by boat will become more popular.

In Table 6.2 the major flows of long distance passengers in 2031 are depicted.

Table 6.2: Passengers on Amazon River 2031

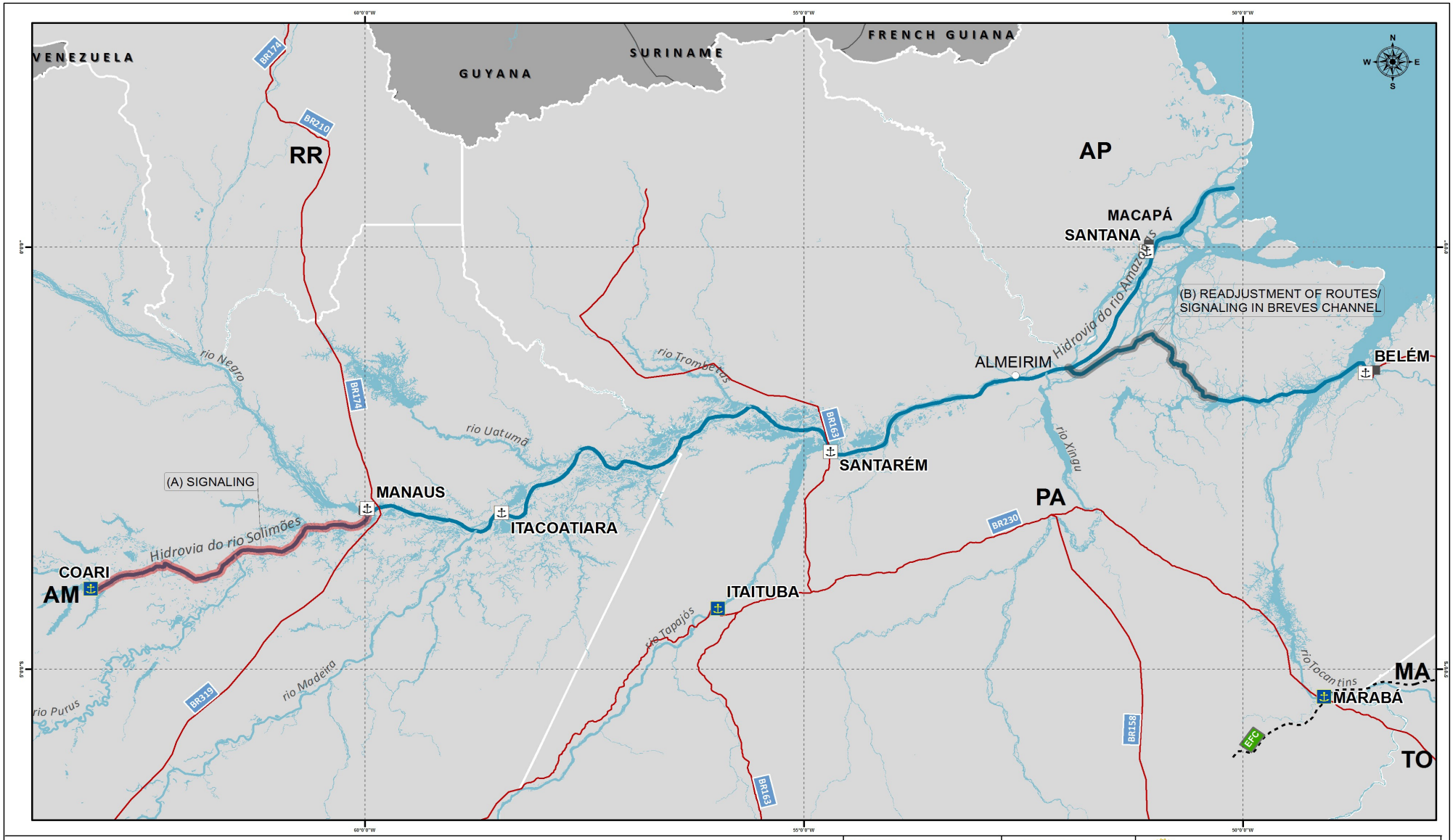
Route	Distance (km)	# passengers
Manaus – Tefe	600	258.599
Manaus – Parintins	400	254.301
Belém – Portel	325	233.702
Manaus – Santarém	756	235.578
Belém – Muana	100	186.638
Manaus – Coari	400	170.034
Ponta de Pedras – Belém	75	153.599
Santarém - Monte Alegre	100	150.969
Belém – Macapá	574	146.856
Santarém – Jurúti	200	140.450
Itaituba – Santarém	359	132.194
Manaus – Anari	1350	137.925

6.5.1.2 Measures to improve the navigability the transport system

In order to improve the navigability conditions in the described sections of the Amazon, Solimões and Negro Rivers few investments are necessary. Mainly signaling, along Solimões and Negro Rivers, between Manaus (AM) and Coari (AM), is required, because of the existence of mobile sandbars that restrict navigation in some sections. Civil works like enlargement of the river, dredging and river regularization were identified as necessary in the narrowing located in the section between Almeirim (PA) and the Tocantins River mouth. These works are summarized in Table 6.3.

Table 6.3: Civil works and Signaling, in the Amazon, Solimões and Negro Rivers

River Section	Length (km)	Actions (Type of work)	Estimated Cost (million R$)
Coari (AM) - Manaus (AM) (Solimões / Negro River)	420	(A) Signaling	50
Manaus (AM)- Almerim (PA) (Amazon River)	1,040	-	-
Almeirim (PA) – Santana (AP) Amazon River	260	-	-
Almeirim (PA) – mouth of Tocantins River (PA) (Amazon River / Breves Channel)	600	(B) Readjustment of routes / Signaling	250
TOTAL	**2.320**		**300**



CARTOGRAFICAL CONVENTIONS

- Capital of the State
- City
- Sea Ports
- Inland Waterway Terminal
- Highways
- Railroad
- Intervention: Signaling
- Intervention: Channel Improvments
- Amazons Waterway
- Hydrography
- Water Surface
- State Borders
- International Borders

REFERENCES

Sources:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

FOLHA: DATA:

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL: SAD69

MAIN LOCATION

MINISTÉRIO DOS TRANSPORTES

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PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

AMAZON WATERWAY SYSTEM

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To handle the forecasted volumes of cargo in 2031, the handling capacity of the terminals will have to be increased. The standard terminals have been adopted for the different commodities to calculate the required number of berths and terminals. For each of the standard terminals the cost of infrastructure (jetties, internal roads and pavements) and superstructure (storage facilities, cargo handling equipment and offices) have been estimated.

For the terminals along the Amazon, Solimões and Negro Rivers the resulting required number of berths in the ports of Coari and Manaus is presented in the following table. The doubling of the cargo volume will demand 12 new berths along the Amazon. The required private investments in these handling facilities will be of R$ 429 million. It must be realized that the terminal expansion that will be required in the sea-ports will be of the same order of magnitude.

Table 6.4: Terminal capacity, in the Amazon, Solimões and Negro Rivers

River terminals	Type of terminal	Number of berths	Estimated Cost (million R$)
Amazon			
	Liquid bulk	8	242
	Ro-ro, break bulk	4	186
TOTAL		**12**	**429**

Not only the capacity of the terminals will have to be increased to match the forecasted growth of cargo volumes, but also the capacity of the fleet.

This calculation is based on the assumption that standard barge convoys will be applied on the different rivers. For the Amazon, Solimões and Negro Rivers a convoy of 4 x 5 barges has been adopted. The dimensions of a standard barge are:

- Length: 58,00 m
- Beam: 11,00 m
- Draught: 4,00 m
- Capacity: 1.900 tons

The investments in barges and push boats have been estimated.

For the fleet capacity on the Amazon, Solimões and Negro Rivers the resulting numbers of barges and push boats have been presented in Table c. To transport the forecasted cargo volumes, 96 barges will be required, as well as 6 push boats. The total private investment in this fleet is estimated to be of R$ 179 million.

Table 6.5: Fleet capacity, in the Amazon, Solimões and Negro Rivers

Type of vessel	Number of barges	Number of push boats	Estimated Cost (million R$)
Liquid bulk	48	3	90
Ro-Ro	48	3	90
TOTAL	**96**	**6**	**179**

6.5.1.3 Measures to improve passenger transport

Improvement and funding of public passenger terminals

New or continued funding of the renewal and improvement of public terminals and jetties should be taken care of by the responsible regional authorities. The figure below shows the principal passenger terminals in the Amazon region.

It is advised that these authorities reach an agreement to what quality standards should be applied for the terminals in order to attain an upgrade of the complete IWT passengers transport system. The necessary funding should match these quality standards.

Combining services

Another area for improvement concerns combining IWT services for local use and tourists in the Amazonas. Until now this has not been very easy, resulting from different requirements. However improving transport conditions for tourists will benefit the economic development of the region, contributing to improving living conditions for all.

Regulation and inspection

Last but not least passengers IWT regulating organizations (DNIT/ANTAQ/SETRAN/CPH) are overlapping, leading to inefficiency and technical safety inspection is falling short.

In order to improve efficiency of regulation and inspection, geared at improving the level of service of passenger (public and tourist) transport, a Regional Development Group in the Amazonas (Belém or Manaus) will be set up to address the issues at stake.

CARTOGRAPHIC ITEMS

- Borders
- Rivers Studied
- Water Surface
- Passenger Terminal
- State Capital
- Main Highways
- PHE - Selected Waterways

REFERENCES

Sources:
- Integrated Cartographic Base from Brazil - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA
0 70 140 280 km
GEOGRAPHIC COORDINATE SYSTEM, HORIZONTAL DATUM: SAD69

LOCATION

MINISTRY OF TRANSPORT

ARCADIS logos

INLAND WATERWAYS STRATEGIC PLAN

PASSENGER TERMINALS AMAZON REGION

EXECUTED BY:	SCALE:	SHEET:	DATE:
ARCADIS logos	1:7.500.000	- BRASIL -	2013

6.5.2 RDG - Madeira Waterway System: Madeira River

Porto Velho – Amazon River (near Itacoatiara)

6.5.2.1 Opportunities and points of improvement

Currently, the Madeira River is navigable from Porto Velho (RO) to its mouth, on the Amazon river (near Itacoatiara (AM)). In this section, during the flood season, the sailing conditions are good, mainly due to the available water depths that can reach up to 15 m, covering the sand bars, rocky outcrops and other hurdles. Obstacles that restrict the navigation of big convoys (4 x 5) in some sections, specially between Humaitá (AM) and Porto Velho (RO), in general, are observed only during the dry season, when the used convoys are smaller (3 x 3).

The Madeira River is also very important for regional development, as the vessels are the main transport mode for people living in the cities along the banks. And, as well as for the Amazon River, the Madeira River is located in an area with dense vegetation, so waterway transport shows up as a less impacting mode, not only due to the less green-house gas emissions but also because it represents in some sense an alternative to road transport for local communities, that is normally safer than road transport and reduces the need of other roads construction, that would have a higher environmental impact than the maintenance of the waterway navigation conditions.

The Madeira River functions currently as a main transport route for the state of Rondônia and to a lesser extend for Mato Grosso. Transport on the Madeira River to and from Rondônia (imports and exports) in 2011 was about 1 million tons and from Mato Grosso (mainly exports) was about 3 million tons (especially soy, soymeal and corn). In total inland waterway transport on the Madeira River in 2011 was 4 million tons. These flows use the Amazon River as well[19], as Itacoatiara and Santarém are the seaports for exports.

The transport to and from Rondônia will increase to about 2.2 million tons in 2031. This will mainly consist of cement, Ro-Ro transport, and oil products. Transport from Mato Grosso will be about 2.5 million tons, essentially soy, soymeal and corn. This is only 10% more than the transport volume in 2011. The main reason is the competition of the Tapajós River for the same exports from Mato Grosso. The important northern regions within Mato Grosso (like Sorriso and Sapezal) will use the Tapajós River, once completed, as the main export link to the seaports.

6.5.2.2 Measures to improve the navigability and the transport system

In order to improve the navigability conditions and therefore ensure a minimum draught during the whole year, as well as conditions to navigation of the big convoys that will transport the future cargo, civil works on the Madeira waterway are necessary. These works are summarized in Table 6.6.

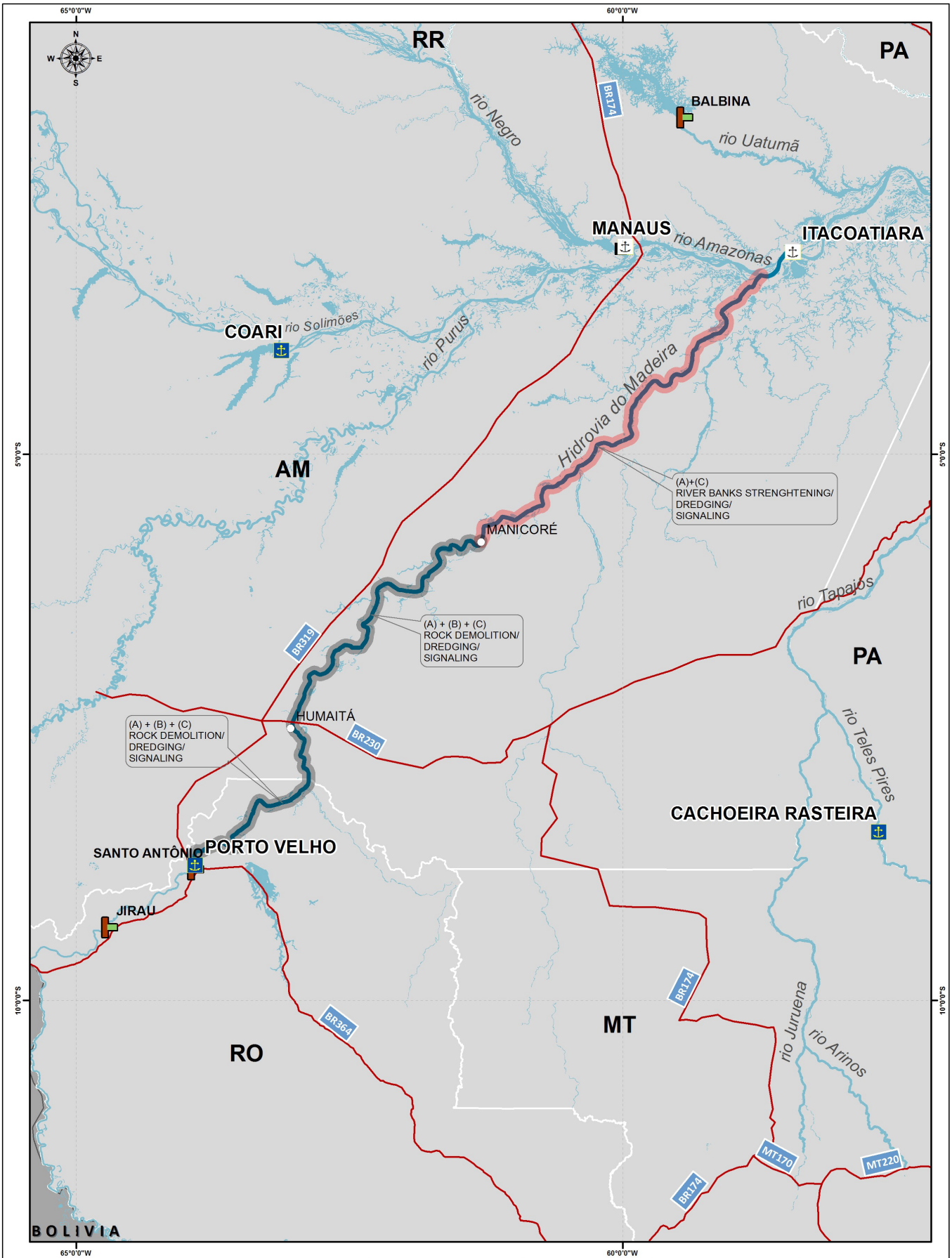
The required civil works comprehend rock demolition on the rocky outcrops areas, in order to allow navigation during the dry season. In addition, activities like dredging and regularization works are necessary to mitigate and avoid the aggradation problems along the river, especially

[19] In the study all transport flows with origin and destination in Porto Velho are assigned to the Madeira River to avoid double counting.

during dry season. Once the aggradation problems are dynamic, an updated signaling system is required also to guarantee the safety of navigation.

Table 6.6: Civil works and Signaling, in the Madeira River

River Section	Length (km)	Actions (Type of work)	Estimated Cost (million R$)
Itacoatiara (AM) – Porto Velho (RO)	1,060	(A) River banks strengthening / Dredging	800
		(B) Rock demolition	1.000
		(C) Signaling	200
TOTAL	**1.060**		**2.000**



CARTOGRAFICAL CONVENTIONS

- State Capital
- City
- Sea Ports
- Inland Waterway Terminals
- Existent HPP, without Lock System
- Highways
- Railroads
- Interventions: Rock Demolition/Dredging/Signaling
- Interventions: River Streghtening/Dredging/Signaling
- Madeira Waterway
- Hydrography
- Water Surface
- State Borders

REFERENCES

Sources:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL: SAD69

MAIN LOCALIZATION

MINISTÉRIO DOS TRANSPORTES

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PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

MADEIRA WATERWAY SYSTEM

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
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To accommodate the forecasted cargo volumes the capacity of the terminal facilities as well as the fleet will have to be expanded. The required capacity increase is summarized in Table 6.7 and Table 6.8. For the barges in the Madeira River a standard size has been assumed. The length of the standard barge is 60 m long and with a beam of 11 m.

While planning for these interventions, it is important to evaluate their potential aggregated impact on the region. It is recommended that a Strategic Environmental Assessment is conducted to anticipate and mitigate eventual territorial conflicts and enable a smoother licensing process for each intervention.

To handle the forecasted volumes of cargo in 2031, the handling capacity of the terminals will have to be increased. The standard terminals have been adopted for the different commodities to calculate the required number of berths and terminals. For each of the standard terminals the cost of infrastructure (jetties, internal roads and pavements) and superstructure (storage facilities, cargo handling equipment and offices) have been estimated.

For the terminals along the Madeira River the resulting required number of berths in the port of Porto Velho is presented in the following table. The increase of the cargo volume will ask for 10 new berths. The majority of the new berths (6) are destined for agri bulk, 3 berths are required for ro-ro and break bulk and one for liquid cargo. The required private investments in these handling facilities will be R$ 245 million. It must be realized that the terminal expansion that will be required in the sea-ports will be of the same order of magnitude.

Table 6.7: Terminal capacity, in the Madeira River

River terminals	Type of terminal	Number of berths	Estimated Cost (million R$)
Madeira	Agri bulk	6	146
	Liquid bulk	1	30
	Ro-ro, break bulk	3	69
TOTAL		**10**	**245**

The capacity of the fleet will have to be increased considerably. The calculation of the required number of barges and push boats is based on the assumption that standard barge convoys will be applied on the different rivers. For the Madeira River a convoy of 4 x 5 barges has been adopted. The standard barges have smaller draught than the ones on the Amazon.

The dimensions are:

- Length: 58,00 m
- Beam: 11,00 m
- Draught: 2,50 m
- Capacity: 1.200 tons

For the fleet capacity on the Madeira River the resulting numbers of barges and push boats have been presented in the following table. To transport the forecasted cargo volumes 136 barges will be required, as well as 9 push boats. The total private investment in this fleet is estimated to be R$ 183 million. It should be realized that the price of a standard barge and a standard push boat for the Madeira River is lower than for the Amazon River system.

Table 6.8: Fleet capacity, in the Madeira River

Type of vessel	Number of barges	Number of push boats	Estimated Cost (million R$)
Agri bulk barge	73	4	90
Liquid bulk	21	2	34
Ro-Ro, container	42	3	59
TOTAL	**136**	**9**	**183**

6.5.3 RDG - Teles Pires-Tapajós Waterway System: Tapajós and Teles Pires Rivers

Santarém - Cachoeira Rasteira

6.5.3.1 Opportunities and points of improvement

The Tapajós Waterway System has a strategic geographical position, linking the major centers of agricultural production in Brazil to the Amazon River, and consequently to the Atlantic Ocean. However, nowadays the navigation is only possible from Santarém (PA), at the mouth of Tapajós River in the Amazon River, to Itaituba (PA), with 280 km of extension.

Upstream of Itaituba the Tapajós River, and its tributary, the Teles Pires River, present a series of rocky outcrops, rapids and waterfalls that hinder the navigation of commercial vessels. As Tapajós and Teles Pires Rivers are also strategic from the Brazilian Energy Sector perspective, three hydropower power plants between Itaituba and Cachoeira Rasteira (São Luís do Tapajós, Jatobá and Chacorão HPPs) are planned in this section.

The construction of those hydropower plants have been facing implementation challenges in order to have the local communities' support, especially indigenous communities that live close to Jacareacanga (the confluence of Tapajós, Teles Pires and Juruena Rivers). The Munduruku's have their land already regularized, Kayabis's land has been approved and Apiacá do Pontal and Isolados' land has been delimited by FUNAI. The federal government proposed an innovative hydropower plant format that would result in less flooded area and less construction impact, but changes to the region's social, economic and environmental dynamic are expected.

On the aforementioned section (from Santarém (PA) to Itaituba (PA)), only 50.000 tons of cement and cokes were transported in 2011.

With the extension of the navigable section of Tapajós River, including the Teles Pires River, until Cachoeira Rasteira (MT) the competitive position of the Tapajós River will be improved. Cargo transport from Mato Grosso, still the major producer of soy and corn in 2031, will be cheaper using the Tapajós River.

The total cargo transport on the Tapajós and Teles Pires Rivers will be 9.7 million tons in 2031, consisting of soy, soymeal and corn, the main exported commodities, and fertilizers, the imported cargo. These flows are related to the agricultural production in and export from the northern regions of Mato Grosso.

6.5.3.2 Measures to improve the navigability and the transport system

The IWT, between Santarém and Cachoeira Rasteira, depends directly on the construction of HPPS, with lock systems, which will allow navigation along extensive sections of the rivers. However, between Itaituba and Cachoeira Rasteira, where the river bank it is not expected to be flooded by the future reservoirs additional measures are required, such as rock demolition, dredging, river regularization and signaling.

It is very important that, within the Regional Development Group of Tapajós, these measures proposed to enhance navigation conditions are analyzed together with the hydropower plants and other projects that are being considered for this same area, in order to come with the less impacting integrated solution not only for environment, but also for traditional communities living in the region. It is recommended that a Strategic Environmental Assessment is conducted for the region, that would help understanding the aggregated impact of all the projects in the area and studying alternatives for potential issues before each project go on to a licensing phase.

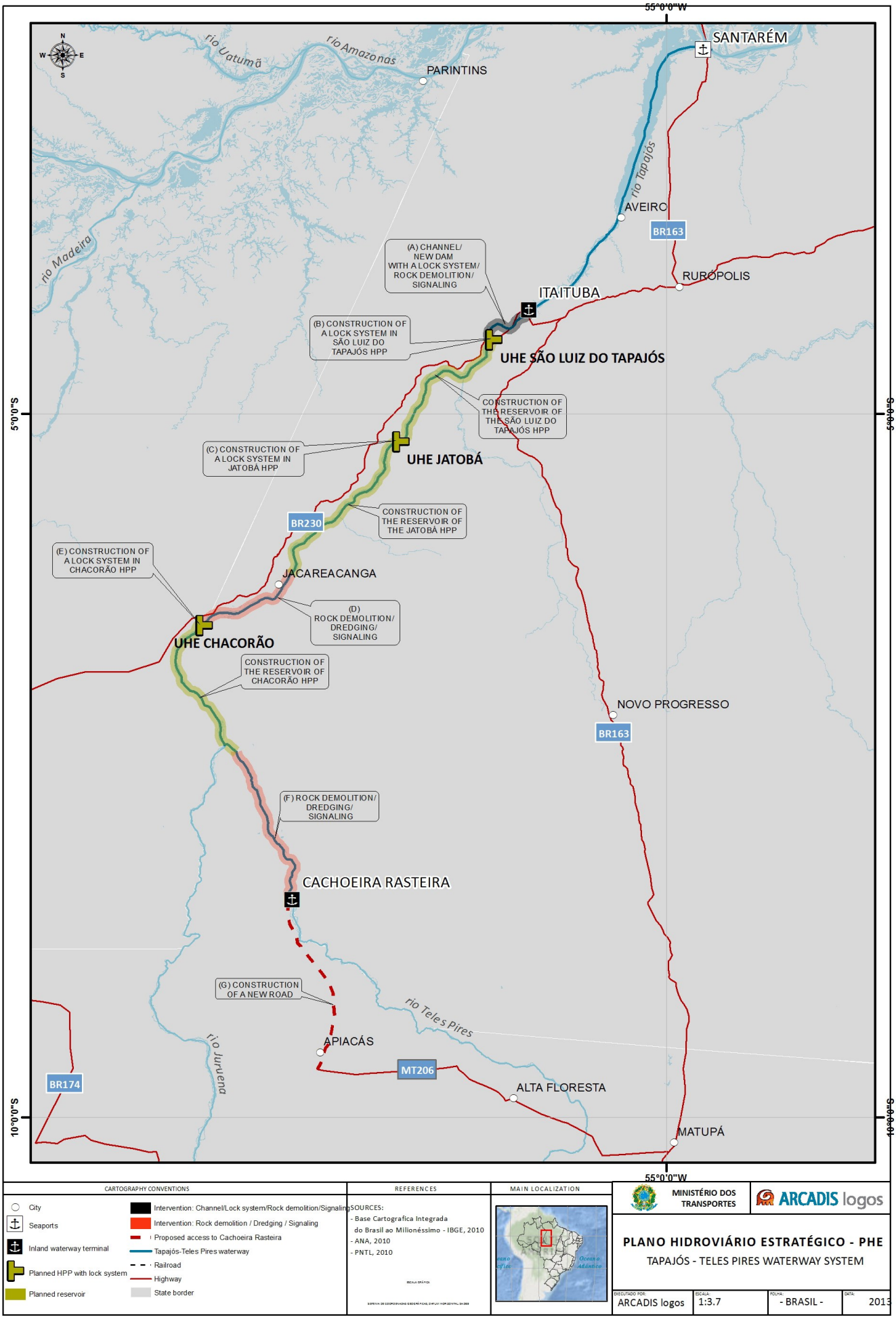
Table 6.9: Civil works and Signaling, in the Tapajós River

River Section	Length (km)	Actions (Type of work)	Estimated Cost (million R$)
Santarém (PA) – Itaituba (PA)	280	-	-
Itaituba (PA) – Cachoeira Rasteira (MT)	680	(A) Dam with lock / Canal / Rock demolition / Signaling	500
		(B) Construction of a lock system in São Luís do Tapajós HPP	650
		(C) Construction of a lock system in Jatobá HPP	300
		(D) Rock demolition / Dredging / Signaling between the end of Jatobá reservoir and and Chacorão dam	560
		(E) Construction of a lock system in Chacorão HPP	450
		(F) Rock demolition / Dredging / Signaling between the end of Chacorão reservoir and Cachoeira Rasteira	500
		(G) Construction of a road connecting Apiacás (MT) to Cachoeira Rasteira terminal	461
TOTAL	**960**		**3.501**

The choice for the Cachoeira Rasteira location was based on an analysis that considered environmental, economic and navigability conditions aspects, as well as risks associated to the construction of dams with locks. The latter factor was considered the most incisive in the selection, as upstream to Cachoeira Rasteira, at least three dams must be constructed to enable navigation, of which, only two are included in the Energetic Plan.

Even if these two are built with locks, the third dam that is necessary, located among HPP Chacorão and HPP São Manoel, would have its reservoir placed on the Indigenous Territory named “Kayabi”, which is highly sensitive from the environmental point of view.

In this sense, it is recommended that a Strategic Environment Assessment is carried out to determine the impact of the alternative considering the implementation of the terminal together with the road access, and the alternative comprehending the construction of an additional dam with lock in an environmental sensitive area.


55°0'0"W
SANTARÉM
rio Uatumã
rio Amazonas
PARINTINS
rio Tapajós
AVEIRO
BR163
rio Madeira
(A) CHANNEL/ NEW DAM WITH A LOCK SYSTEM/ ROCK DEMOLITION/ SIGNALING
RURÓPOLIS
ITAITUBA
(B) CONSTRUCTION OF A LOCK SYSTEM IN SÃO LUIZ DO TAPAJÓS HPP
UHE SÃO LUIZ DO TAPAJÓS
CONSTRUCTION OF THE RESERVOIR OF THE SÃO LUIZ DO TAPAJÓS HPP
5°0'0"S
(C) CONSTRUCTION OF A LOCK SYSTEM IN JATOBÁ HPP
UHE JATOBÁ
BR230
CONSTRUCTION OF THE RESERVOIR OF THE JATOBÁ HPP
(E) CONSTRUCTION OF A LOCK SYSTEM IN CHACORÃO HPP
JACAREACANGA
(D) ROCK DEMOLITION/ DREDGING/ SIGNALING
UHE CHACORÃO
CONSTRUCTION OF THE RESERVOIR OF CHACORÃO HPP
NOVO PROGRESSO
BR163
(F) ROCK DEMOLITION/ DREDGING/ SIGNALING
CACHOEIRA RASTEIRA
(G) CONSTRUCTION OF A NEW ROAD
rio Teles Pires
APIACÁS
rio Juruena
MT206
BR174
ALTA FLORESTA
10°0'0"S
MATUPÁ
55°0'0"W
CARTOGRAPHY CONVENTIONS
City
Seaports
Inland waterway terminal
Planned HPP with lock system
Planned reservoir
Intervention: Channel/Lock system/Rock demolition/Signaling
Intervention: Rock demolition / Dredging / Signaling
Proposed access to Cachoeira Rasteira
Tapajós-Teles Pires waterway
Railroad
Highway
State border
REFERENCES
SOURCES:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010
MAIN LOCALIZATION
MINISTÉRIO DOS TRANSPORTES
ARCADIS logos
PLANO HIDROVIÁRIO ESTRATÉGICO - PHE
TAPAJÓS - TELES PIRES WATERWAY SYSTEM
EXECUTADO POR: ARCADIS logos
ESCALA: 1:3.7
FOLHA: - BRASIL -
DATA: 2013

To handle the forecasted volumes of cargo in 2031, the handling capacity of the terminals will have to be created in Cachoeira Rasteira. The standard terminals have been adopted for the the agri-bulk cargo to calculate the required number of berths and terminals. For the standard terminal the cost of infrastructure (jetties, internal roads and pavements) and superstructure (storage facilities, cargo handling equipment and offices) have been estimated.

Along the Tapajos River the resulting required number of berths in the port of Cachoeira Rasteira is presented in the following table. The increase of the cargo volume will ask for 19 new berths. All of them destined for loading of agri bulk and unloading of fertilizer. The required private investments in these handling facilities will be R$ 460 million. It must be realized that the terminal expansion that will be required in the sea-ports will be of the same order of magnitude.

Table 6.10: Terminal capacity, in the Tapajós River

River terminals	Type of terminal	Number of berths	Estimated Cost (million R$)
Tapajós	Agri bulk	19	460
	Liquid bulk		
	Ro-ro, break bulk		
TOTAL		**19**	**460**

The capacity of the fleet will also have to be created. The calculation of the required number of barges and push boats is based on the assumption that standard barge convoys will be applied on the different rivers. For the Tapajos River a convoy of 2 x 2 barges has been adopted. The dimensions of the standard barge are:

- Length: 58,00 m
- Beam: 11,00 m
- Draught: 2,50 m
- Capacity: 1.200 tons

For the fleet capacity on the Tapajos River the resulting numbers of barges and push boats have been presented in the following table. To transport the forecasted cargo volumes 290 barges will be required, as well as 73 push boats. The total private investment in this fleet is estimated to be R$ 382 million.

Table 6.11: Fleet capacity, in the Tapajós River

Type of vessel	Barges	Push boats	Estimated Cost (million R$)
Agri bulk	290	73	382
TOTAL	**290**	**73**	**382**

6.5.4 RDG: Tocantins-Araguaia Waterway System: Tocantins River

Vila do Conde - Miracema do Tocantins

6.5.4.1 Opportunities and points of improvement

Currently, the Tocantins River has no commercial navigation, which occurs only in the section between Vila do Conde port (PA) and the Amazon River, which comprehend the Pará River. However, Tocantins River presents several elements that can affect positively or negatively its navigation potential between its mouth and Miracema do Tocantins (TO).

From the mouth of Tocantins River until the Tucuruí dam, with 250 km of extension, the navigability conditions are good, allowing commercial navigation. In addition, Tucuruí dam is already equipped with a lock system with a capacity of about 40 million tons, according to Eletronorte.

From this point upstream the river presents several elements that may affect navigation, like rocky outcrops and extensive river banks, mainly during the dry season, when the river presents low depths and poor navigation reliability. The main bottleneck is called “Pedral de São Lourenço”, between the end of Tucuruí reservoir and Marabá city.

Three additional Hydroelectric Power Plants (HPPs) are planned in the Tocantins River, between the Tucuruí dam and Miracema do Tocantins, which will flood several of the natural existing constraints. These HPPs equipped with locks will make possible the IWT along the river. Even with these new reservoirs, some river sections will remain in free flow, with several constraints, mainly river banks.

Currently (2011), no inland waterway transport is observed on the Tocantins River. Between Belém and Manaus the Ro-Ro transport is relevant, but this transport mainly takes place on the Amazon River, therefore it is assigned to the Amazon River.

Significant transport flows are expected in the Tocantins River. This is due to two important developments in the region: the planned steel plant in Marabá and the agricultural production in the so-called MATOPIBA region.

Although it is not yet clear when the production of the steel plant will start, it is obvious that once production has started the transport flows for inland waterways will be voluminous. Transport forecasts for 2031 are about 32.5 million tons between Marabá and Vila do Conde, consisting of export products (steel and ores) and imported coals for use in the production process of steel.

The agricultural production in the so-called MATOPIBA region, the border between the states Maranhão, Tocantins, Piauí and Bahia, will be among the fastest growing in Brazil in the coming decades, according to the forecasts. This production can be exported using several transport routes. The most promising one is the Tocantins waterway, provided investments will be made. The forecast shows a volume of about 8.6 million tons of agricultural commodities (soy, soymeal and corn) in 2031.

6.5.4.2 Measures to improve the navigability and the transport system

In order to guarantee good navigability conditions and therefore ensure a minimum draught for the future convoys, several civil works on the Tocantins River are required. These works are summarized in Table 6.12.

Between the Tocantins mouth and Marabá city (PA) the main intervention consists of rock demolition in Pedral de São Lourenço. The construction of the Marabá, Serra Quebrada and Tupiratins HPPs, with lock systems, is a minimum requirement for the viability of IWT upstream of Marabá city. Additionally the river sections that will remain in free flow will require measures as regularization of the river bed, dredging, rock demolition and signaling.

An Inland Terminal for cargo is also planned to be implemented, where transshipment from trucks to barges will take place.

After comparing the capacity of locks and the forecasted transported volume in 2031 the locks have enough capacity to handle the forecasted flows. There is one lock where the capacity might be a problem in the future: the Tucuruí locks in the Tocantins River. According to calculations by Antaq, the capacity of the Tucuruí locks is 40 million tons on a yearly basis, while the forecasted transport flow between Marabá and Vila do Conde is a little larger: 41.1 million tons. The capacity problem might occur in 2030.

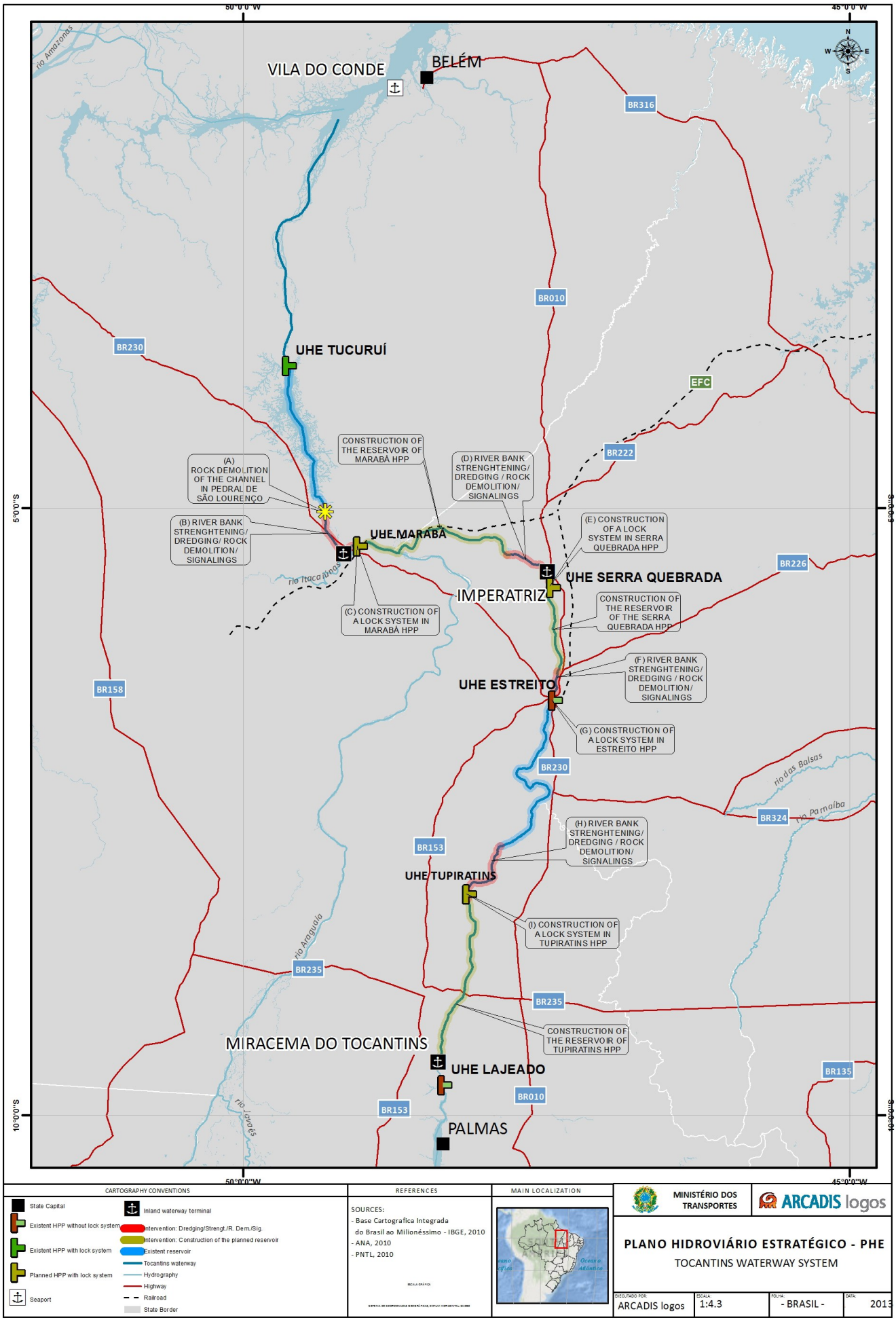
Possible solutions to solve this bottleneck are:

- Increasing the hours of operation of the locks. The capacity of 40 million tons is based on an operating time from 06.00 to 18.00 hours. Increasing the operating time with 2 hours would give enough extra capacity to handle all the forecasted transported flows in 2031.
- Increasing the load factor (at the moment 70% is assumed).
- Reducing the time for handling the ships in the locks.

Improved information and river navigation systems could help to achieve increased capacity for the locks. These interventions should have their potential aggregated impact evaluated. It is recommended that a Strategic Environmental Assessment is conducted to anticipate and mitigate eventual territorial conflicts and enable a smoother licensing process for each intervention.

Table 6.12: Civil works and Signaling, in the Tocantins River

River Section	Length (km)	Actions (Type of work)	Estimated Cost (million R$)
Mouth of Tocantins River - Marabá	450	(A) Rock demolition in 'Pedral de São Lourenço'	660
		(B) River bank strengthening / Dredging / Rock demolition / Signaling between Itapiranga (PA) and Marabá (PA)	180
Marabá - Miracema do Tocantins	780	(C) Construction of a lock system – UHE Marabá	350
		(D) River bank strengthening / Dredging / Rock demolition / Signaling between the end of Marabá reservoir and UHE Serra Quebrada	700
		(E) Construction of a lock system - HPP Serra Quebrada	400
		(F) River bank strengthening / Dredging / Rock demolition / Signaling between the end of Serra Quebrada reservoir and Estreito dam	200
		(G) Construction of a lock system - HPP Estreito	640
		(H) River bank strengthening / Dredging / Rock demolition / Signalings between the end of Estreito reservoir and Tupirantins dam	450
		(I) Construction of a lock system - HPP Tupiratins	200
Miracema do Tocantins	-	Construction of an inland terminal	-
TOTAL	**1.230**	**-**	**3.780**


50°0'0"W
45°0'0"W
5°0'0"S
10°0'0"S
rio Amazonas
VILA DO CONDE
BELÉM
BR316
BR010
BR230
UHE TUCURUÍ
EFC
BR222
CONSTRUCTION OF THE RESERVOIR OF MARABÁ HPP
(A) ROCK DEMOLITION OF THE CHANNEL IN PEDRAL DE SÃO LOURENÇO
(D) RIVER BANK STRENGHTENING/ DREDGING / ROCK DEMOLITION/ SIGNALINGS
(B) RIVER BANK STRENGHTENING/ DREDGING/ ROCK DEMOLITION/ SIGNALINGS
UHE MARABÁ
(E) CONSTRUCTION OF A LOCK SYSTEM IN SERRA QUEBRADA HPP
BR226
UHE SERRA QUEBRADA
rio Itacaiúnas
IMPERATRIZ
(C) CONSTRUCTION OF A LOCK SYSTEM IN MARABÁ HPP
CONSTRUCTION OF THE RESERVOIR OF THE SERRA QUEBRADA HPP
BR158
(F) RIVER BANK STRENGHTENING/ DREDGING / ROCK DEMOLITION/ SIGNALINGS
UHE ESTREITO
(G) CONSTRUCTION OF A LOCK SYSTEM IN ESTREITO HPP
BR230
rio das Balsas
rio Parnaíba
BR324
(H) RIVER BANK STRENGHTENING/ DREDGING / ROCK DEMOLITION/ SIGNALINGS
BR153
UHE TUPIRATINS
(I) CONSTRUCTION OF A LOCK SYSTEM IN TUPIRATINS HPP
rio Araguaia
BR235
BR235
CONSTRUCTION OF THE RESERVOIR OF TUPIRATINS HPP
MIRACEMA DO TOCANTINS
UHE LAJEADO
BR135
BR010
BR153
rio Javaés
PALMAS
CARTOGRAPHY CONVENTIONS
State Capital
Existent HPP without lock system
Existent HPP with lock system
Planned HPP with lock system
Seaport
Inland waterway terminal
Intervention: Dredging/Strengt./R. Dem./Sig.
Intervention: Construction of the planned reservoir
Existent reservoir
Tocantins waterway
Hydrography
Highway
Railroad
State Border
REFERENCES
SOURCES:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010
MAIN LOCALIZATION
Ocean o Pacífico
Ocean o Atlântico
MINISTÉRIO DOS TRANSPORTES
ARCADIS logos
PLANO HIDROVIÁRIO ESTRATÉGICO - PHE
TOCANTINS WATERWAY SYSTEM
EXECUTADO POR: ARCADIS logos
ESCALA: 1:4.3
FOLHA: - BRASIL -
DATA: 2013

To handle the forecasted volumes of cargo in 2031 the handling capacity of the terminals will have to be created along the Tocantins. The standard terminals have been adopted to calculate the required number of berths and terminals. For the standard terminal the cost of infrastructure (jetties, internal roads and pavements) and superstructure (storage facilities, cargo handling equipment and offices) have been estimated.

Along the Tocantins two different transport systems can be distinguished. On the one hand the import of coal and the export steel products related to the proposed steel mill in Maraba and on the other hand the transport of agri bulk (soy, corn and fertilizer) from Matto Grosso, handled in the port of Miracema do Tocantins. The required number of berths for agri-bulk cargo in the port of Miracema do Tocantins is 17, as can be seen in the following table. The increase of the cargo volume related to the steel mill will ask for 22 new berths in Maraba: 13 berths destined for loading of steel products (break bulk and ro-ro) and 9 for unloading of coal. The required private investments in these handling facilities will be R$ 413 million in Miracema do Tocantins and R$ 781 million in Maraba. It must be realized that the terminal expansion that will be required in the sea-ports will be of the same order of magnitude.

Table 6.13: Terminal capacity, in the Tocantins River

River terminals	Type of terminal	Number of berths	Estimated Cost (million R$)
Tocantins	Agri bulk	17	413
	Coal	9	200
	Break bulk	13	581
TOTAL	**Total**	**39**	**1195**

The capacity of the fleet will also have to be created. The calculation of the required number of barges and push boats is based on the assumption that standard barge convoys will be applied on the different rivers. For the Tocantins River a convoy of 2 x 2 barges has been adopted both for the agri-bulk and the steel production related cargoes. The dimensions of the standard barge are:

- Length: 58,00 m
- Beam: 11,00 m
- Draught: 2,50 m
- Capacity: 1.200 ton

For the fleet capacity on the Tapajos River the resulting numbers of barges and push boats have been presented in table c. To transport the forecasted agri-bulk cargo volumes 252 barges will be required, as well as 63 push boats. For the steel-related cargoes 429 barges are required and 108 push boats. The total private investment in this fleet is estimated to be R$

331 million for the agri-bulk fleet and R$ 565 million for the steel production related fleet. Some optimization may be obtained by combining coal imports with steel exports as a return cargo.

Table 6.14: Fleet capacity, in the Tocantins River

Type of vessel	Number of barges	Number of push boats	Estimated Cost (million R$)
Agri bulk	252	63	331
Coal	198	50	261
Break bulk	231	58	304
TOTAL	**681**	**171**	**897**

6.5.5 RDG – São Francisco Waterway System: São Francisco River

Petrolina – Ibotirama - Pirapora

6.5.5.1 Opportunities and points of improvement

Currently, the São Francisco River has commercial navigation between Juazeiro (BA)/Petrolina (PE) and Ibotirama (BA), a section of 560 km. In this river section the main constraints are related to the Sobradinho lock capacity, where a split of convoys is required, rocky formations on the bottom of the river (mainly between Juazeiro and Sobradinho dam and in Pedral de Meleiro), and aggradations problems. In addition divergences of interests on the operation of Sobradinho reservoir, focused on energy generation, are observed.

In the section between Ibotirama (BA) and Pirapora (MG), the navigability constraints vary according to the hydrological season. During the dry season many natural bottlenecks hinder navigation, such as sand bars, rocky outcrops and intense river bank erosion. The commercial navigation until Pirapora (MG) depends also on the flow discharge of the HPP Três Marias, 130 km upstream of Pirapora (MG). During wet season, the commercial navigation is possible, with some restrictions, especially in the section between Ibotirama (BA) and Bom Jesus da Lapa (BA).

On the section between Juazeiro (BA)/Petrolina (PE) and Ibotirama (BA) only 50.000 tons of cottonseed was transported in 2011.

Besides a modest growth of the waterway transport of cottonseed (from 50.000 to 61.000 tons), an increase in the transport of agricultural commodities from the MATOPIBA region is foreseen. According to the forecasts, a cargo volume of about 2.6 million tons can be expected in the section from Ibotirama to Pirapora in 2031.

6.5.5.2 *Measures to improve the navigability and the transport system*

In order to improve safety and reliability in the IWT between Juazeiro (BA)/Petrolina (PE) and Ibotirama (BA), measures are required, such as rock demolition in Pedral de Meleiro and in the section between Juazeiro and Sobradinho dam; construction of additional structures in the Sobradinho Lock, aiming at increasing its efficiency; dredging and river bank regularization. In the section between Ibotirama (BA) and Pirapora (MG), interventions like dredging, river bank regularization, rock demolition and signaling are also required.

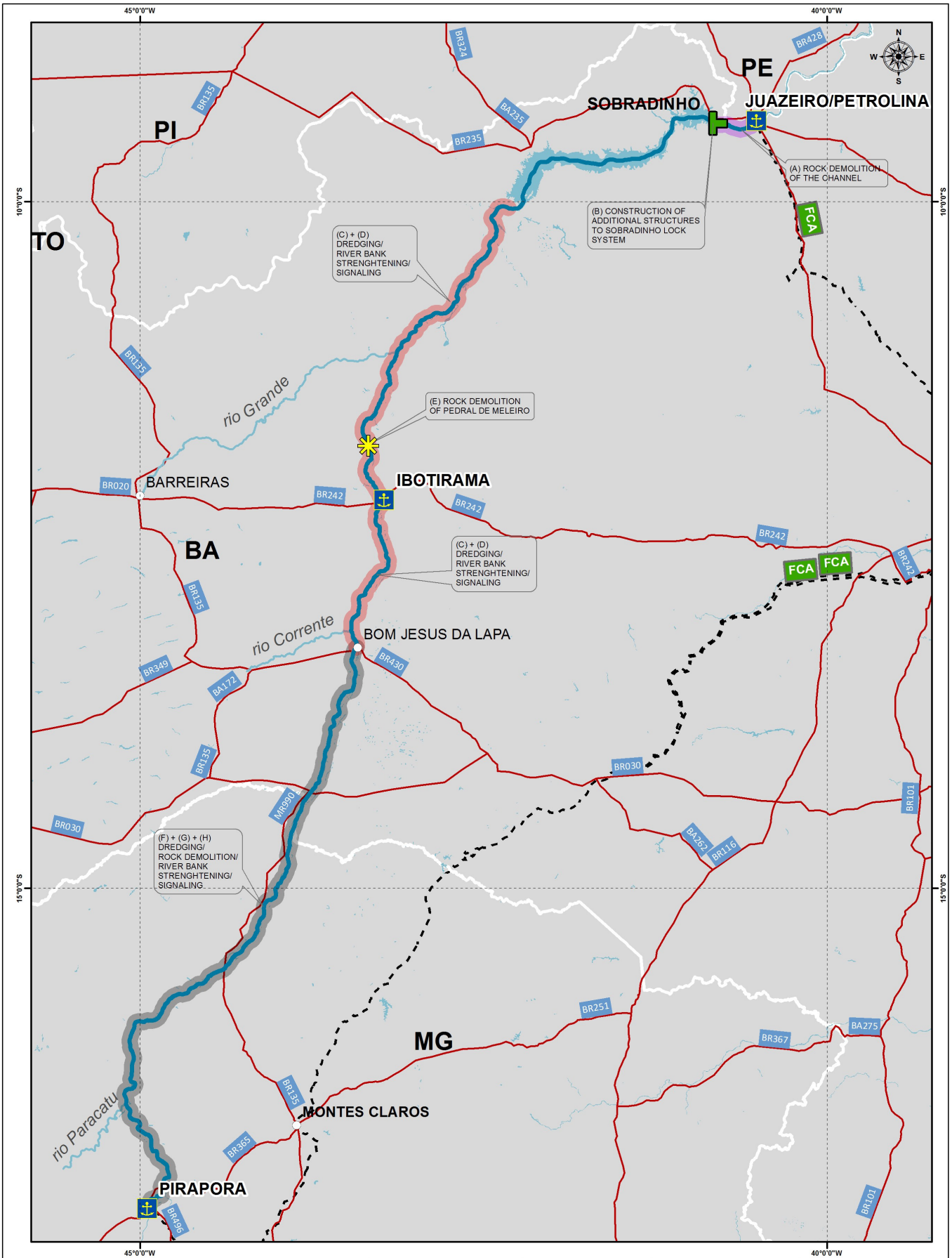
These works are summarized in Table 6.15.

Table 6.15: Civil works and Signaling, in the São Francisco River

River Section	Length (km)	Actions (Type of work)	Estimated Cost (million R$)
Petrolina (PE) – Ibotirama (BA)	560	(A) Rock demolition of the Channel	24
		(B) Construction of additional structures in Sobradinho Lock	15
		(C) Dredging / Signaling	5,5
		(D) River bank strenghtening	64
		(E) Rock demolition	24
Ibotirama (BA) – Bom Jesus da Lapa (BA)	145	(F) Dredging / Signaling	5,5
		(G) River bank strenghtening	30
Bom Jesus da Lapa (BA) – Pirapora (MG)	595	(F) Dredging / Signaling	14
		(G) River bank strenghtening	50
		(H) Rock demolition	30
TOTAL	**1.300**		**262**

As the São Francisco River is situated in the semi-arid region, dams, locks, dredging, rock demolition and river bank straightening, necessary to ensure the viability of the waterway, need to be evaluated together with the other uses of water resources to ensure that the development of waterways do not impact on the water availability in nearby regions.

To guarantee integration among different projects planned for the same region it is suggested to conduct a Strategic Environmental Assessment.



CARTOGRAFICAL CONVENTIONS

- Capital of the State
- City
- Inland Waterway Terminal
- Existent HPP, with lock
- Intervention: Dredging/Strenght./Sig.
- Intervention: Dredging/Rock Demolition/Strenght./Sig.
- Intervention: Rock Demolition
- Punctual Intervention
- São Francisco Waterway
- Hydrography
- Water Surface
- Highway
- Railroad
- State Borders

REFERENCES

Fontes:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL: SAD69

MAIN LOCATION

MINISTÉRIO DOS TRANSPORTES

ARCADIS logos

PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

SÃO FRANCISCO WATERWAY SYSTEM

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1:3.000.000	- BRASIL -	2013

To handle the forecasted volumes of cargo in 2031 the handling capacity of the terminals will have to be created along the São Francisco. The standard terminals have been adopted to calculate the required number of berths and terminals. For the standard terminal the cost of infrastructure (jetties, internal roads and pavements) and superstructure (storage facilities, cargo handling equipment and offices) have been estimated.

The transport system on the São Francisco can be characterized as the IWT part of a multi-modal export chain for the export of agri-bulk. The chain consists of truck transport from the production areas to Ibotirama, IWT between Ibotirama and Pirapora and rail transport between Pirapora and the sea-port of Vitoria. For the terminals along the São Francisco River the required number of berths in the ports of Pirapora and Ibotirama is presented in Table 6.16. The increase of the cargo volume will ask for 7 berths in Pirapora and 6 in Ibotirama. The number of berths in Ibotirama can be lower because Ibotirama is the port where the cargo is being loaded into the barges and Pirapora is the port where the cargo is unloaded. Unloading operations are less efficient than loading operations. The required private investments in these handling facilities will be R$ 337 million. It must be realized that terminal expansion that will be required in the sea-ports as well as on the rail terminals. These costs will be of the same order of magnitude.

Table 6.16: Terminal capacity, in the São Francisco River

River terminal	Type of terminal	Number of berths	Estimated Cost (million R$)
São Francisco	Agri bulk	13	337
TOTAL		**13**	**337**

The capacity of the fleet will also have to be created. The calculation of the required number of barges and push boats is based on the assumption that standard barge convoys will be applied on the different rivers. For the São Francisco River a convoy of 2 x 2 barges has been adopted for the agri-bulk cargoes. The standard barge for the São Francisco is smaller than the one for the other rivers. The dimensions are:

- Length: 50,00 m
- Beam: 8,00 m
- Draught: 1,80 m
- Capacity: 540 ton

For the fleet capacity on the São Francisco River the resulting numbers of barges and push boats have been presented in Table 6.17. To transport the forecasted agri-bulk cargo volumes

108 barges will be required, as well as 27 push boats. For ro-ro and container cargo an additional 5 barges and 2 push boats are required. The total private investment in this fleet is estimated to be R$ 84 million.

Table 6.17: Fleet capacity, in the São Francisco River

Type of vessel	Number of barges	Number of push boats	Estimated Cost (million R$)
Agri bulk	108	27	79
Ro-ro, containers	5	2	5
TOTAL	**113**	**29**	**84**

The proposed waterway navigation on São Francisco River is, in this plan, limited to the section between Pirapora (MG) and Juazeiro (BA)/Petrolina (PE). However, it is emphasized that there is a future potential for the expansion of the São Francisco River navigation between Juazeiro/ Petrolina and Itaparica dam, expanding navigation in 400 km. To do so, it is necessary that Riacho Seco and Pedra Branca HPPs, both inventoried by ANEEL in the section between Sobradinho and Itaparica, to be built and equipped with locks.

6.5.6 RDG – Tietê-Paraná Waterway System: Paraná, Paranaíba and Tietê Rivers

São Simão / Três Lagoas – Pederneiras / Anhembi

6.5.6.1 Opportunities and points of improvement

Currently, Paraná, and Tietê Rivers are navigable from São Simão (GO) and Três Lagoas (MS) to Anhembi (SP) and the IWT in these rivers are one of the most well-structured in Brazil. In these rivers sections, the main natural bottleneck is a rock formation, with 6 km long, immediately downstream of HPP Nova Avanhandava, which restricts the drafts. Another aspect that affects the efficiency of commercial navigation along these rivers is the existing locks and a bridge (SP-191) that forces the split of the convoys 2x2, leading to queues and delays.

The Paraná-Tietê system is one of the most used waterways in Brazil, where about 5.8 million tons were transported in 2011. In this system, it is important to distinguish the long and short distance transport. Short distance transport is observed in the Paraná River between Brazil and Paraguay. In this section the volumes are high (about 1.7 million tons) and sand and corn are the most transported commodities. Short distance transport is also observed in Tietê, where large volumes (2 million tons) of sand (10 to 20 km.) and sugarcane (across the river) are transported. Long distance transport on the (combined) Paraná and Tietê Rivers is observed between Sao Simão (GO) and Pederneiras / Anhembi (SP). In this section, 2 million tons of soy, soymeal and corn were transported in 2011.

The future long distance transport on the Paraná – Tietê will be influenced by three major developments:

- The ethanol logistic system
- The pulp plant in Três Lagoas
- The shift towards northern ports for exports of agricultural commodities

The ethanol logistic system collects ethanol in the region and stores it at a central hub in Paulínia. The Paraná – Tietê will play an important role in collecting ethanol from three locations and transporting to Anhembi. From there a pipeline will take care of the last part of the transport. The total forecasted volume is about 8.5 million tons in 2031. In the forecasts for the Paraná – Tietê River the transport of 0.5 million tons of oil products in 2031 is anticipated. This is return cargo for the ethanol transport from three hubs on the Paraná – Tietê River to Anhembi. This oil transport (from Petrobras) is the basis for regional depots in the Paraná region and increased regional transport on the Paraná – Tietê River.

The pulp plant in Três Lagoas will generate upstream and downstream flows on the Tietê River, as the Eucalyptus wood will be transported from Anhembi to Três Lagoas and will serve as raw material for the production process, and the pulp will be transshipped in Pederneiras to be further exported via Port of Santos.

The logistic shift of agricultural exports from Santos to more northern ports (Santarém, Vila do Conde and Itaqui) will lead to lower transport growth on the Paraná-Tietê, or even a reduction in the transport of agricultural products like soy and corn.

Taking into account all the developments, the forecasts for the Paraná-Tietê system show a growth to 20.8 million tons of long distance transport in 2031.

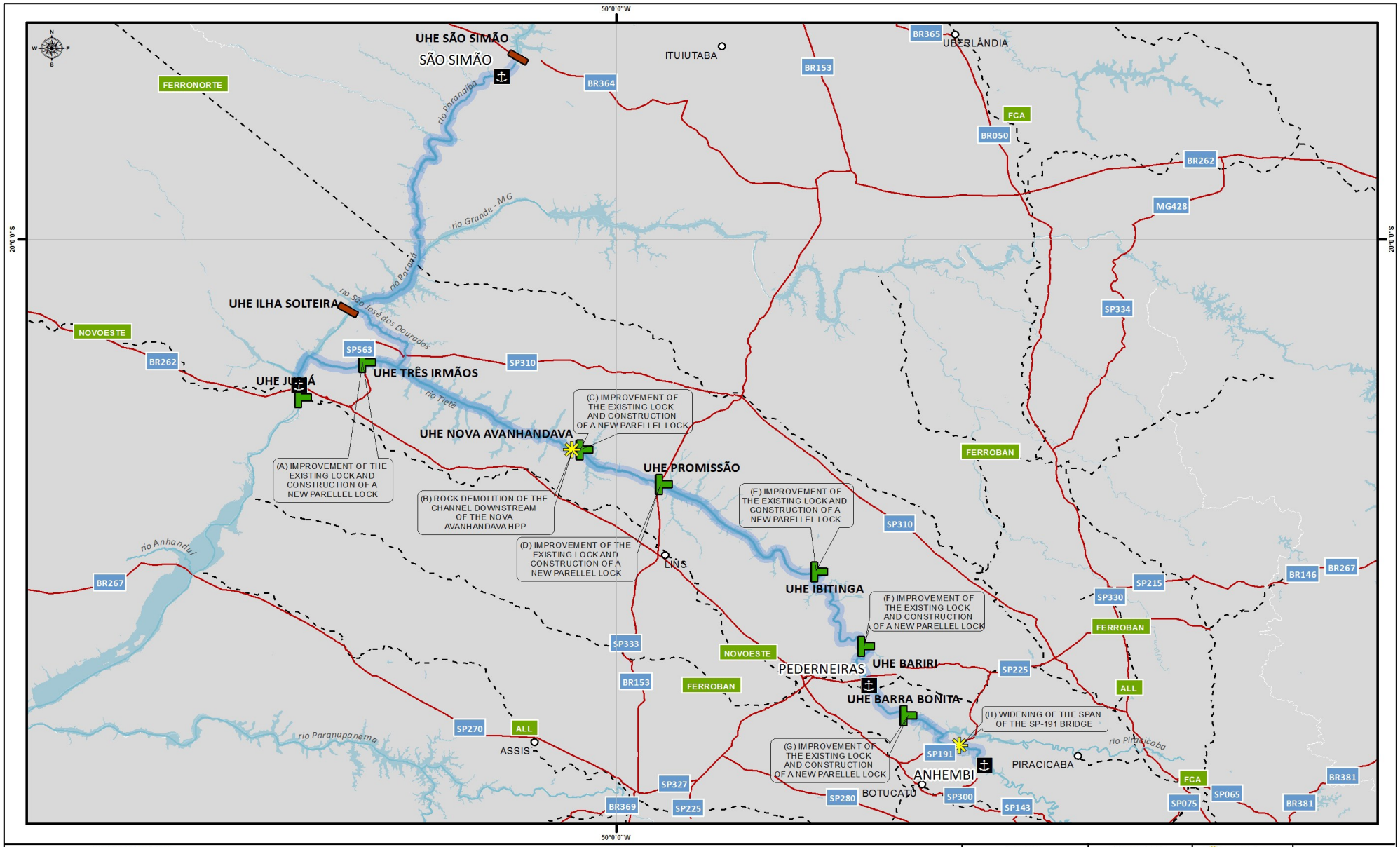
6.5.6.2 Measures to improve the navigability and the transport system

In order to improve the navigability conditions in the Paraná and Tietê Rivers, civil works are required in these rivers, such as: additional locks in the existing systems, widening of the span and heightening of the bridge (SP-191) and rock demolition in the rock formation downstream of Nova Avanhandava.

These interventions are planned to occur on a more urbanized area and to guarantee little impact on the communities living close to the rivers, it is suggested that a Strategic Environmental Assessment be conducted on the region.

Table 6.18: Civil works and Signaling, in the Tietê Paraná Rivers

River Section	Length (km)	Actions (Type of work)	Estimated Cost (million R$)
São Simão (GO) – Pereira Barreto (SP)	270	-	-
Três Lagoas (MS) – Pereira Barreto (SP)	70	(A) Improvement of the existing lock and construction of a new parallel lock in Três Irmãos HPP	900
Pereira Barreto (SP) – Anhembi (SP)	470	(B) Rock demolition of the Channel	360
		(C) Improvement of the existing lock and construction of a new parallel lock in Nova Avanhandava HPP	840
		(D) Improvement of the existing lock and construction of a new parallel lock in Promissão HPP	370
		(E) Improvement of the existing lock and construction of a new parallel lock in Ibitinga HPP	330
		(F) Improvement of the existing lock and construction of a new parallel lock in Bariri HPP	330
		(G) Improvement of the existing lock and construction of a new parallel lock in Barra Bonita HPP	330
		(H) Widening of the span and heightening of the bridge SP-191	20
TOTAL	**610**		**3.480**


50°0'0"W
20°0'0"S
UHE SÃO SIMÃO
SÃO SIMÃO
ITUIUTABA
UBERLÂNDIA
FERRONORTE
BR364
BR153
BR365
FCA
BR050
BR262
MG428
rio Paranaíba
rio Grande - MG
rio Paraná
UHE ILHA SOLTEIRA
rio São José dos Dourados
NOVOESTE
SP563
SP310
SP334
BR262
UHE JUPIÁ
UHE TRÊS IRMÃOS
rio Tietê
(C) IMPROVEMENT OF THE EXISTING LOCK AND CONSTRUCTION OF A NEW PARELLEL LOCK
UHE NOVA AVANHANDAVA
FERROBAN
UHE PROMISSÃO
(A) IMPROVEMENT OF THE EXISTING LOCK AND CONSTRUCTION OF A NEW PARELLEL LOCK
(B) ROCK DEMOLITION OF THE CHANNEL DOWNSTREAM OF THE NOVA AVANHANDAVA HPP
(E) IMPROVEMENT OF THE EXISTING LOCK AND CONSTRUCTION OF A NEW PARELLEL LOCK
SP310
(D) IMPROVEMENT OF THE EXISTING LOCK AND CONSTRUCTION OF A NEW PARELLEL LOCK
rio Anhandui
LINS
BR267
UHE IBITINGA
(F) IMPROVEMENT OF THE EXISTING LOCK AND CONSTRUCTION OF A NEW PARELLEL LOCK
SP330
SP215
BR146
BR267
FERROBAN
SP333
NOVOESTE
PEDERNEIRAS
UHE BARIRI
SP225
BR153
FERROBAN
UHE BARRA BONITA
ALL
(H) WIDENING OF THE SPAN OF THE SP-191 BRIDGE
SP270
ALL
rio Paranapanema
rio Piracicaba
(G) IMPROVEMENT OF THE EXISTING LOCK AND CONSTRUCTION OF A NEW PARELLEL LOCK
SP191
ASSIS
ANHEMBI
PIRACICABA
FCA
BR381
SP327
SP280
BOTUCATU
SP300
SP065
SP075
BR381
BR369
SP225
SP143
50°0'0"W
CARTOGRAPHY CONVENTIONS
City
Inland waterway terminal
Existent HPP with lock system
Existent HPP without lock system
Highways
Railroads
Ponctual interventions
Tietê-Paraná waterway
Existent reservoir
Hydrography
Water Surface
State Border
REFERENCES
Sources:
- Base Cartografica Integrada do Brasil ao Milionésimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010
MAIN LOCALIZATION
MINISTÉRIO DOS TRANSPORTES
PLANO HIDROVIÁRIO ESTRATÉGICO - PHE
TIETÊ-PARANÁ WATERWAY SYSTEM
DEVELOPED FOR
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1:2.75
- BRASIL -
2013

To handle the forecasted volumes of cargo in 2031 the handling capacity of the terminals will have to be created along the Tietê Paraná Rivers. The standard terminals have been adopted to calculate the required number of berths and terminals. For the standard terminal the cost of infrastructure (jetties, internal roads and pavements) and superstructure (storage facilities, cargo handling equipment and offices) have been estimated.

Just like the São Francisco the transport system on Tietê Paraná Rivers can be characterized as the IWT part of a multi-modal export chain, involving truck transport, IWT and rail transport. For the terminals along the São Francisco River the required number of berths in the ports of São Simão, Tres Lagoas and Pederneiras is presented in the following table. The increase of the cargo volume will ask for a total of 75 berths along the Tietê Paraná rivers: 10 in São Simão, 26 in Tres Lagoas and 39 in Pederneiras.

The required private investments in these handling facilities will be R$ 1.788 million, R$ 263 million in São Simão, R$ 565 million in Tres Lagoas and R$ 960 million in Pederneiras. It must be realized that terminal expansion that will be required in the sea-ports as well as on the rail terminals. These cost will be of the same order of magnitude.

Table 6.19: Terminal capacity, on the Tietê Paraná Rivers

River Terminal	Type of Terminal	Number of berths	Estimated Cost (million R$)
São Simão	Agri bulk	9	263
	Ro-ro, break bulk	1	
Três Lagoas	Wood & pulp	13	565
	Liquid bulk	13	
Pederneiras	Agri bulk	12	960
	Ro-ro, break bulk	1	
	Wood & pulp	13	
	Liquid bulk	13	
TOTAL		**75**	**1.788**

The capacity of the fleet will also have to be created. The calculation of the required number of barges and push boats is based on the assumption that standard barge convoys will be applied on the different rivers. For the Tietê Paraná River a convoy of 2 x 2 barges has been adopted for the agri-bulk cargoes. The dimensions of the standard barge are:

- Length: 58,00 m
- Beam: 11,00 m
- Draught: 2,50 m
- Capacity: 1.200 ton

For the fleet capacity on the Tietê Paraná River system the resulting numbers of barges and push boats have been presented in the following table. To transport the forecasted cargo volumes a total of 294 barges will be required, as well as 76 push boats. The total private investment in this fleet is estimated to be R$ 393 million.

Table 6.20: Fleet capacity, on the Tietê Paraná Rivers

Type of vessel	Number of barges	Number of push boats	Estimated Cost (million R$)
Agri bulk	86	22	114
Wood and pulp	86	22	114
Liquid bulk	117	30	156
Ro-ro, containers, break bulk	5	2	8
TOTAL	**294**	**76**	**393**

6.5.7 RDG – South Waterway System: Jacuí and Taquari Rivers and Loagoa dos Patos

Estrela / Cachoeira do Sul - Rio Grande

6.5.7.1 Opportunities and Points of Improvement

The South Waterway System is one of the most well-structured systems in Brazil, with dams equipped with locks and signaling installed, however only about 3,5 million tons is transported, due to low investments in maintenance works, mainly on the Taquari and Jacuí rivers. One particularity of this Waterway System is the use of self-propelled barges. The Lagoa dos Patos is currently navigated by commercial vessels with a draft of 5,1 m, enabling maritime access to Porto Alegre (RS).

The section of Jacuí River, between Porto Alegre (RS) and Triunfo (RS), has commercial navigation, with signaling installed, where attention due to the existing rocks and siltation is required. The Jacuí River, between Triunfo (RS) and Cachoeira do Sul city(RS), is also navigable, with the Amarópolis and Anel de Dom Marco dams equipped with locks and whose reservoirs allow navigation with 2,5 m of draft. However, the navigation of self-propelled barges in this section is hindered by rock formations on the river bank, aggradations and sand banks erosion, decreasing the water depths below the minimum required for navigation.

The Taquari River is navigable for self-propelled barges in the section between its mouth, near Triunfo (RS), and Estrela (RS), 80 km long. In this section it was constructed the Bom Retiro Dam with a lock system, whose reservoir allows navigation with 2,5 m of draft. The main constraints to navigation are concentrated in an area immediately downstream of Bom Retiro Dam, where, depending on the hydrological season, the water depths don´t allow the navigation of the self-propelled barges.

The major transport flows in the South Waterway System take place on the Lagoa dos Patos, between Porto Alegre port, and ports like Guaíba and Pelotas, and the seaport of Rio Grande, where flows were about 2.7 million tons in 2011. Another million tons was also transported on the Jacuí and Taquari Rivers. The major transport flows have Rio Grande seaport as origin or destination, apart from the transport of coal between Charqueadas and Triunfo for the chemical industry near Triunfo.

The forecasts for 2031 show a growth of IWT to 9.4 million tons in 2031. This modest growth is due to the limited opportunities in the agricultural sector. The main new flows are related to a pulp factory in Guaíba and the container transport between Porto Alegre and Rio Grande seaport. Agricultural products (including fertilizers) will grow to 2.8 million tons and chemical products, coal (used in chemical industry) and oil to 3.3 million tons, a share of 35%, while wood and pulp will show a growth to 2.2 million tons. Other cargoes, like industrial products and containers together form the last million tons.

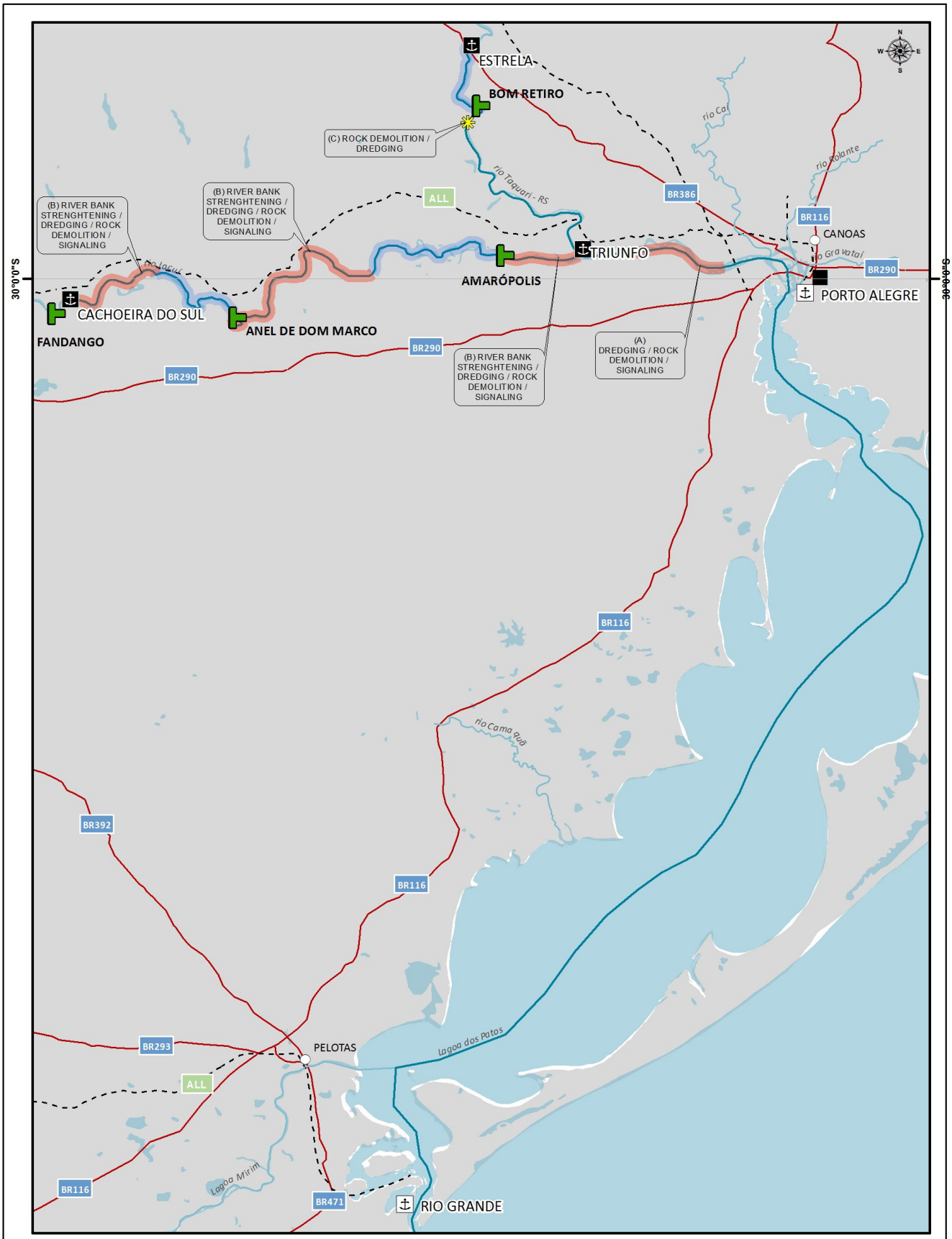
6.5.7.2 Measures to improve the navigability and the transport system

In order to improve the navigability conditions in this Waterway System, civil works are required in some sections.

In Jacuí River, between Porto Alegre (RS) and Triunfo (RS), and in Taquari River, between Triunfo (RS) and Estrela (RS), the required civil works, such as rock demolition and dredging, are important to improve safety and reliability of the IWT. In the section of Jacuí River between Triunfo (RS) and Cachoeira do Sul (RS), civil works such as river bank regularization, dredging and rock demolition and the update of the signaling system are also required. These rivers cross more urbanized areas and, although the civil works are not of significant impact, it is suggested that a Strategic Environmental Assessment is undertaken to evaluate and propose the less impacting manner to conduct these together with other projects expected for the region.

Table 6.21: Civil Works and Signaling, Hidrovia do Sul (Rivers of the South)

River Section	Length (km)	Actions (Type of work)	Estimated Cost (million R$)
Rio Grande (RS) – Porto Alegre (RS) (Lagoa dos Patos)	305	-	-
Porto Alegre (RS) – Triunfo (RS)	55	(A) Rock demolition / Dredging	80
Triunfo (RS) – Cachoeira do Sul (RS)	170	(A) River bank strengthening / Dredging / Rock demolition / Signaling	680
Triunfo (RS) – Estrela (RS)	80	(C) Rock demolition / Dredging	500
TOTAL	**610**		**1.260**



CARTOGRAPHY CONVENTIONS

- State Capital
- City
- Existent dam with lock system
- Seaports
- Inland Waterway Terminal
- Ponctual Problems
- Interventions
- Existent Reservoir
- South Waterway
- Hydrography
- Railroad
- Highway
- State Border

REFERENCES

SOURCES:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
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- PNTL, 2010

MAIN LOCALIZATION

MINISTÉRIO DOS TRANSPORTES

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PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

SUL WATERWAY SYSTEM

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1:1.25	- BRASIL -	2013

A number of different transport systems can be distinguished on the Hidrovia do Sul river system:

- The transport flows of wood and pulp, agri bulk, liquids, ro-ro, break bulk and containers between Porto Alegre and Rio Grande do Sul;
- Coal transport between Charqueadas and Triunfo; and
- Wood and pulp between Taquari and Guaiba.

To handle the forecasted volumes of cargo in 2031 the handling capacity of the terminals will have to be created for each of the mentioned flows on the Hidrovia do Sul system. The standard terminals have been adopted to calculate the required number of berths and terminals. For the standard terminal the cost of infrastructure (jetties, internal roads and pavements) and superstructure (storage facilities, cargo handling equipment and offices) have been estimated.

For the terminals along the Hidrovia do Sul river system the required number of berths in the ports of Porto Alegre, Charqueadas, Triunfo, Taquari and Guaiba is presented in Table 6.22 the following table. The increase of the cargo volume will ask for a total of 20 berths along the Hidrovia do Sul: 14 in Porto Alegre, 2 each in Guaiba and Taquari and 1 each in Charqueadas and Triunfo.

The required private investments in these handling facilities will be R$ 458 million, R$ 356 million in Porto Alegre, R$ 58 million in Guaiba and Taquari and R$ 44 million in Charqueadas and Triunfo. It must be realized that terminal expansion that will be required in the sea-port of Rio Grande do Sul. These costs will be of the same order of magnitude.

Table 6.22: Terminal Capacity, Hidrovia do Sul (Rivers of the South)

River Terminal	Type of Terminal	Number of berths	Estimated Cost (million R$)
Charqueadas	Coal	1	44
Triunfo	Coal	1	
Taquari	Wood & pulp	2	58
Guaiba	Wood & pulp	2	
Porto Alegre	Agri bulk	6	356
	Ro-ro, break bulk	1	
	Wood & pulp	3	
	Liquid bulk	4	
TOTAL		**20**	**458**

The calculation of the required fleet is based on the assumption that standard barge convoys will be applied on the different rivers.

The wave climate on the Lagoa dos Patos does not permit the navigation on this stretch of water with barge convoys. For this part of the system self-propelled barges are applied with the following dimensions:

- Length: 110,00 m
- Beam: 16,00 m
- Draught: 4,50 m
- Capacity: 5.400 ton

For the fleet capacity on the Sul River system the resulting number of self-propelled barges has been presented in the following table. To transport the forecasted cargo volumes a total of 26 self-propelled barges will be required. The total private investment in this fleet is estimated to be R$ 173 million.

Table 6.23: Fleet capacity, Hidrovia do Sul (Rivers of the South)

Type of vessel	Nr of self-propelled barges	Estimated Cost (million R$)
Agri bulk	7	50
Wood & pulp	6	43
Dry bulk	1	7
Liquid bulk	8	57
Ro-ro, containers, Break bulk	4	29
TOTAL	**26**	**186**

6.5.8 RDG – Paraguay Waterway System: Paraguay River

(Apa River Mouth – Cáceres)

6.5.8.1 Opportunities and points of improvement

The Paraguay River, in the National territory, is the main river that crosses the Pantanal Bioma, an area of importance for biodiversity conservation. The River is located in a large sedimentary basin, flat and rather meandering. The Parque Nacional do Pantanal Mato-Grossense represents the biggest conservation unit in flooded area in America and was also recognized by Unesco and it is located close to the confluence of São Lourenço River and Paraguay River.

Despite of that, commercial navigation, with convoys of 4x4, is observed between the mouth of Apa River, which defines the border between Brazil and Paraguay, and the cities of Ladário (MS)/Corumbá (MS). In this section the main constraints to commercial navigation are related to curves with small radius and two bridges, where the split of the convoys is necessary.

The section between Corumbá (MS)/Ladário (MS) and Cáceres (MT) is further meandering and narrowing, and the navigability conditions are affected by aggradation that cause low water depths in some sections, restricting navigation depending on the hydrological season. These aspects affect considerably the current sailing conditions in this river, where, in the past, convoys of 2x3 were observed, and nowadays navigation in this section is limited to tourism.

The Paraguay River is important for the transport of iron ore and manganese ore from the Corumbá region. The capacity of the Paraguay River is according to estimations over 75 million tons per year. Although the distance to the seaports in the Rio de la Plata delta is over 3.000 km, the IWT is cheap due to the convoys large capacity. Currently IWT is about 5.4 million tons, of which 5.3 million tons is iron ore.

It is important to mention that this waterway is also of great importance for regional development, as the waterway transport is the main transport mode for people living in the cities along its banks.

The forecasts show a growth of IWT to 20.4 million tons, mainly due to the growth of iron ore and manganese exports (from 5.3 to 14.9 million tons). The export of agricultural commodities, from Mato Grosso (through the port of Cáceres) and Mato Grosso do Sul (through Porto Murtinho), will also grow to 5.5 million tons.

6.5.8.2 Measures to improve the navigability and the transport system

In order to improve the navigability in Paraguay River, civil works on the river are required. These are summarized in Table 6.24.

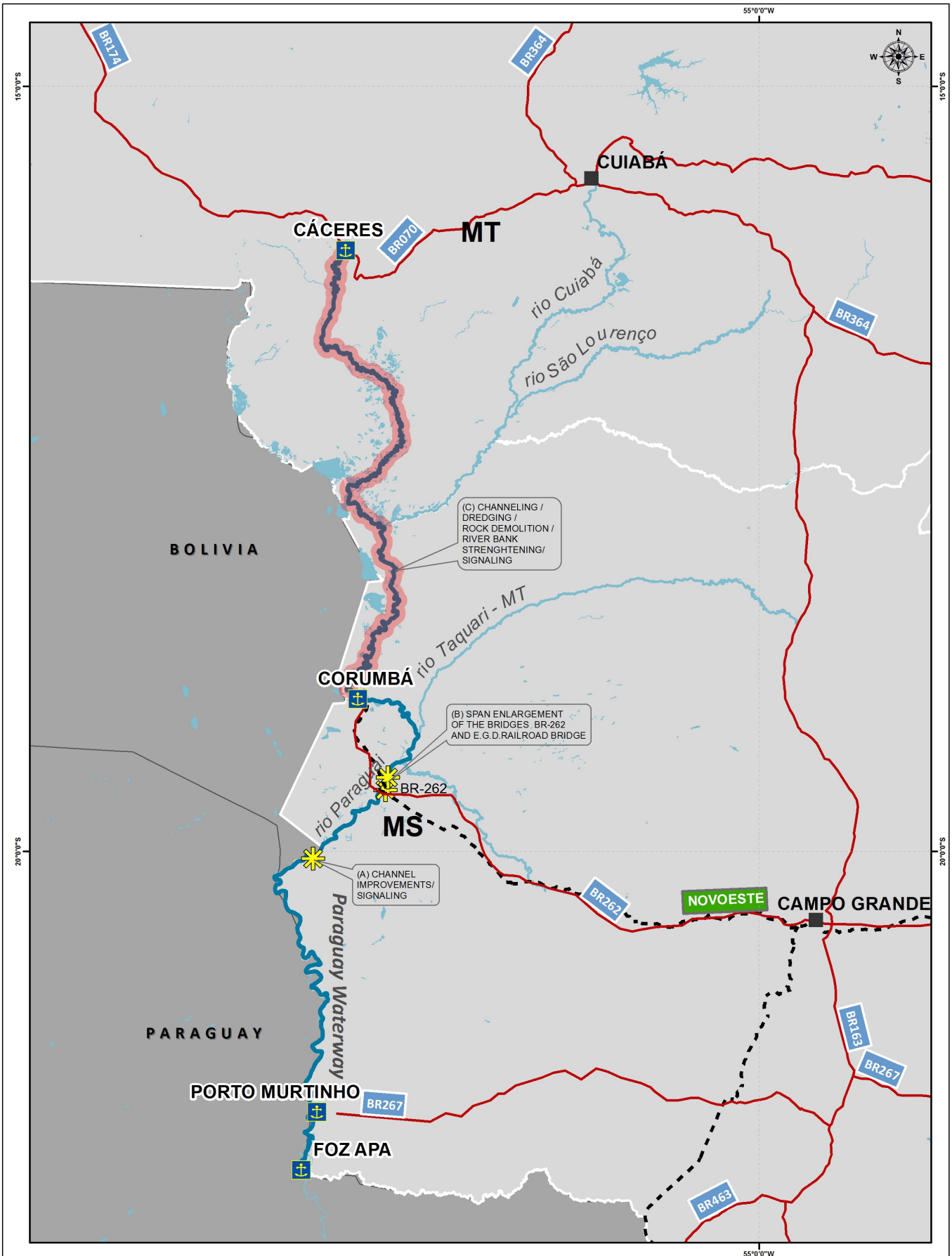
In the section between Brazilian borders (rio Apa mouth) and Corumbá, the spans enlargement and heightening of two bridges that cross Paraguay river (BR-262 and rail road) are necessary. This rail road bridge called Eurico Gaspar Dutra is a historic heritage; therefore, to modify its structure, detailed studies are necessary.

Moreover the curves that affect navigability conditions need to be adjusted as well, increasing the IWT efficiency. In the section between Corumbá and Cáceres the efforts needed to improve navigation are higher, requiring activities like dredging, river banks strengthening, rock demolition and specially adjustments in the natural channel through many kilometers. Additional signaling systems are also necessary in all the sections.

Considering the region vulnerabilities the planning of the civil works shall consider the environmental characteristics of the surroundings, the traditional communities living nearby rivers and the interests of neighboring countries. It is recommended that a Strategic Environmental Assessment is conducted to evaluate the aggregated impact of all the initiatives being considered for this region.

Table 6.24: Civil works and Signaling, in the Paraguay River

River Section	Length (km)	Actions (Type of work)	Estimated Cost (million R$)
Mouth of Apa River – Corumbá (MS) / Ladário (MS)	570	(A) Channel improvements/ Signaling	50
		(B) Span enlargement and heightening of bridges BR-262 and E.G.D. railroad	200
Corumbá (MS) / Ladário (MS) – Cáceres (MT)	640	(C) Channeling / Dredging / Rock demolition / River bank strengthening / Signaling	2.048
TOTAL	**1.210**		**2.298**



CARTOGRAFICAL CONVENTIONS

- State Capital
- Inland Waterways Terminal
- Highways
- Railroads
- Interventions:Channeling/Dredging/Rock demolition/Strenghtening
- Punctual Intervention
- Paraguay Waterway
- Hydrography
- Water Surface
- State Border
- International Border

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Sources:
- Base Cartografica Integrada do Brasil ao Milionéssimo - IBGE, 2010
- ANA, 2010
- PNTL, 2010

ESCALA GRÁFICA

SISTEMA DE COORDENADAS GEOGRÁFICAS, DATUM HORIZONTAL: SAD69

MAIN LOCALIZATION

MINISTÉRIO DOS TRANSPORTES

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PLANO HIDROVIÁRIO ESTRATÉGICO - PHE

PARAGUAY WATERWAY SYSTEM

EXECUTADO POR:	ESCALA:	FOLHA:	DATA:
ARCADIS logos	1:2.500.000	- BRASIL -	2013

In the Paraguay River two different transport systems can be distinguished:

- The transport of ore between the port of Ladario and the sea-ports in Argentine;
- The transport of agri-bulk between the port of Caceres and the sea-ports in Argentine.

To handle the forecasted volumes of cargo in 2031 the handling capacity of the terminals will have to be adapted. The standard terminals have been adopted to calculate the required number of berths and terminals. For the standard terminal the costs of infrastructure (jetties, internal roads and pavements) and superstructure (storage facilities, cargo handling equipment and offices) have been estimated.

For the terminals along the Paraguay River the required number of berths in the ports of Ladario and Caceres is presented in the following table. The increase of the cargo volume will ask for a total of 20 berths along the Paraguay: 11 agri bulk berths in Caceres and 8 ore berths and 1 ro-ro and break bulk berth in Ladario.

The required private investments in these handling facilities will be R$ 494 million, R$ 268 million in Caceres and R$ 226 million in Ladario.

Table 6.25: Terminal capacity, in the Paraguay River

River terminals	Type of terminal	Number of berths)	Estimated Cost (million R$)
Paraguay River	Agri bulk	11	268
	Dry bulk	8	180
	Ro-ro, containers, break-bulk	1	47
TOTAL		**20**	**494**

The capacity of the fleet will also have to be created. The calculation of the required number of barges and push boats is based on the assumption that standard barge convoys will be applied on the different rivers. For the Paraguay two different standard convoys have been selected. For the ore transport system a convoy of 4 x 4 barges and for the the agri-bulk transport system a convoy of 2 x 3 barges. The dimensions of the standard barge are:

- Length: 58,00 m
- Beam: 11,00 m
- Draught: 2,50 m
- Capacity: 1.200 ton

For the fleet capacity on the Paraguay River system the resulting numbers of barges and push boats have been presented in table c. To transport the forecasted cargo volumes a total of

1.280 barges will be required, as well as 129 push boats. The total private investment in this fleet is estimated to be R$ 1.929 million.

Table 6.26: Fleet capacity, in the Paraguay River

Type of vessel	Number of barges	Number of push boats	Estimated Cost (million R$)
Agri bulk	451	76	929
Dry bulk	825	52	988
Ro-ro, containers break bulk	4	1	11
TOTAL	**1.280**	**129**	**1.929**

6.6 OVERVIEW OF TOTAL INVESTMENTS

In the previous paragraphs per waterway system the opportunities and points of improvements were described and the needed investments in civil works, signaling and delayed maintenance are explained. An overview of investments costs is summarized in Table 6.27.

Table 6.27: Overview of investment costs (in R$ millions)

	Existing waterways	New waterways	Total
Madeira	2.000		2.000
Amazon	300		300
Tapajos		3.421	3.421
Tocantins			
Vila do Conde - Marabá		840	840
Marabá - Miracema		2.940	2.940
Sao Francisco			
Ibotirama - Petrolina	133		133
Pirapora - Ibotirama		130	130
Paraná – Tietê	3.480		3.480
Paraguay			
Ladario/Corumbá - Caceres		2.048	2.048
Foz rio Apa – Ladario/Corumbá	250		250
Hidrovia do Sul	1.260		1.260
Total	**7.423**	**9.379**	**16.802**

The investments have been divided in two parts:

- Investments in waterways where currently cargo transport takes place. The investments are mainly aimed at improving the waterway, by building locks with more capacity, increasing the reliability, performing dredging works.
- Investments in new waterways for cargo transport. Three new sections are important because of the forecasted large flows of cargo on these new waterways: Tapajós (Itaituba – Cachoeira Rasteira), Tocantins (Vila do Conde – Miracema do Tocantins) and Paraguay River (Ladário – Caceres).

Table 6.28: Overview of (private) investment costs in terminal and fleet expansion (in R$ millions)

	Inland terminal expansion	Fleet expansion	Total
Madeira	245	183	428
Amazon	429	179	608
Tapajos	460	382	842
Tocantins	1.195	897	2.092
Sao Francisco	337	84	421
Paraná – Tietê	1.788	393	2.181
Paraguay	494	1.929	2.423
Hidrovia do Sul	458	186	631
Total	**5.406**	**4.233**	**9.626**

As has been stated in the previous chapters, the investment cost in the terminals of the sea-ports is of the same order of magnitude as the investment cost in the inland terminals. Therefor the total private investments amount to the order of magnitude of R$ 15.000 million, as compared to R$ 16.800 million for the public investments in the waterway improvements.

7 PILOT PROJECTS

7.1 INTRODUCTION

Creating the conditions for a successful inland waterway system takes time, since it requires large scale investments and some fundamental changes. It also requires innovations. Some of those innovations can be successful at the short term and can grow to be an example for other waterways in Brazil, improving the accessibility of a specific region and improving the connectivity between regions. Therefore pilot projects will be implemented in several waterways.

The pilot projects should enable to put on test some of the innovation suggested to better structure the inland waterway system in Brazil and should serve as an incentive to bring economic development and regional accessibility. Successes can grow to be good and inspiring examples for the remaining waterways in Brazil. Successes will initiate new projects and the innovations could spread like wildfire through the county.

The pilot projects should ideally be relatively quick wins. Quick wins are relatively easy to implement and have a more than likely chance to be successful.

The following pilot projects are proposed:

a. Implementation of (first level) RIS (River Information Services);
b. Intramodal transport as part of regional development
c. Public Private Partnership
d. Inland container terminal development

7.2 GENERAL IMPLEMENTATION

Responsibilities

The Task Force is responsible for the selection of the pilot projects, the organization of the budgets and assignment of each project to the appropriate Waterway Administration. The relevant Working Groups of the Task Force will prepare the pilots and advice a river selection.

Working group 1 (Internal organizational structure to support IWT) should prepare and supervise the pilot Implementation of RIS. Working group 2 (Integrated planning and supportive legislation) should prepare and supervise the pilot Intramodal transport as part of regional development. Working group 3 (Public-private partnership) should do this for the pilots Public Private Partnership and Inland Container terminal development.

Once a pilot has started, the Task Force supports and supervises the implementation of the pilot projects. The National Task Force should decide about the final selection, which decision is prepared by the Working Groups. The Waterway Administration will carry out the pilot projects in cooperation with the Regional Development Groups and other related stakeholders.

Selection

This year the Task Force will select suitable rivers for the pilot project and assign the pilot projects to Waterway Administrations.

Most of the rivers could be considered for a pilot, but some rivers are more interesting than others for a specific pilot project subject. For each pilot, the expert team has made a selection of three waterways which are most suited for a pilot. In the selection process it is important to geographically spread the pilots. In addition to the spread of capacity at the Waterway Administrations, this has the advantage that more Waterway Administrations and more stakeholders get involved in the PHE.

7.3 PILOT PROJECT 1: IMPLEMENTATION OF RIS

RIS stands for River Information Services and it includes a number of digital services that help the skippers to organize their trips. RIS can be implemented in different levels of complexity. The first level of RIS only includes information to the skippers. The information is essential to plan the individual trips and to estimate a reliable Time of Arrival at the destination. The information includes:

- Operating times of locks and bridges;
- Essential contact information of infrastructure managers and operators of locks and bridges;
- Currents (current and predicted);
- Waterlevels (current and predicted);
- Traffic information (obstructions and operational limitations);
- Nautical charts.

These services are provided through a centralized website or “portal”.

The next level of RIS includes exchange of information. The skipper is able to report his trip to the authorities through the same server and provide information regarding the origin, destination, ship ID, his load and the people on board. This information is relevant for the authorities in case of calamities (for instance: it can be verified whether dangerous goods are involved) and the information can be used for historical data-analyses. In an ultimate stage, the RIS server is able to interact with on-board route planners, so that the skipper is provided with real-time route information during the journey.

Some of the basic services are already being provided, but the information is fragmented and must be collected from several sources. The implementation of the RIS server aims to result in a centralized and harmonized presentation of all information that is required for the skipper. The expert team advises to start with a first level of RIS that provides information only via a fairly simple RIS server. If successful, the system can be expanded with Electronic Reporting and in the future with real-time data exchange with on-board route planning systems. Since the technology is available internationally, RIS can develop quite fast in Brazil.

Table 7.1: Pilot project - Implementation of River Information Services (RIS)

Description of the pilot project	
Pilot project	Implementation of River Information Services (RIS).
Description	Implementation of RIS in a waterway that is currently used, like Tietê - Paraná, South or Madeira, or Amazon rivers. The implementation starts with a "first level" RIS system, which is focused to provide information to the skippers. If successful, the pilot can be rolled out to the rest of the country. Furthermore, additional functionalities, such as Electronic Reporting and real-time data exchange can be added to the RIS system.
Responsibility	
Responsible organization	Ministry of Transport (MT), Infrastructure Managers
Participants involved	MT, Waterway Administrations, ANTAQ, Navy, Shipping lines
Finance	
Estimated budget	Preparation: 1.0 million R$. Implementation and realization: 5.0 million R$.
Planning	
Starting– end date	2014 – 2018
Steps	1. Select river 2. Determine scope: select type of information to be provided 3. Determine missing links and infrastructure; 4. Develop required infrastructure/data/automation plan 5. Tender models, infrastructure and centralized website/portal 6. Test the system 7. Implement the system 8. Evaluate 9. Write recommendations

Approach

As a first step, a waterway or route should be selected for the pilot. Step 2 involves determining the scope of the RIS server. The information that is relevant to communicate to the skippers needs to be selected. This will define the exact scope of the project. Not all information is always relevant. For instance, if the water level is regulated between locks, there is no need to provide real time information on the water levels or currents. In that case it would be sufficient to communicate the nominal/fixed current/water level.

Step 3 will verify the availability and formats of information. For instance, a system to predict currents and water levels will require a complex network of measuring points along the waterway. This information will be input for a prediction model, which will calculate the expected current and water levels. If such a system is not available, the system should be

developed. Further to this, not all data is available in a digital format. In that case, additional systems are required to digitalize this data.

In step 4, the complete RIS server data structure is analyzed and defined. It includes all required information systems, data protocols, interfaces, data storage, data exchange, and so on. The complete operation of the system should be defined in the infrastructure/data/automation plan.

Step 5 involves the realization of all required systems, infrastructure and applications. The system should be properly tested (step 6) before it will be taken into operation. When the system has proven to work accordingly to the expectations, the system can be operationalized (step 7). The system can be evaluated after one or two years of operation (step 8). This evaluation leads to recommendations that can be used for further development of RIS (step 9). Further developments can include expansion (expansion of RIS to a national level) or adding functionalities (such as Electronic Reporting).

7.4 PILOT PROJECT 2: INTRAMODAL TRANSPORT AS PART OF REGIONAL DEVELOPMENT

The rivers follow their natural pattern and the course of the waterway does not always provide a direct connection between origin and destination of the potential load. Some waterways that could be used for import and export cargo do not lead to a seaport. As a result, many loads are still transported by rail or truck. As an alternative, inland water navigation can be used on a part of the route between origin and destination. A significant part can be realized by inland waterway transportation and the remaining route can be realized by train, or road. Due to the remaining distance, this second transport mode cannot be considered as pre- or end haulage. It is an additional link in the transport and such a transport can be considered “intramodal”. Since inland waterway transportation is very cost-efficient at longer distances, this concept of “intramodal” transport can reduce transport costs and improve the regional accessibility at lower costs. This will help to stimulate new and existing economic activities within the region.

The realization of an intramodal transportation will require:

- A good infrastructure (road/rail) within the region;
- Well designed and maintained waterways;
- A multimodal (road/rail) transshipment point at the “end of the waterway”;
- A good infrastructure (road/rail) between transshipment point and destination (seaport);
- A region with economic potential, which is already part of another regional development plan.

Intramodal transport will require more than the development of infrastructure. Terminal Operators are required to exploit the multimodal transshipment points. New shipping lines should be established. The transport will involve more transport modes and more terminals. Intramodal transport should be properly prepared and logistic service companies could assist shipping companies with that.

The expert team advises to start with large, long distance, bulk type commodities. These can justify larger investments and it will be easier to achieve a feasible business case. If successful, smaller and more regional types of commodities can be added. Cooperation between the stakeholders is key for success.

Table 7.2: Pilot project - Intramodal transport as part of regional development

Description of the pilot project	
Pilot project	Intramodal transport as part of regional development
Description	Developing an intramodal corridor in cut-off waterways with many opportunities for regional cargo flows, like the São Francisco, Hidrovias do Sul, Tietê-Paraná. Development of the waterway and transshipment points to make inland waterway transport interesting as an alternative mode. The transportation from origin to the destination will be realized by several transport modes (=intramodal transport). The project involves the upgrade of the inland waterway infrastructure, the realization and operation of transshipment points (in the region and at the "end" of the waterway), the realization of infrastructure to the transshipment points (road/rail) and the realization of logistic service companies. This development stimulates new and existing economic activities within the region.
Responsibility	
Responsible organization	Ministry of Transport (MT),
Participants involved	MT, Waterway Administrations , Regional Development Group, State authority, Cargo owners (trading companies), Shipping lines, Terminal operators, infrastructure managers
Finance	
Estimated Budget	Preparation: 1.0 million R$. Implementation and realization: 2.0 million R$.
Planning	
Starting– end date	2014 – 2020
Steps	1. Determine scope: determine interesting bulk flows (longer distances) and select waterway; 2. Determine transshipment point 3. Determine missing links and infrastructure; 4. Establish developing company and involve stakeholders 5. Determine business case 6. Tender the plan 7. Implement the plan 8. Evaluate 9. Write recommendations

Approach

The first step is to select the (cut-off) waterway that will be investigated. The selection will mainly be based on the bulk flows that are available in the region. The National Task Force will select the waterway and, with input from the Regional Development Groups, the transshipment point and constrains (step 2 and 3).

The pilot not only involves the realization of infrastructure, but also a series of projects, such as the realization of terminals, the establishment of shipping lines, establishment of logistic services and providing infrastructure. These activities should be coordinated rigorously so, the Regional Development Group must be equipped well for this purpose or consider the establishment of a development company that would be responsible for the pilot. (step 4).

The development group/company should involve all the potential stakeholders shall have to create support for the projects. The developing company should look for potential investors and operators. Communication and support is key for success!

When all stakeholders are involved and support the plan, the business plan can be prepared. If feasible, plans can be made for the realization of infrastructure, terminals and transshipment points. After the tender phase, the realization can start after which the intramodal corridor can be operationalized (step 5, 6, 7 and 8).

The plan can be evaluated, by the Task Force and Regional development Group, after one or two years of operation (step 8). This evaluation leads to recommendations, which can be used for further development of other intra-modal corridors (step 9).

The process to realize this pilot is complex. A lot of stakeholders are involved and their interests are not always in line. In the Netherlands, the Authorities (RWS) have developed a uniform process approach to cooperate in “corridor” projects. The expert team advises to develop a similar process plan in the pilot, which could be based on the Dutch example. The success of this project is not determined by the realization of the individual components; the pilot can only be successful if all stakeholders are involved, when they support the plan and are able to cooperate in a pro-active approach. If successful, the process approach could be used as a guideline for future projects.

7.5 PILOT PROJECT 3: PUBLIC PRIVATE PARTNERSHIP

Inland waterway transport is being developed and the Brazilian Government is not fully equipped to perform all additional activities that are required for efficient infrastructure management. Private parties can help the public parties with the implementation of an efficient maintenance strategy. Due to the demand for fast implementation, a public-private partnership (PPP) could be considered. The PPP should ensure safe and efficient infrastructure and should ensure a fast implementation. The funding for the works will be partially covered by the government (approx. 70%) and partially by fee/toll that will be paid by the passing ships (approx. 30%). The fee/toll will be collected by the Contractor.

The waterways that are currently used for inland waterway transportation do face overdue maintenance. Pilot project Public Private Partnership aims to prepare a Design-Build-Finance-

Maintain-(DBFM) contract. A DBFM contract can solve the maintenance issues, because the contractor will be responsible for the maintenance and performance of the waterway for a number of years after the start of the contract. The required quality of the waterway will be defined in performance indicators. The contract will ensure that the agreed quality will be maintained, but the contractor will be free (within the boundaries of the contract) in the organization of his works. The project will be funded from public and private money.

Table 7.3: Pilot project - Public Private Partnership

Description of the pilot project	
Pilot project	Public Private Partnership
Description	Development of a Public Private Partnership for the maintenance of the waterways. The public party hires a private company for design, build, finance, maintenance in a contract for several years. Tocantins and Tapajos Rivers are examples of suitable rivers for this pilot.
Responsibility	
Responsible organization	Preparation of the pilot will be done by Working group 3, MT prepares the discussions. Implementation of the pilot will be done by the relevant Waterway Administration
Participants involved	MT, Waterway Administrations, Public organizations, private organizations
Finance	
Estimated budget	Preparation: 1.0 million R$. Implementation and realization: 2.0 million R$.
Planning	
Starting date – End date	2014-2020
Steps	1. Determine scope: selection of the waterways 2. Determine the present condition of the waterway (baseline) 3. Decide about the contract conditions with the Regional Development Group 4. Waterway Administration determines demands and conditions 5. Tender the contract 6. Execute the works 7. Evaluation 8. Write recommendations

Approach

First, it is required to define the waterway that will be used to outsource the maintenance. Based on the current information the Tocantins and Tapajos Rivers are suitable for this pilot.

Secondly, the baseline condition ("As-Is situation") of the waterway must be determined. The waterway cross-sections along the entire length of the waterway should be measured. Also the subsoil should be investigated. This information is important for the contract preparations.

In the third step, it is important to define the contract conditions. The conditions should be specified in the form of performance. Important issues (not limitative) are:

- The Contractor should maintain specific profiles along the waterway to ensure sufficient water depth;
- The Contractor should ensure a specific availability of the waterway (maintenance should hardly hinder the navigation).
- The Contractor should regularly verify the performance indicators and prove that he still meet the requirements.
- The Contractor is responsible for keeping nuisance to local communities, pollution and other environmental impacts under the legal or agreed limits.
- The funding by the government and acceptable toll/rates.

The fees/toll rates are an important issue. High rates will reduce the contribution of the government, but it can influence the competitiveness of the modality water in relation to road and rail transport. If the toll/fee is set too high, a modal shift will never be realised. From that perspective, it is advised to set clear limitations to the maximum allowed fees/toll in the Contract.

Contract conditions will be included in the contract, after which the tender phase can commence.

After the contract is signed with a Contractor, the works can be executed (step 6). The plan can be evaluated after the execution of the works (step 7). This evaluation leads to recommendations, which can be used for further development of public-private partnerships (step 8).

7.6 PILOT PROJECT 4: INLAND CONTAINER TERMINAL

The maritime container transport has been growing steadily in Brazil and it is expected that this sector will continue to grow in the years to come. This makes the container sector a promising market for IWT. To facilitate inland waterway transport for the container market, it is required to develop inland container ports. Pilot 4 involves the development of such an inland container port.

This pilot project will be prepared by working group 3 with the assistance of MT. When the location of the pilot has been determined, the working group should assign and establish a developing group/company (e.g. Port authority) which should elaborate and support this project.

The project is more than the development of an inland terminal. Several conditions must be met:

- The waterway should be suited to handle the container vessels;
- Container lines must be established;
- The inland terminal should be accessible by rail and road;
- The seaport should be suited to handle the inland container vessels;
- The containerization of loads should be maximized in the vicinity of the inland container terminal;
- An operator should be found to exploit the terminal.

All stakeholders should support the initiative and some of them should be prepared to invest. The process of cooperation with the stakeholders is just as important as the project itself.

Table 7.4: Pilot project - Inland Container Terminal

Description of the pilot project	
Pilot project	Inland Container Terminal
Description	Developing an inland container terminal in an area with potential for container transport, like Tietê-Paraná, Amazon or Hydrovias do Sul.
Responsibility	
Responsible organization	Preparation of the pilot will be done by working group 3 of the Task Force. MT prepares the discussions. Implementation of the pilot will be done by the relevant Waterway Administration
Participants involved	MT, Port authority, local authorities, public organizations, companies, cargo owners (trading companies), potential terminal operator, potential operators inland waterway container lines, the industry (shippers), infrastructure managers, seaport container terminal, road transport companies.
Finance	
Estimated budget	Preparation: 1.0 million R$. Implementation and realization: 30.0 million R$[20]. (Investment: 50% private and 50% public).
Planning	
Starting date – End date	2014-2020
Steps	1. Determine scope: selection of the preferred location for this pilot 2. Establish developing group/company 3. Involve and attract stakeholders 4. Develop business case 5. Tender the plan 6. Execute pilot 7. Evaluate 8. Write recommendations

In July 2010 a Task Force consisting of local authorities, barge owners, terminal operators and the industry (shippers), prepared a feasibility study[21] for an intermodal container terminal in Rio Grande Do Sul. The stakeholders decided not to continue. Working group 3 should verify the reasons and should investigate the lessons learned and determine the institutional interventions that are required to make such a project a success. These lessons learned should be taken into account in this pilot project.

[20] Costs estimate for the realization of the Inland Container Terminal is based on expert judgement. The total costs for the realization of an Inland Container Terminal are based on a large number of variables.
[21] Source: Task Force Intermodal (2010; FIERGS CIERGS)

Approach

The first step is to define the preferred location. The expert team advises to find a location that has sufficient potential to reach an initial capacity of at least 30.000 TEU per year. Such quantities will improve the feasibility of the business case (Dutch experience).

The pilot does not only involve the realization of the inland container terminal. It will require an upgrade of the waterway, new land sided infrastructure (road/rail), the establishment of one or more new container shipping lines, a new operator for the terminal and the attraction of investors. These activities should be coordinated and therefore, is the expert team advises to establish a development group/company that is responsible for the pilot (step 2). This group should follow a predefined process plan for corridor related projects (similar to pilot project 2).

The first responsibility of the development group/company is to attract stakeholders and create support for the idea (step 3). The development group/company should look for potential investors and operators. When all stakeholders are involved and support the plan, the business plan (step 4) can be prepared. If the business plan indicates the plan is feasible, plans can be made for the realization of infrastructure and terminals. The realization can start, after which the inland container terminal can be operationalized (step 5, 6).

The plan should be evaluated after one or two years of operation (step 7). This evaluation leads to recommendations, which can be used for further development of other inland container terminals (step 8).

8 PUBLICIZING AND MONITORING PLAN

8.1 PUBLICIZING PLAN

Publicity will help to build awareness and interest in the IWT. Awareness and interest are important factors for the success of the IWSP. The main elements of the publicizing plan at hand are its scope and goals, the target audience and the key messages. The scope defines the boundaries of this publicizing plan while reaching established goals. The target audience is derived from the stakeholder analysis and makes clear which groups need to be part of the project and in what way. The key messages are the concepts which the target audience needs to remember. This Publicizing Plan contains a communication strategy and the necessary resources.

8.1.1 Scope and Goals of the Publicizing Plan

The scope of this Publicizing Plan is to communicate the main results of the IWSP (Inland Waterways Strategic Plan) to its target audience. It is important to note that this scope is strictly limited to publicizing the results of the IWSP. It is imperative that the Task Force, once instated, develops a Communication Plan for all further communication. This Communication Plan should contain the communication strategy of the Task Force, further stakeholder participation and all communication related to the implementation of the IWSP measures. More information about the Task Force can be read in Chapter 5.

The goals of publicizing the results of the IWSP are:

- **Announce kick-off:** announce and promote the start of the IWSP implementation;
- **Contact with target audience:** make sure that the content of the IWSP will reach its target audience;
- **Gain support:** Gain support for the Task Force and raise public support for the IWSP;
- **Receive feedback:** obtain feedback about the strategy/measures for the Task Force;
- **Reduce public worries:** Reduce public worries by explaining the IWSP and its effects.

8.1.2 Target Audience

The target audience is a specific group of people at which the key messages of the IWSP are aimed at. To determine the target audience product 2, the Stakeholder Consultation (Arcadis Logos, February 2013), was used. In figure 8.1 the results from the Stakeholder Consultation are given. In this figure the identified stakeholders are visible on the power and interest axes.

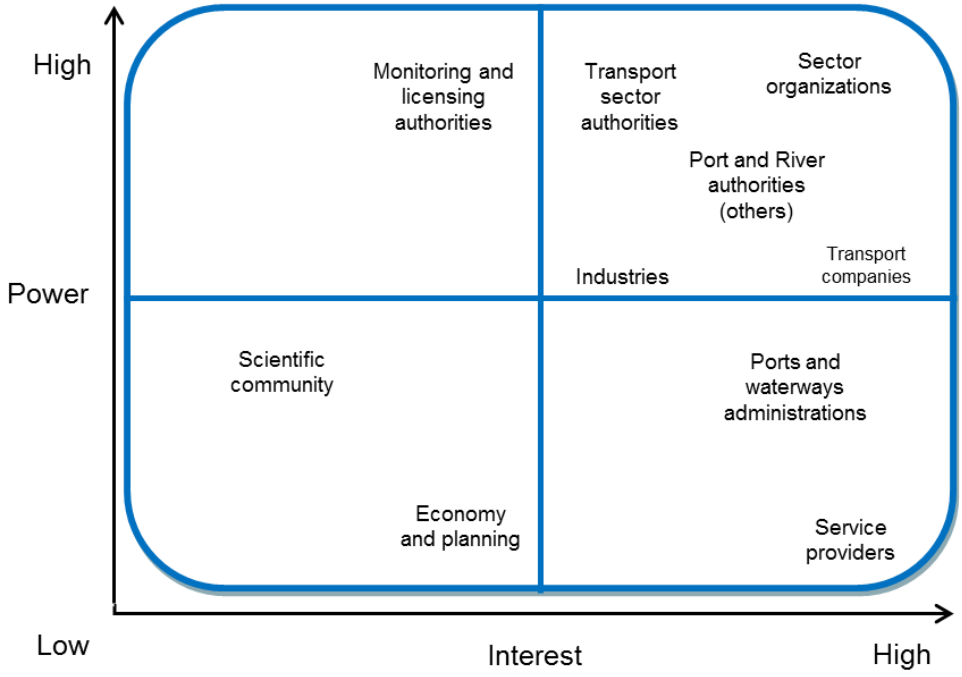


Figure 8.1: Stakeholder Interest/Power quadrant from the Stakeholder Consultation[22].

In the Stakeholder Consultation all the stakeholders that were identified and interviews were assembled into 10 groups based on their different roles and responsibilities. These 10 groups are:

Public

- **Transport authorities** develop and implement policies and regulations to enhance transport sector;
- **Ports and waterway authorities** regulate and implement physical interventions related to IWT;
- **Waterway administrations** maintain waterways for commercial navigation;
- **Port administrations** regulate import and export of cargo;
- **Monitoring and licensing authorities** develop and enforce regulation for transport and interventions of waterways through permits and licensing procedures;
- **Economy and planning authorities** develop and implement policies and regulations regarding spatial planning and to stimulate economic development.

Private

- **Shipping companies** provide transport service of passengers and cargo for industries;
- **Industrial companies** produce goods to sell on (word) marked;

[22] 'Power' is the ability or capacity to influence the PHE effectively with political, legal or financial means. 'Interest' is a measure for the stake that stakeholders might have in the PHE.

- **Service providers** to IWT provide services to enable IWT (e.a. dredging, ship construction, consulting).

Interest and experts

- **Scientific community** contributes to existing knowledge;
- **Sector organizations** are umbrella organization that represent the interest of specific types of industries.

In order to obtain a better understanding of the conditions under which stakeholders can be partners in strengthening the IWT, interests, influences and attitudes of stakeholders were analyzed. The 10 groups are in the quadrant in the figure above showing their level of power and interest.

The interests of the consulted authorities and companies in the development of IWT vary widely between different groups. The public authorities' interest is formalized in their professional responsibilities, while the private companies' interest is restricted to their economic interests in the region that means their possible benefit from the expansion and improvement of IWT system.

Authorities of IWT licensing, inspection and monitoring, transport and ports and waterways groups and sector organizations in general have the greatest influence on the development of IWT. It was noted that public institutions that operate on a national level have greater power than those working on a regional level, such as the waterways administrations.

Representatives of local communities were not involved during the study, but now the measures of the IWSP are defined, the publishing of the IWSP is a good moment to start informing the affected communities.

For this Publicizing Plan the target audience was identified. The Publicizing Plan aims to reach decision makers and/or representatives of the following target audience:

- ***Public Sector**: Transport authorities,, waterway and port administrations, monitoring and licensing authorities, economy and planning authorities, other ports and waterway authorities, all other ministries;*
- ***Private sector**: Transport companies, industrial companies, service providers to IWT, energy sector*
- ***Interest and expert groups and organizations**: Sector organizations, scientific community, local communities, NGO's..*

8.1.3 Key Messages

Key messages are the concepts that MT wants the target audience to remember from this publicizing campaign. The expert team proposes the following messages:

- The vision and goals of the plan;
- IWT benefits and opportunities for cargo and passengers;

- The rivers and their action plans as defined in the Inland Waterways Strategic Plan (IWSP);
- How sensitive environment and social groups will be protected;
- The next steps of the IWSP.

The key messages could be:

Vision: The economy of Brazil is growing fast and aiming at facilitating this growth, the country needs an excellent transport system, in which all the modalities are well maintained, efficiently managed and strongly linked. Inland waterway transport (IWT) needs to be supported to become a serious alternative mode of transport in the Brazilian transport network. The strategic plan is based on four elements:

- Strengthen the IWT to strengthen the economy of Brazil.
- Start from a basis of current users.
- Build the network step by step.
- Build the network together.

Benefits and opportunities: When the forecasts for production and exports of all important commodities are considered, the prospects for inland waterways in Brazil are excellent. The expected growth of passenger transport in the Amazon region also offers good prospects. The main benefits of the IWSP are coordinated government planning and development of all elements of the transport system, reduction in transport costs, increased transport volumes, cost efficiency and increased effectiveness of the development processes, budget reduction and optimized planning.

Goal: The goal of the IWSP is to improve and expand the Brazilian navigable inland waterway network and to improve the transport system and its reliability to accommodate 120 million tons of cargo by inland waterway transport by 2013. Waterway user groups can be enlarged by including regional cargo and passenger transport.

Investments: Civil works, signaling and delayed maintenance will be carried out in the waterway systems of the Amazon, Madeira, Tapajós, Tocantins, Sao Francisco, Tietê Paraná, Hidrovia do Sul and Paraguay. Pilot projects will be implemented to improve the waterway transport on the short term, implementing innovative elements to the system and to set a good and inspiring example. The pilots are a) Implementation of RIS in the Madeira River, b) Multi Modal Corridor, c) Public Private Partnership and d) Multi Modal Container Terminal.

Social and natural environment: Waterway transport may be the most suitable for vulnerable social groups and environmental areas, because of its lowest impact on the environment compared to roads and railways. Nevertheless, the development of IWT must be done with the minimum impact on the social and natural environment.

Next steps: The Ministry of Transport means to bring the project further with the involvement of the stakeholders. By introducing a National Task Force IWT Development and Regional

Development Groups the cooperation between public and private parties is initiated to implement the Masterplan for the development of IWT in Brazil.

The key messages need to be adjusted to the specific interest and level of knowledge of each target audience. For example, the public sector would be more interested in the institutional changes and in the Task Force, whereas the private sector would prefer to learn more about the specific river measures.

8.1.4 Communication Strategy

The different stakeholder groups require tailored communication means to make sure the key messages reach them. The target audience clearly splits into three separate categories. This potentially large group of people would need/want to participate or are affected by the IWSP or are merely interested. Linked to the different categories are different ways to deal with those groups, which are listed below.

- **Involve:** this is the most intense way of dealing with a certain stakeholder group. Active participation of this group is necessary, because they need to be involved in the first steps of the implementation of the strategy and the Task Force.
- **Talk:** a group that may have worries about negative effects, but has a limited access to power and knowledge, needs to be invited to “talk”. This group can obstruct the project by lobby and negative publicity.
- **Inform:** this group claims less attention and efforts. At this early stage of the implementation of the IWSP it will suffice to keep this group informed on a regular basis.

It is obvious that a group with high power and high interest needs to be involved. A group with low power and low interest can suffice with information about the project.

In Table 8.1 a communication strategy of the publicizing of the IWSP is advised by the expert team. For each stakeholder group the expert team suggests the level of involvement (involve, talk or inform) and communication means. This communication strategy is only valid for the publicizing of the IWSP and needs to be reviewed on a regular basis. Several stakeholders that only need to be informed at this stage need to be involved (consulted) in a later stage of the implementation.

Table 8.1: Communication Strategy and Means for each Stakeholder Group

Main group	Stakeholder group	Strategy	Communication means
All	The communication means for all stakeholders are: • Presentation event that concludes the IWSP development phase. • News message and permanent information on MT website with downloadable IWSP reports. • Interview with Minister of Transport for National and regional television news. • Articles in national and regional newspapers. • E-mail to all the participants of the Stakeholder Consultation • Organize regional open-for-all information events (one by each Waterway Administration, initially)		
Public	CONIT (chaired by the Minister of State for Transport. Members: Ministry of Justice, Defense, Finance, Planning, Budget and Management, Development, Industry, and Foreign Trade, Cities, and the Special Port Secretariat of the Presidency of the Republic)	Involve	Meetings with Minister for Transport. Workshop with CONIT representatives. E-mail news message with link to more information to all CONIT staff
	Waterway Administrations	Involve	Workshop with the eight WA where projects will be implemented. E-mail news message with link to more information to all WA staff,
	SEGES, EPL, DNIT, ANTT Secretary of Ports SEP, ANTAQ Ministries of Energy, of Defense (Navy), of Environment/ANA,	Involve	Meetings with decision makers, workshop with representatives of all relevant departments, e-mail news message with link to more information to all staff,
	River Basin Committees (Public/Private cooperation)	Involve	Regional workshops
Private	Transport companies (shipping lines, cargo owners, terminal operators)	Involve	Meetings with decision makers of transport companies that are required to be involved. Invite all to regional information events. Relevant specialized magazines.
	Industrial companies & Service providers to IWT (dredging companies, shipyards, consultancy firms) & Energy sector	Inform	Relevant branch magazines. Invite to regional information events.

Main group	Stakeholder group	Strategy	Communication means
Interest and experts	Sector organizations, industry associations (ex. FIESP), producers associations (ex. APROSOJA) & Scientific community (UFAM, UNIR, IMEA)	Inform	Articles in branch and scientific magazines.
	Representatives of local communities	Talk	Invite to regional information events, group talks, open doors.
	NGO's (Fundação Nacional do Índio (FUNAI), Fundação Cultural Palmares (FCP), Instituto do Patrimônio Histórico e Artístico Nacional (IPHAN), Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA))	Talk	Meetings with representatives. Invite to regional information events.

The implementation of the Publicizing Plan can be done at two levels:

1. MT can organize all the national communication. Once instated, the Task Force can lead the national communication.

2. The Waterway Administrations can organize all the regional communications, for example the open-for-all information events and regional workshops. The relevant Waterway Administration are: Sao Francisco WA, East Amazon WA, West Amazon WA, Paraguay WA, Southern WA, Tocantins and Araguaja WA and Paraná WA. Once instated, the Regional Development Groups can become responsible for the regional communication.

From the moment of publishing the Inland Waterways Strategic Plan it is important to manage the way of communicating and using the media. This can be done as follows:

- Manage lists of media contacts;
- Create key messages, press releases, and other written material;
- Work with journalists and news outlets to publicize the key messages.

8.1.5 Determine resources needed for the campaign

The implementation of the publicizing plan requires communication experts. A capacity of the equivalent of 1 expert full time for 6 months is estimated to be sufficient. This can be one person but the work can also be divided several people. During this time of 6 months the Task Force will be instated and they will take over de communication. The work list for the communication experts could be:

- Create a page and news message about the IWSP on the website of MT;
- Write press releases for national and regional newspapers;

- Write e-mail for all relevant ministry staff and send;
- Write e-mail for all stakeholders from the stakeholder consultation and send;
- Write press material for branch/specialized magazines;
- Coordination and facilitation group talks/open doors with local communities;
- Coordination and facilitation of meetings with decision makers of companies that need to be involved in the implementation of the Task Force;
- General coordination and facilitation of the regional workshops, seminars and information events;
- Coordinate the development of a Communication Plan by the Task Force.

The plan includes one workshop or seminar with CONIT, one with representatives of the eight Waterway Administrations and one with other public stakeholders that need to be involved in the implementation of the Task Force. In addition the plan includes the organization of eight regional information events for stakeholders and the general public. For each event a presentation is advised and a temporary information center with some posters, maps, management summaries and staff to answer questions (for example a week in a meeting room of a WA building or town hall). Also eight regional workshops with River Basin Committees are included.

Other required resources are rooms for workshops, seminars and meetings, catering (coffee/thee), materials such as posters, maps and summaries, workshop kits.

8.2 MONITORING PLAN

8.2.1 Introduction

It is essential that the IWSP is implemented and makes the difference that it is aimed for. Knowledge of implementation progress (milestones) and effects is therefore important. This chapter therefore, contains the plan for monitoring the project progress and effects; the Monitoring plan.

Even if investments take place according to plan, this does not guarantee that transport over water increases. For monitoring of investment planning there are two types of indicators: output (implementation monitoring) and outcome indicators (effectiveness monitoring). The first consists of evaluating the progress of the investments and action plans (time, budget, quality); the second evaluates the effect of the investments and the goal achievement. Both output and outcome have their specific Key Result Indicators (KRI's)that will give an overview of whether the plan is on track. Figure 8.2 presents the relation between the aforementioned elements.

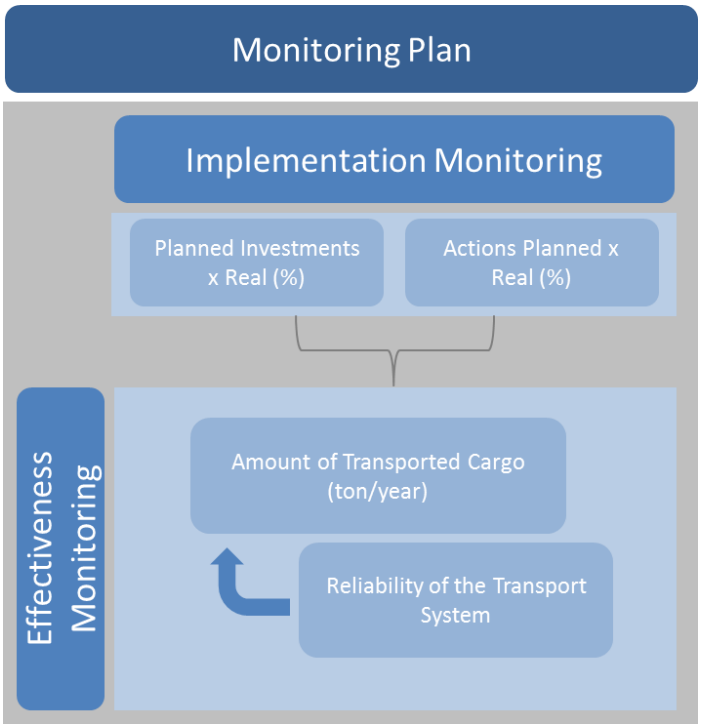


Figure 8.2: Monitoring plan – Elements and Key Results Indicators

As can be seen in the figure above, the investments and actions implemented will affect the effectiveness of the plan on the amount of transported cargo and reliability of the transport system. It is important to note that reliability of the transport system influences the amount of transported cargo, which was extensively brought to attention by stakeholders during the preparation of the strategic plan. As well as being identified as one of the main issues of the IWT, it has been decided to consider the "Reliability of the Transport System" as a Key Result Indicator.

It is necessary to choose Key Performance Indicators (KPI's), which, according to Parmenter[23], represent a set of measures focusing on those aspects of organizational performance that are the most critical for the current and future success of the organization. These will support the decision making process by identifying the progress towards achieving goals, as well as the elements that should be focused on to increase the performance. In this way, it will support continuous improvement of the strategy.

8.2.2 Responsibilities in Effectuation of the Monitoring

Figure 8.3 presents the relation between the Task Force and the Regional Development Groups. The Task Force selects the main indicators to be gathered and is responsible for the overview reporting at a National level. The Regional Development Groups are mainly responsible for the regional actions, such as overseeing the civil works and RIS implementation timeframe; information that should be gathered to calculate the KPI's and the KRI's. The RDG's report to the Task Force, which will evaluate, centralize and publish the data monitored, as well as analyze the status of the civil works and the Action Plans. The Task Force is responsible

[23] PARMENTER, D. **Key performance indicators – Developing, Implementing and using winning KPI's.** 2007. John Wiley & Sons.

for adapting the Action Plans and the budget allocation when the monitoring results show this need.

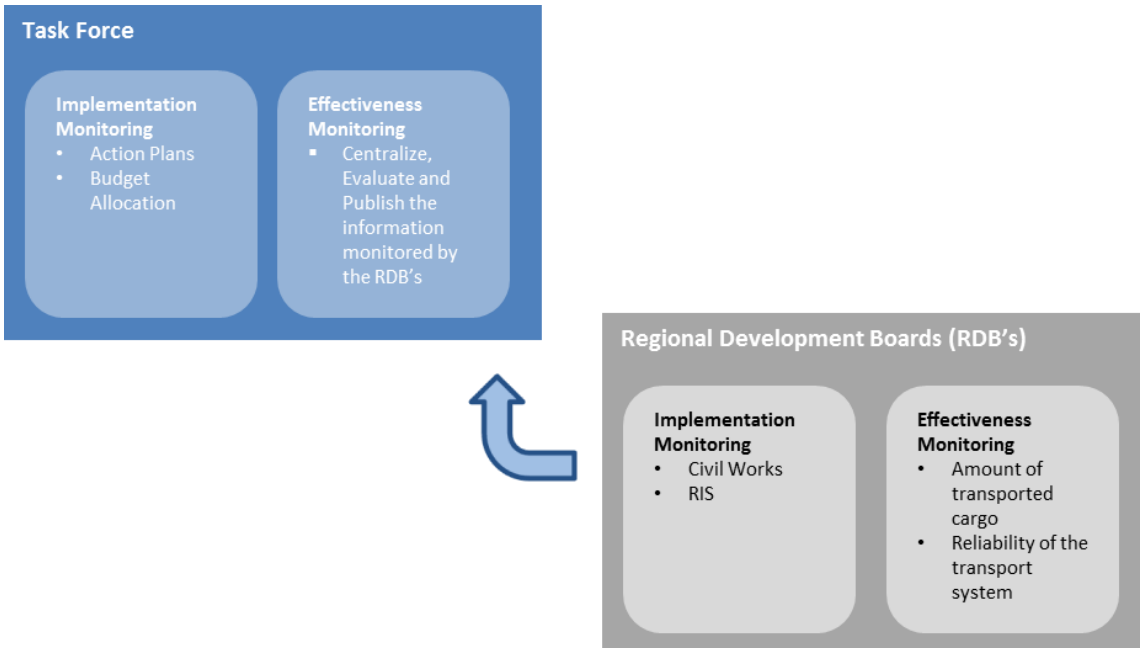


Figure 8.3: Relation between the Task Force and RDG's

8.2.3 Implementation and Effectiveness Monitoring

The implementation monitoring is related to the actions that should take place under the Task Force and Regional Development Groups. The organizations that implement the improvements in the waterways will gather the information in the RDG's. From there it will be sent to the Task Force for preparing the National overview of progress reports.

The Effectiveness Monitoring will take place to evaluate whether the physical and institutional actions are effective in increasing the amount of transported cargo on waterways and the reliability of the transport system. It is also a very useful way to enhance the planning process by creating a more concise monitoring system. The implementation of RIS will facilitate the monitoring of the waterways in such a way that statistical data will be made available.

Due to the fact that effectiveness monitoring is related to operational and waterway management aspects, it will be performed at the Regional Development Group level, but always reported to the Task Force IWT Development.

For determining the Key Performance Indicators, as well as the data that needs to be collected, a three step approach was performed:

- Step 1: Identification of the data already being monitored by Brazilian Authorities;
- Step 2: Identification of the data monitored in the U.S.;
- Step 3: Further data to be monitored by Brazilian Authorities and Key Performance Indicators.

Step 1 – Identification of data Already Monitored by Brazilian Authorities.

During the Diagnosis phase, it was identified that waterway monitoring is still incipient, only the Paraná system does it in a more structured manner. On the AHRANA website, operational reports are monthly released, in which information regarding the cargo flows (origin, destination and volumes), water levels and lock operations (name of the ship, draught, O/D of the ship, type of cargo, number of ships per month, locking time, number of lockages per month, number of lockages –filling or emptying – without ships and others) are made available by the lock operator.

ANTAQ monitors the throughput of the ports, however, monthly data is not available, which hinders the identification of peak months per port and type of cargo.

Step 2 – Identification of the monitored aspects in the US

The waterway monitoring system in Europe and in the US is very structured, mainly due to their early development and longtime experience in using this modality and the organization of the sector.

The U.S., for instance, has a platform called “Navigation Data Center” of the US Army Corps of Engineers, in which data regarding the waterway operation is available, such as:

- Waterborne Commerce:
  - Waterborne Commerce of the United States – domestic and foreign tonnages and trips by commodity for major port and waterways;
  - Foreign Waterborne Commerce between the U.S. and foreign countries summarized by U.S. ports, foreign country, vessel flag, commodities and containerized;
  - Monthly domestic tonnages and indicators;
  - Origin to destination foreign and domestic waterborne cargo movements by region and state;
  - Waterborne tonnage for principal ports and U.S. states and territories.
- Vessel Characteristics:
  - Inventory of vessel companies and their American flag vessels operating in the transportation of freight and passengers
  - National summary of all vessels.
  - Characteristics of each vessel listed by vessel operator name.
- Port Facilities:
  - Description of physical and intermodal characteristics of the coastal, Great Lakes, and inland ports of the U.S., including names, addresses and telephone numbers of contact personnel.

- Dredging Information:
  - Dredging activity from pre-bid through completion, including location, quantity, type of dredger and responsible Corps District;
  - Reports Government estimate, all contractor bids, winning bidder and upon completion, actual costs and quantity dredged.
- Locks:
  - Lock performance monitoring systems statistics – currently monthly information;
  - Key lock report – monthly summary and year-to-date totals of commodity tonnages and barge traffic per key locks on inland waterways;
  - Annual summary of lock statistics – number of vessels and lockages by type; tonnage, barges, tows, average delays, total delay time, lock closures;
  - Lock characteristics – the physical aspects of all Corps owned and operated locks.

According to the U.S. Army, the data were compiled from several agencies, including the U.S. Army Corps of Engineers Navigation Data Center, the U.S. Bureau of the Census, the U.S. Coast Guard, Oak Ridge National Laboratory, and Vanderbilt University. One of the objectives of this coordinated effort is to make waterway data more widely available and easily accessible. This documentation is standardized.

As for the water levels, information regarding the Great Lakes and the U.S. waterways is available on the NOAA (National and Oceanic Administration) domain and its branches (http://www.riverwatch.noaa.gov/index.shtml).

Step 3 - Further information to be monitored by Brazilian Authorities.

Based on the analysis of the PIANC document titled “Performance Indicators for Inland Waterways Transport – User Guideline” and on the data already monitored in the US and Europe, a set of indicators to be monitored was selected, grounded on the principle that they may affect the Key Result Indicator.

For each of these indicators, the necessary data on waterway operation must be collected from several stakeholders, so data collection and analysis methods must be standardized, which will be confirmed and elaborated while setting the “Task Force Inland Waterway Development” agenda.

Table 8.2: Key Performance Indicators associated to the Amount of Transported Cargo.

Segment	Key Performance Indicator	Calculation	Basic Data
Infrastructure	P1 - Capacity of the waterway (tons/year)	$P1 = \frac{(1) * 365 * P6}{(2)} * (3)$	(1) Operating hours per day
			(2) Average time for lockage dependent on the technical performance of the lock
			(3)Technical capability of a lock to handle a certain transport volume per lockage
Ports	P2 - Handling Capacity (Tons or TEU's/hour)	$P2 = (7) * \big((8) - (9) - (10)\big)$	(4) Total quay meters of a specific port
			(5) Total number of truck loading bay
			(6) Total length of rail transshipment tracks
			(7) Total waterside handling capacity (ton/h)
			(8) Operating hours per year
			(9) Maintenance hours per year
			(10) Repair work hours per year
	P3 - Storage capacity utilization (Percent)	$P3 = \frac{(11)}{(12)} * 100$	(11) Monthly utilised average storage capacity per commodity
			(12) Total storage capacity available according to commodity group
Fleet	P4 - Maintenance, service, operating supplies (R$/ton)	$P4 = \frac{\big((13) + (15) + (16)\big)}{\frac{(14)}{(17)}}$	(13) Total maintenance costs per convoy
			(14) Total amount of cargo transported regarding a convoy
			(15) Total service costs regarding specific vessel type per month
			(16) Total costs for operating supplies regarding specific convoy
			(17) Total amount of cargo transported regarding defined fleet in tons per month
	P5 - Capacity (Percent)	$P5 = \frac{(19)}{(18)}$	(18) Capacity of entire specified fleet
			(19) Total amount of cargo transported per month, per commodity

Table 8.3: Key Performance Indicators associated to the Reliability of the Transport System.

Segment	Key Performance Indicator	Calculation	Basic Data
Infrastructure	P6 - Availability of Locks (hours/month)	$P6 = \frac{[(1)*2-((2)Lock\ A+(2)Lock\ B-(4)*2)*100]}{(1)*2}$	(1) Total operating hours of a certain lock per month
			(2) Total downtime of lock chamber A – lock A - in hours within a month due to maintenance, weather conditions and others
			(3) Downtime of a lock chamber A in hours within a month due to weather conditions
			(4) Total hours of lock downtime- all lock chambers contemporaneous
			(5) Hours of lock downtime due to weather conditions - all lock chambers contemporaneous
	P7 - Availability of Core Waterway Infrastructure (days/year)	$P7 = \frac{365-(6)}{(10)}$	(6) Total stop of navigation on a specific waterway section measured in days per year
			(7) Stop of navigation on a specific waterway section due to high water in days per year
			(8) Stop of navigation on a specific waterway section due to accidents measured in days per year
			(9) Navigable days below design draught per year
			(10) Total navigable days per year
Ports	P8 - Waiting time for service (Percent)	$P8 = \frac{(11)}{(12)}*100$	(11) Total number of arriving vessels started for transshipment within a time span of "x" minutes per month
			(12) Total number of ship arrivals per month
Safety	P9 - Number of injuries, fatalities and damages (Accidents per ton-km)	$P9 = \frac{(13)+(14)+(15)}{(16)}$	(13) Number of injuries within a specified waterway section per time period
			(14) Number of fatalities within a specified waterway section per time period
			(15) Number of damages within a specified waterway section per time period
			(16) Total Number of ton-kilometres travelled within a specified waterway section per time period
	P10 - Accidents (Accidents per ton-km)	$P10 = \frac{(17)}{(18)}$	(17) Total number of accidents within a specified waterway section per time period
			(18) Total number of ton-kilometres travelled within a specified waterway section per time period

These indicators will be calculated for each waterway system and evaluated at the National level. The benchmarks for the performance should be defined within the Task Force. For each waterway system, the Key Result Indicator related to the transported cargo should be compared to those planned for the project horizon. The modal share of the IWT should also be calculated.

In order to evaluate the contribution of each waterway system and its impact on cargo transportation, it is recommended to implement indicators to compare the foreseen contribution of a waterway system to the real contribution, as shown in Table 8.4.

Table 8.4: Key Performance Indicators for Contribution of Each Waterway System

Indicator	Calculation	Data requirements
Foreseen contribution of the waterway system *"i"* e ano *"n"* ($P_{p,n,i}$) in %- Objective	$P_{p,n,i} = \frac{V_{p,n,i}}{V_{p,t}}$	$V_{p,n,i}$ – Foreseen cargo for the year "n", for the Waterway System "i"
		$V_{p,t}$ – Total foreseen cargo for the year "n".
Real contribution of the Waterway System *"i"* and year *"n"* ($P_{n,i}$) –in %.	$P_{n,i} = \frac{V_{n,i}}{V_t}$	$V_{n,i}$ – Transported cargo on the year "n", for the Waterway System "i"
		V_t – Total transported cargo on the year "n".

8.2.4 Monitoring Passenger Transport

Inland waterway passenger transport mainly takes place on the Amazon Region, where several lines serve the population. As it has been identified, there is no monitoring of this type of transport, so little information is available. ANTAQ recently published a passenger study to characterize the demand of that area.

In order to have better information on passenger transport, it is important that a monitoring system is employed to at least determine the passenger transport flows and the level of service provided. It is suggested that at every inland passenger terminal an IT system is used to compute the traffic.

The indicators presented in Table 8.5 are suggested to be implemented.

Table 8.5: Key Performance Indicators for Passenger Transport

Key Performance Indicator	Calculation	Basic Data	Period of Collection
P11 - Development of total number of passenger transport along waterway section (percentage)	$P11 = \frac{(1)}{(2)}$	(1) Total number of passengers along specified waterway section per month considering upstream and downstream movements (2) Comparative value previous year	Monthly
P12 – Development of total passenger transport performance (percentage)	$P12 = \frac{(3)}{(1)}$	(3) Total number of passenger transport kilometres along specified waterway section	Monthly
P13 - Accidents (Accidents per passenger transport-km)	$P13 = \frac{(17)}{(18)}$	(4) Total number of accidents within a specified waterway section per time period (5) Total number of ton-kilometres travelled within a specified waterway section per time period	Monthly

For the evaluation of the level of service, the indicators to be used and data to be collected should be further discussed within the Task Force.

8.2.5 Implementing the Monitoring step by step

It is important to start with the most important and feasible indicators, because the total amount of information needed is extensive; a step-wise approach is proposed. In the first step the most important information is gathered. This includes:

Output indicators to do the implementation monitoring:

1. Indicate whether the preparations for investments are executed according to plan,
2. Indicate whether the investments are respecting the limits of budget, time, and the required quality.

The information on the output indicators should come from the organization responsible for the project (the responsible construction company or waterway organization).

Outcome indicators to do the effectiveness monitoring:

Outcome indicators are generally more complicated to measure. The most important and feasible information includes:

1. **Inventory information on infrastructure and fleet**

- Capacity per waterway and capacity of individual locks in the concerning waterway
- Handling capacity of ports and terminals per waterway
- Fleet capacity per waterway

2. **Transport flows: amount of cargo transported**

- Per waterway
- Per month
- Per commodity
- Including origin and destination

3. **Information on transport safety**

Number of accidents with

- Only material damage
- Injuries
- Fatalities

This information makes it possible to calculate the most important KPI's. If this monitoring system is successful, it can be expanded in the next phase. The information currently provided by AHRANA contains the required information for this phase of the monitoring plan.

The sources of information are mainly the waterway authorities. They are able to provide information on capacity of waterways and capacity of locks. Furthermore, they should provide information on transport flows. The information on accidents will also be provided by the waterway authorities. The Navy will provide information on the fleet capacity per waterway. The information on capacity of ports and terminals will come from terminal and port authorities.

The information on transport flows and accidents should be provided on a monthly basis, while the information on inventories should be updated every half year. After a first inventory, only changes have to be submitted.

9 IMPLEMENTING THE PLAN

In this chapter an overview is generated of all the recommendations and interventions that are mentioned in the plan. It provides all key information about measures, involved organizations, timing and budget. More detail can be found in the previous chapters. Chapter 5 describes the task force and its Working Groups. Information about the recommendations to improve the navigability conditions on the rivers that involve civil works and signaling are presented in detail in Chapter 6. The Pilot Projects are described in Chapter 7. Chapter 8 explains the publicizing and the monitoring plan. This chapter starts in the first paragraph with the summary of the organizational recommendations. In the second paragraph an overview of the physical interventions and the investment planning.

9.1 OVERVIEW OF ORGANIZATIONAL IMPROVEMENTS OF THE TRANSPORT SYSTEM

The recommendations to improve the organizational part of the transport system will require less budget then the physical interventions. This does not mean they can be organized easily. The close cooperation and focus towards the same goal is also required. The table below provides an overview of the recommendations that improve the organizational aspects of the transport system including the required estimated budget. The investments in civil works, fleet expansions and terminals are considered as part of the investment planning (par. 9.2).

The basis for the cost estimates are the following assumptions: Government (internal) working hours are not separate taken into the cost estimate, the Task Force will be provided with a budget to cover the expenses of studies required for these additional tasks. According to the present estimate for the physical interventions 17 billion R$ will be spent on IWT improvement. A first estimate of the supporting study and preparation cost associated with the functioning of the Task Force is 1,5 % of the total development budget: 255 million R$. These costs are considered as part of the investment planning (par. 9.2).

Table 9.1: Overview of Recommendations (continuation)

Description of the project			Responsibilities		Finance	Status	Planning	More information
Nr.	Measure	Recommendation	Responsible	Involved	Estimated Budget	Starting date	End date	Chapter. Paragraph
1	Coordination of a Task Force IWT Development	Coordinate a Task Force on a National level, which create the conditions for the implementation of the Inland Waterways Strategic Plan (IWSP) for the development of IWT in Brazil.	Ministry of Transport (MT)	Public and private representatives: CONIT, Waterway Administrations, SEGES, EPL, DNIT, ANTT, ANTAQ, Ministry of Energy, Ministry of Defense (Navy), Ministry of Environment, National Water Agency (ANA), Ministry of Foreign Relations, Cargo owners (trading companies), Shipping lines, Terminal operators.	Coordination: 0.25 million R$ per year[24]	2013	Coordination of the Task Force [December/2013] - [June / 2014]. Preparation and implementation of the Task Force [July /2014] - [December / 2024].In 2025 the Task Force will be evaluated and participants will decided in which structure and with which aim the Task Force will go on.	5.1Task Force participants
2	Optimize internal organizational structure to support IWT	Preparation and implementation of Working Group 1: optimize internal organizational structure to support IWT.	Task Force, Working group 1.	Representatives of Ministry of Energy (ANEEL), Ministry of Defense (Navy), Ministry of Environment (IBAMA), ANA, Ministry of Foreign Relations, SEP, Ministry of Transport (SPNT), Ministry of Planning, Ministry of Finance. .	1.0 million R$.	2013	Preparation of Working Group 1 [December/2013] - [June / 2014]. Implementation of Working Group 1 [July /2014] - [June / 2015].	5.3 Working Groups to prepare decisions about specific improvements
3	Integrated planning	Preparation and implementation of Working Group 2: Integrated planning.	Task Force, Working group 2.	Representatives of the different Ministries: Ministry of Energy, Ministry of Defense (Navy), Ministry of Environment, Ministry of Foreign Relations, SEP, Ministry of Transport, Ministry of Planning, Ministry of Finance, ANA.	0.5 million R$.	2013	Preparation of Working Group 2 [December/2013] - [June / 2014]. Implementation of Working Group 1 [July /2014] - [June / 2015].	5.3 Working Groups to prepare decisions about specific improvements
4	Public-private partnerships	Preparation and implementation of Working Group 3: Public-private partnerships.	Task Force, Working group 3.	Public and private representatives: Ministry of Transport, Waterway Administrations, SEP, representatives of Contractors, Cargo owners (trading companies), Shipping companies, Terminal operators).	1.5 million R$.	2013	Preparation of Working Group 3 [December/2013] - [June / 2014]. Implementation of Working Group 1 [July /2014] - [June / 2015].	5.3 Working Groups to prepare decisions about specific improvements
5	Coordination of the Regional Development Groups (RDG's)	Coordinate (maximum 8) RDG's, which implement the required projects in a specific waterway together throughout the life span of the assets. All members add their own efforts to the Waterway Administration while implementing the improvement project for a specific waterway. The Regional Development Group's report to the National Task Force IWT Development.	Ministry of Transport (MT)	Public and private representatives to be determined specifically for each separate development project.	1.0 million R$ per year[25]	2013	Implementation of the RDG [November/2013] - onward. The RDG can be seen as a commission (e.g. Rhine commission) and will be permanent.	6.1 Organize actions by a Regional Development Group (RDG)

[24] Assumption: Cost estimate for a (senior) coordinator (1 FTE) is 0.25 million R$ (per year).
[25] Assumption: Cost estimate for a (senior) coordinator (1/2 FTE) is 0.125 million R$ (per 1 RDG). In total maximum 8 RDG's, makes in total 1.0 million R$ per year.

Description of the project			Responsibilities		Finance	Status	Planning	More information
Nr.	Measure	Recommendation	Responsible	Involved	Estimated Budget	Starting date	End date	Chapter. Paragraph
6	Preparation, implementation and realize the Pilot Project	Implementation of River Information Services (RIS)	Ministry of Transport (MT), Infrastructure Managers	MT, Waterway Administrations, ANTAQ, Navy, Shipping lines	Preparation: 1.0 million R$. Implementation and realization: 5.0 million R$.	2014	2018	7.3 Pilot Projects
7	Preparation, implementation and realize the Pilot Project	Intramodal transport as part of regional development	Ministry of Transport (MT)	MT, Waterway Administrations, Regional Development Group, State authority, Cargo owners (trading companies), Shipping lines, Terminal operators, infrastructure managers	Preparation: 1.0 million R$. Implementation and realization: 2.0 million R$.	2014	2020	7.4 Pilot Projects
8	Preparation, implementation and realize the Pilot Project	Public Private Partnership	Preparation: Working group 3 (MT) Implementation: relevant Waterway Administration	MT, Waterway Administrations, Public organizations, private organizations	Preparation:1.0 million R$. Implementation and realization: 2.0 million R$.	2014	2020	7.5 Pilot Projects
9	Preparation, implementation and realize the Pilot Project	Inland Container Terminal	Preparation: working group 3 (MT) Implementation: relevant Waterway Administration	MT, Port authority, local authorities, public organizations, companies, cargo owners (trading companies), potential terminal operator, potential operators inland waterway container lines, the industry (shippers), infrastructure managers, seaport container terminal, road transport companies.	Preparation:1.0 million R$. Implementation and realization: 30.0 million R$[26]. (Investment: 50% private and 50% public).	2014	2020	7.6 Pilot Projects
10	Publicizing plan	Coordination and implementation of the Publicizing plan	Task Force	Task Force, RDG partners and target audience.	In total: 0.25 million R$: Coordination: 0.125 million R$[27]. Implementation: 0.125 million R$.	2013	Implementation of the plan [October / 2013] - [April / 2014].	8.1 Publicizing plan
11	Monitoring plan	Implementation the monitoring plan	Task Force	Task Force and RDG partners.	Coordination, collection and analyzing: 0.750 million R$ per year[28].	2013	Implementation of the plan [September / 2013] - [December / 2024].	8.2 Monitoring plan

[26] Costs estimate for the realization of the Inland Container Terminal is based on expert judgement. The total costs for the realization of an Inland Container Terminal are based on a large number of variables.
[27] Assumption: Cost estimate for a (senior) coordinator (1/2 FTE) is 0.125 million R$.
[28] Assumption: Cost estimate for a (senior) coordinator (3 FTE) is 0.750 million R$.

9.2 OVERVIEW OF PHYSICAL INTERVENTIONS AND INVESTMENT PLANNING

The total investments in waterways are estimated to be about R$ 17 billion. This amount will be spread over a period of 11 years, and the investments will be executed early enough to reach the goal before 2031. The large scale investments suggested in this Plan demand time due to the necessity of the plan confirmation as a whole and the organization of the implementing process, and this is particularly time demanding when considering stakeholder involvement in these processes. The investments will start after half a year, when the task force is operational. After that the implementation of the investments can be started. The preparation phase of the investments, which involve studies and preliminary designs, including the Basic Designs, (which in general require 2 - 3 years) start in 2015 for the majority of the projects. Therefore, in the period between 2014 and 2016 the expenses are limited to the costs of the preparation phase, which is estimated as 1.5% of total investment costs. Between 2018 and 2020 the expenses will peak to approximately R$ 3 billion per year, when the activities on the Detailed Designs and civil works are concentrated. From 2021 and further, the investment cost will decline and the investments will be finished by 2024.

Besides the investments in the waterways by the government, the private sector is also expected to invest. The total private investments amount to more than 5 billion R$ in inland terminals, the same order of magnitude in sea terminals and more than 4 billion R$ in fleet expansion.

The aim of this investment planning is to spread the annual required budget and capacity of governmental staff and contractors over time, as well as to prioritize the investments, based upon:

- Economically and technically most feasible and profitable projects
- Rivers with currently IWT
- Planned investments (e.g. plants, hydro dams)
- Support from the regional stakeholders

It should be noted that after the main investments, maintenance will still be necessary to guarantee the reliability in the longer term. The yearly maintenance costs will be R$ 543 million.

An overview of the investment planning is given in Table 9.2.

Table 9.2: Investment Plan: Terminals and Fleet

Waterways Systems	Years (2016-2031)																Investiments (R$ millions)
TERMINALS	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Amazonas		143,0	143,0	143,0													429,0
Madeira			81,7	81,7	81,7												245,0
Tapajós	46,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0							460,0
Tocantins		149,4	149,4	149,4	149,4	149,4	149,4	149,4	149,4								1.195,0
Sao Francisco		112,3	112,3	112,3													337,0
Paraná - Tietê		357,6	357,6	357,6	357,6	357,6											1.788,0
Hidrovia do Sul	152,7	152,7	152,7														458,0
Paraguai	61,8	61,8	61,8	61,8	61,8	61,8	61,8	61,8									494
Total	260,4	1.022,7	1.104,4	951,7	696,4	614,7	257,1	257,1	195,4	46,0							5.406,0
FLEET	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Amazonas		59,8	59,8	59,8													179,4
Madeira			61,1	61,1	61,1												183,4
Tapajós	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2							382,2
Tocantins		112,1	112,1	112,1	112,1	112,1	112,1	112,1	112,1								896,5
Sao Francisco		28,0	28,0	28,0													84,1
Paraná - Tietê		78,5	78,5	78,5	78,5	78,5											392,5
Hidrovia do Sul	61,9	61,9	61,9														185,7
Paraguai	241,1	241,1	241,1	241,1	241,1	241,1	241,1	241,1									1.928,6
Total	341,2	619,6	680,7	618,8	531,0	469,9	391,4	391,4	150,3	38,2							4.232,4

	SECTION	RESTRICTIONS	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL
AMAZONAS	Coari - Manaus (Solimões / Negro rivers)	(A)					0,38	0,38	49,25													50,0
	Almeirim - foz do rio Tocantins (Amazonas / Canal de Breves rivers)	(B)			1,88	1,88	82,08	82,08	82,08													250,0
MADEIRA	Itacoatiara - Porto Velho (Madeira river)	(A)			4,00	4,00	4,00	262,67	262,67	262,67												800,0
		(B)					15,00	328,33	328,33	328,33												1000,0
		(C)						1,50	1,50	197,00												200,0
SÃO FRANCISCO	Petrolina - Ibotirama (São Francisco river)	(A)					0,36	23,64														24,0
		(B)					0,23	14,78														15,0
		(C)				0,04	0,04	5,42														5,5
		(D)			0,48	0,48	31,52	31,52														64,0
		(E)					0,36	23,64														24,0
	Ibotirama - Bom Jesus da Lapa (São Francisco river)	(A)				0,04	0,04	5,42														5,5
		(B)			0,23	0,23	14,78	14,78														30,0
	Bom Jesus da Lapa - Pirapora (São Francisco river)	(A)				0,11	0,11	6,90	6,90													14,0
		(B)			0,38	0,38	16,42	16,42	16,42													50,0
		(C)						0,45	29,55													30,0
PARAGUAI	Foz rio Apa - Corumbá (Paraguai river)	(A)					0,75	49,25														50,0
		(B)			1,50	1,50	98,50	98,50														200,0
	Corumbá - Cáceres (Paraguai river)	(A)						10,24	10,24	10,24	672,43	672,43	672,43									2048,0
TOCANTINS	Marabá - Vila do Conde	(A)			4,95	4,95	216,70	216,70	216,70													660,0
		(B)				1,35	1,35	88,65	88,65													180,0
	Marabá - Miracema do Tocantins (Tocantins river)	(A)			1,75	1,75	1,75	68,95	68,95	68,95	68,95	68,95										350,0
		(B)							5,25	5,25	344,75	344,75										700,0
		(C)					2,00	2,00	2,00	78,80	78,80	78,80	78,80	78,80								400,0
		(D)							1,50	1,50	98,50	98,50										200,0
		(E)					4,80	4,80	157,60	157,60	157,60	157,60										640,0
		(F)						3,38	3,38	147,75	147,75	147,75										450,0
		(G)					1,00	1,00	1,00	39,40	39,40	39,40	39,40	39,40								200,0
TAPAJÓS - TELES PIRES	Santarém - Itaituba (Tapajós river)																					
	Itaituba - Cachoeira Rasteira (Tapajós and Teles Pires rivers)	(A)			2,50	2,50	2,50	164,17	164,17	164,17												500,0
		(B)		4,88	4,88	128,05	128,05	128,05	128,05	128,05												650,0
		(C)		1,50	1,50	1,50	73,88	73,88	73,88	73,88												300,0
		(D)				4,20	4,20	183,87	183,87	183,87												560,0
		(E)					2,25	2,25	2,25	88,65	88,65	88,65	88,65	88,65								450,0
		(F)									3,75	3,75	246,25	246,25								500,0
		(G)				3,46	3,46	151,36	151,36	151,36												461,0
HIDROVIA DO SUL	Rio Grande - Porto Alegre (Lagoa dos Patos)																					
	Porto Alegre - Triunfo (Jacuí river)	(A)			1,20	78,80																80,0
	Triunfo - Cachoeira do Sul (Jacuí river)	(A)			10,20	334,90	334,90															680,0
	Triunfo - Estrela (Taquari river)	(A)			7,50	246,25	246,25															500,0
PARANÁ	São Simão - Pereira Barreto (Paraná and Tietê rivers)																					
	Três Lagoas - Pereira Barreto (Paraná and Tietê rivers)	(A)			4,50	4,50	4,50	221,63	221,63	221,63	221,63											900,0
	Pereira Barreto - Anhembi (Tietê river)	(A)							5,40	177,30	177,30											360,0
		(B)		4,20	4,20	4,20	206,85	206,85	206,85	206,85												840,0
		(C)		1,85	1,85	1,85	91,11	91,11	91,11	91,11												370,0
		(D)		1,65	1,65	1,65	81,26	81,26	81,26	81,26												330,0
		(E)		1,65	1,65	1,65	81,26	81,26	81,26	81,26												330,0
		(F)		1,65	1,65	1,65	81,26	81,26	81,26	81,26												330,0
		(G)			0,15				0,15	0,15	19,70											20,2
	Total costs (x milion RS)			17,4	58,6	831,9	1833,9	2828,3	2804,5	3028,3	2119,2	1700,6	1125,5	453,1								16801,2
	Year		13	14,0	15,0	16,0	17,0	18,0	19,0	20,0	21,0	22,0	23,0	24,0	25	26	27	28	29	30	31	
	%			0,1	0,3	5,0	10,9	16,8	16,7	18,0	12,6	10,1	6,7	2,7								
	Legend		Studies and Preliminary Designs (including the Basic Design)																			
			Civil Works and Detailed Design																			
			(A), (B), ... Detail description of the following restrictions can be found in Chapter 6																			

Table 9.3: Investment Planning

10 EPILOGUE

This Inland Waterways Strategic Plan marks the beginning of a change for Inland Waterway Transport in Brazil. Implementing this change will not be easy, but the benefits for Brazil will be large. It will require coordinated investments in infrastructure and believe in the power of this energy efficient, cheap, safe and environmental friendly mode of transport. All organizations and companies involved must work together to improve the system. Everybody has to carry a rock to build this house.

To create successful Inland Waterway Transport the government should provide a well-maintained waterway or organize the preconditions for companies to fulfill this task. The trading companies must decide about the routing of their cargo and bring sufficient cargo that is suitable to be transported by barges to the vessels. The different governmental organizations must work together to create a supportive government system and a well-organized, safe and up-to-standard transport system, within a supportive social and environmental framework. The transport companies can support the government with expert knowledge and can set an inspiring example for other transport companies to switch to this mode of transport. Passenger transport improvement starts with current operators as well, inclined to lead the way. The recommendations in this plan provide the main steps to take. The IWST is also a tool for organizing this public and private cooperation with a Task Force and Regional Development Groups.

As the Inland Waterway Transport in Brazil is successfully improved, this mode will be a good alternative that is integrated into the entire transport system. Companies and the public can choose between road, rail and waterway transport, or a combination of the three, to achieve the optimal transport solution in terms of cost, reliability, safety and travel time. The economy of Brazil will experience the benefits. The increasing demand to transport bulk cargo to be exported via sea ports will be facilitated by the efficient IWT system. Using IWT will result in lower inland transport cost for these commodities and, as a consequence, in lower prices and a better competitive position of the Brazilian products on the world market. The improvements will form a basis for a solid inland waterway system that can be expanded in cargo types, geographical scale and facilities. If the basis is ready, the dynamics of economy and needs of the natural and social environment will always require attention to maintain well, which counts for all the modes in the transport system.

The strategy presented in this plan is the first step on a pathway of waterway developments that stakeholders will follow, continually contributing to making IWT an important mode of transport in the national transport matrix. Like one of the many push-boats that will traverse the country, each improvement by any local or regional stakeholder helps to push the sector ahead.

11 APPENDIX

11.1 GLOSSARY

Barge

A vessel with or without its own propulsion, with a flat bottom, designed for transporting liquid or dry bulk products. When it does not have its own propulsion, it is moved by a tugboat or pusher tug.

(Source: Brazilian Naval Engineering Society – SOBENA)

Breadth

Vessel width at the cross section to which it refers. Example, Rib Beam 2, etc. When the section is not indicated, it refers to the master section beam.

(Source: Brazilian Naval Engineering Society – SOBENA)

Charter

A contract through which the owner of a ship or any vessel (shipowner) grants or rents to another (charterer), total or partial use of the ship or vessel, for transport of merchandise, people or objects. The same as charter party.

(Source: GEIPOT – Glossary of transportation technical terms, 1997)

Convoy

An assembly of vessels without propulsion, grouped side by side and/or in a line, that navigate tugged or pushed by other vessel(s) with propulsion.

(Source: NORMAM--0088/DPC)

Dam

A **dam**, **weir** or **reservoir,** is an artificial barrier, made in water courses for retention of large amounts of water. It is used primarily for residential water supply, agriculture, industries, electrical energy production or regularization of flow to allow navigation.

Deep-sea navigation

That which takes place between Brazilian and foreign ports.

(Source: Resolution 843/2007 – Grant to operate in Ocean Transportation/Cabotage/Port support)

Downstream

That part of the water course going away from its source, in the direction of its mouth.

(Source: MMA-Glossary of terms relating to the management of border and transborder water resources, 2006)

Draught, Draft

The vertical distance, taken from a cross section plan, between the lowest part of the vessel in this plan and the waterline. The same as water draft.

(Source: Brazilian Naval Engineering Society – SOBENA)

Dredger

A vessel for removing material from the bottom of shallow waters. It is normally used within or near ports to increase the depth of access channels or turning basins.

(Source: Brazilian Naval Engineering Society – SOBENA)

Ferry boat

A flat-bottomed vessel, with a shallow draft that allows it to operate close to river banks and in shallow water, with a broad beam, often used to transport vehicles.

Ferry ship

A smaller-scale ship used to transport passengers, generally on leisure travel, also transporting their automobiles.

Hydrographic region

Brazilian territorial space consisting of a basin, group of basins or contiguous hydrographic sub-basins with homogeneous natural, social and economic characteristics or similar is considered a hydrographic region, in order to guide the planning and management of water resources.

(Source: CNRH Resolution No. 32, of October 15, 2003)

Inland navigation

That which occurs on inland waterways over national or international routes, on rivers, lakes, canals, lagoons, harbors, coves, inlets and sea areas considered sheltered, by vessels classified or certified exclusively for this modality of navigation.

(Source: Resolution 1555/2009 – Cargo Transshipment Station)

Inland waterway

A navigable route located within terrestrial boundaries, such as rivers, lakes, lagoons and canals, etc.

(Source: NORMAM 28/DHN)

Inland waterway transport

That taking place through river and lake navigation, in inlets, rivers, harbors and coves, or for crossing.

(Source: GEIPOT – Glossary of transportation technical terms, 1997)

Lock

A lock is a hydraulic engineering work that allows ships to climb or descend rivers or inland seas in locations where there are varying levels (dams, waterfalls or rapids). Locks function as stairs or elevators for ships.

Nautical Chart

An analog or digital cartographic document specifically prepared for waterway navigation, published officially by a government or, under its authority, by an authorized waterway service.

(Source: NORMAM-25/DHN)

Navigation Channel

A free sea passage between navigation obstacles or restrictions. If the passage leads to a port or terminal, it is called an access channel.

(Source: NORMAM-17/DHN)

Navigable Rivers

Rivers with rudimentary navigation, open navigation and waterways.

Notice to Skippers

This is a bi-monthly publication (known as “the booklet”) prepared by the Navy Hydrography Center (CHM), delegated by the Hydrography and Navigation Directorate (DHN), for the purpose of providing navigators and general users with information designed for updating Brazilian nautical charts and publications. In addition, “Avisos aos Navegantes” contains some of the Nautical Radio Warnings in effect and other general information important for navigational safety.

Organized port

A public asset built and equipped to meet the needs of navigation, passenger movement or movement and storage of merchandise, and whose traffic and port operations are under the jurisdiction of a port authority.

(Source: MP 595/2012)

Port Authority

The administration of the organized port.

(Source: Resolution 55/2002 – Port Leasing)

Port facility

An installation located within or outside the area of an organized port, used for moving passengers, for moving or storing goods, destined for or coming from waterway transportation.

(Source: MP 595/2012)

Port operator

A legal entity pre-approved to perform activities involving passenger movement or merchandise movement and storage, going to or coming from waterway transport, within the area of an organized port.

(Source: MP 595/2012)

Public administration

The direct and indirect administration of the federal government, states, Federal District and municipalities, including private entities under private law under government control and foundations established or maintained by the government.

River basin

The drainage area of a water course or lake. The Waters Law (Law 9.433/97) chose the river basin as the territorial unity for implementation of the National Water Resources Policy and operation of the National Water Resources Management System (SINGREH) as one of its bases, as provided for in its Art. 1, V.

(Source: MMA—Glossary of terms relating to the management of border and transborder water resources, 2006)

Roll-on/Roll-off

A system for loading highway vehicles and trucks, on ships or planes, by direct movement of the vehicles themselves. (Including a complete train or loose railway car in ocean transport).

(Source: GEIPOT – Glossary of transportation technical terms, 1997)

Roll-on/Roll-off ship

Ships with openings in the stern and/or broadside, allowing vehicles to embark directly into the holds by means of planks (ro-ro).

(Source: GEIPOT – Glossary of transportation technical terms, 1997)

Standard vessel

A hypothetic vessel that has the characteristics for which the waterway is designed. In other words, for a length of “x”, with a beam of “y” and for a maximum draft of “z”, this being for cases of minimum water depths.

Tanker

A ship designed for waterway transport of bulk liquids, such as oil and its derivatives, chemical products, LOG, etc.

(Source: Brazilian Naval Engineering Society – SOBENA)

Terminals for exclusive use

A port facility used under authorization, located outside the area of an organized port.

(Source: MP 595/2012)

Transshipment port

A port facility located near an organized port and used exclusively for operations of transshipment of goods on inland navigation or cabotage vessels.

(Source: MP 595/2012)

Tug, Tugboat

A small, but very strong ship, with a high-power engine and good mobility, designed to tow other vessels.

(Source: Brazilian Naval Engineering Society – SOBENA)

Upstream

In the direction of the headwaters of a river.

(Source: MMA-Glossary of terms relating to the management of border and transborder water resources, 2006)

Vessel, Craft

Any construction, including floating platforms, and, when tugged, fixed platforms, that is subject to registration with the maritime authority, and is able to move through the water by its own means or not, transporting people or cargo.

(Source: NORMAM-02/DPC)

Waterway

A physical space, natural or not, in ocean, sea, river, lake and lagoon waters used for navigation.

(Source: NORMAM 28/DHN)

Waterway

An inland navigation route with standardized characteristics for certain types of vessels, constructed through engineering and regulation works and with signaling and navigation support equipment.

(Source: NORMAM 28/DHN)

Waterway infrastructure

This is the set of areas and resources designed to allow safe operation of vessels. It includes an access channel, a turning basin and respective nautical beaconage and signaling.

(Source: Resolution 1555/2009 – Cargo Transshipment Station)

Waterway system

The set of river stretches with potential for commercial navigation that functions in an integrated manner within a hydrographic region.

11.2 DATABASE

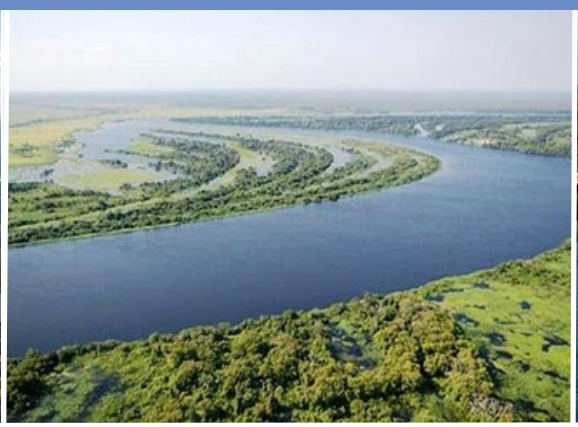
Database elements:

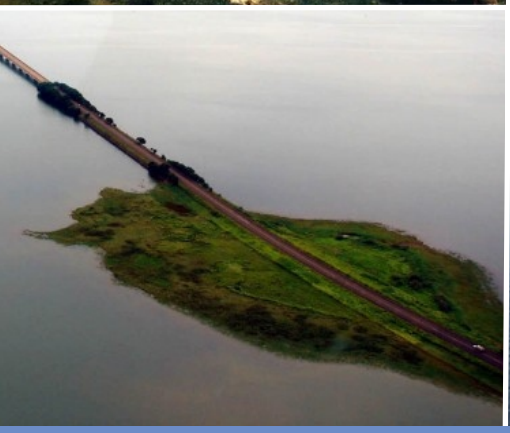
- Economy Results for the preferred strategy
  - Cargo flows per waterway section, per port and origin x destination, in 2011, 2015, 2023, 2031
  - Distances Brazil
- Sources used by economy
  - PNLT
  - Aliceweb system
  - FIESP forecasts for agricultural products
  - Plano National de Mineraçao (assumptions based on the GDP development)
  - Port studies from SEP and PNLP
  - ANTAQ: Draft report - Tocantins
  - IBGE: Micro region/local and agricultural products
- Maps related with economy (including Diagnoses)
  - Two shapefiles: states production/export
  - Several Maps of the 8 studied strategies, including shapefiles

  - Maps of preferred strategy including convoy sizes and river sections, including shapefiles
  - Transport characteristics: main roads, rail, terminals, ports, waterways
  - Current used waterways
  - Preferred strategy
  - Cargo flows
  - Convoy sizes
  - Social, environmental and navigability vulnerabilities
  - Investments per waterway/ region
  - Passenger transport
- Investments cost

Investment maps per waterway/region

Ministério dos Transportes



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