

An aerial photograph showing a person in a small, narrow boat navigating a narrow channel through a vast field of green water hyacinths. The person is using a long pole to maneuver the boat. The water is dark blue, and the surrounding area is completely covered in dense, bright green aquatic plants. The scene is captured from a high angle, looking down at the boat and the surrounding vegetation.

**Handbook
for the Implementation of
Nature-based Solutions
for Water Security:**
Guidelines for designing an
implementation and financing
arrangement

NAture Insurance value: Assessment and Demonstration



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Operationalising the insurance value of ecosystems

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Keywords

Water security, Nature-based Solutions, hybrid infrastructure, green finance, climate finance, adaptation finance, blended finance, implementation strategies, project delivery and finance, procurement.

Foreword

We are delighted to publish this first edition of the Handbook for Implementation of Nature-based Solutions for Water Security.

Climate impacts challenge our status quo. The frequency of extreme events keeps increasing driven by climate change. The World Bank (2016) indicates that the impacts of Climate Change will be channelled primarily through the water cycle and that water scarcity could cost some regions up to 6% of their GDP. COVID-19 is a stark reminder that a shift in our economic development paradigm is urgent. As urged by the GCA (2019), we need three revolutions for a better future: a revolution in understanding, in planning and finance.

In this context, Nature-based Solutions (NbS) emerge as important pillars of new models of economic growth that enable a win-win between economy and environment while helping us mitigate water and climate risks. Unfortunately, the implementation of NbS at scale remains limited. In most cases, NbS are still being implemented as pilot projects of limited size and following parallel processes from mainstream procurement practices. This is what we call the implementation gap.

Aiming at closing this gap, we have developed a collaborative project preparation approach titled Financing Framework for Water Security (FFWS) which aims to set in motion a multisectoral and transdisciplinary process that bridges the strategic adaptive planning and investment planning phases.

The main objective of this handbook is to guide the development of investable NbS propositions and bankable NbS projects for both public and private investors through different modes of governance, funding and implementation arrangements. It offers operational advice and project preparation guidelines, including hands-on formats that project proponents can use continuously and iteratively to develop the entire business case of NbS, enabling them to go from the idea stage towards an investment proposal or investment project stage that can be effectively assessed by potential investors. This makes the handbook a comprehensive and first of a kind document as it adapts the process of developing a business case to the specificities of NbS investments for water security.

Between 2016 and 2020 the FFWS has been continuously developed and successfully implemented by Deltares in seven countries at different scales. Within NAIAD, we have worked together with 23 partners from across Europe. We acknowledge their contributions to the development of this handbook. We have also been generously supported by several sponsors and experts. Our thanks go to the European Commission and the Water as Leverage for Resilient Asian Cities programme.

Our sincere gratitude to Prof. Eelco van Beek, Professor IWRM Modelling at University of Twente and Deltares expert, whose insights into how NbS are considered in the process of Integrated Water Resources Management and river basin planning have been of great value for the development of this handbook. I am especially grateful to Prof. Claude Menard, Professor Economics Université de Paris (Panthéon-Sorbonne), external examiner for my PhD thesis, from whom I have learned the crucial role of institutions and the importance of considering transaction costs in the design of effective implementation arrangements. Inadvertently through his paper "A New Institutional Perspective on Environmental Issues" (2011) he made me realize a crucial research gap in the management of environmental challenges.

We welcome your feedback on the Handbook structure and content, and invite examples for inclusion in the next edition of the Manual.



Monica A. Altamirano, Ph.D
Lead Closing the Implementation Gap team, Deltares

Executive summary

The implementation gap of NbS water security strategies

Climate impacts challenge our status quo. The frequency of extreme events keeps increasing. According to MunichRe, the share of insured losses in 2017 (US\$ 135 bn) is the highest figure in the period from 1980 to 2017. Meanwhile, the World Bank (2016) indicates that the impacts of Climate Change will be channelled primarily through the water cycle and that water scarcity could cost some regions up to 6% of their GDP. COVID-19 is a stark reminder that a shift in our economic development paradigm is urgent. As urged by the GCA (2019), we need three revolutions for a better future: a revolution in understanding, in planning and finance.

In this context, Nature-based Solutions (NbS) emerge as important pillars of new models of economic growth that enable a win-win between economy and environment while helping us mitigate water risks. Unfortunately, the implementation of NbS at scale remains limited. In most cases, NbS are still being implemented as pilot projects of limited size and following parallel processes from mainstream procurement practices. This is what we call the implementation gap.

The development of investable NbS propositions is crucial for the implementation at scale of NbS and the achievement of climate and sustainable development goals by 2030. While it is more and more globally acknowledged that climate change cannot be tackled without ramping investments to protect and restore nature, according to recent studies NbS attract only 3% of global climate funding and private sector investments in NbS remain limited. As a recent H2020 study from the project Naturvation show for urban NbS in Europe, the vast majority of investments in NbS are carried out by the public sector.

From water security strategies to investment plans: closing the gap

More often than not, NbS proponents are organizations with advocacy or scientific background with limited involvement in public or private investment planning processes. Accordingly, NbS pilots and demonstration projects are often shaped as awareness-raising projects rather than as investable propositions. Data granularity regarding implementation costs and risks as well as expected revenues differ greatly between what NbS proponents offer and what investors require.

Aiming at closing this gap, we have developed a collaborative project preparation approach titled Financing Framework for Water Security (FFWS) which aims to set in motion a multisectoral and transdisciplinary process that bridges the strategic adaptive planning and investment planning phases.

Turning NbS project ideas into investable propositions: Financing Framework for Water Security

For NbS water security strategic plans and projects to be able to access funding and/or financing is necessary to prepare a full business case for the entire investment programme and each of the investment projects that make part of it. All investments, including public investments, require a full business case. Essential in the development of the investment case and its five elements - strategic, economic, commercial, financial and management cases- is the development of a suitable implementation arrangement per measure. The success and creditworthiness of a given business case are guaranteed by a robust and fit-for-purpose implementation and financing arrangement per NbS project or cluster of projects.

Making use of system analysis, collaborative modelling techniques and New Institutional Economics, the FFWS enables a process of transdisciplinary collaboration that engages the infrastructure financing community and the proponents of NbS in developing the investment case for NbS while designing an effective project delivery and finance arrangements for hybrid (green-grey) projects. A

process that involves all relevant public, private and community actors key for implementation and enables the translation of strategic plans (e.g. Integrated Water Resources Management -IWRM- plans) into clearly phased hybrid infrastructure clusters that can be absorbed by formal public investment planning processes. They can then be translated into a number of financially viable or even bankable deals making use of a blended finance approach.

Blended finance

Strategic use of development finance and philanthropic funds to mobilise private capital flows to emerging and frontier markets by the OECD and the World Economic Forum (OECD and WEF 2015, OECD 2018).

The FFWS offers an interface between the project delivery and finance community and the water resources planning and watershed conservation communities. It guides the proponents of NbS and/or stakeholders involved in a water security planning process through several questions to develop the five business cases of the investment programme proposed and design a fit for purpose implementation arrangement. The main objective is to design an implementation arrangement with the highest potential to ensure sustainability in service delivery in the long term.

By taking into account: a) the transaction characteristics (technical and financial), b) the level of service required over time and c) the institutional setting and considering good practices worldwide, NbS proponents can choose from a wide range of project delivery and finance options. These options vary from purely public governance options up to the creation of regulated markets for private initiatives.

Through this process, NbS proponents in consultation with all relevant stakeholders decide how to make the provision of the envisioned ecosystem and/or water services possible, what to do themselves, what to delegate and to whom and how to ensure financial sustainability of these investments. An implementation arrangement includes the choice of mode of governance, a funding, financing and procurement strategy.

Between 2016 and 2020 the FFWS has been continuously developed and successfully implemented by Deltares in seven countries at different scales. Within the H2020 NAIAD project, we have worked together with 23 partners from across Europe in further specifying these guidelines to fit the specificities of NbS and test their added value in nine demonstration cases, applying them fully in three of these cases. Those demo cases are ecosystem-based adaptation measures in El Duero basin, Spain; a flood and drought risk management plan in Danube River, Romania; and urban wetland in Rotterdam, the Netherlands. The results from this action research process and the final version of the guidelines are presented in this handbook.

NAture Insurance Value: Assessment and Demonstration (NAIAD)

NAIAD is a project funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No 730497. The project aims to operationalise the insurance value of ecosystems for water-related risk mitigation, by developing and testing concepts, tools and applications on 9 demo sites across Europe, under the common concept of Nature Based Solutions (NbS). At the core of the project is the physical and socio-economic analysis of demo sites, supported with complex modelling and forecast activities, which will, in cooperation with the insurance sector, strive to propose NbS as technically sound and financially viable option for investors at local level and higher and especially for the insurance sector.

The collaborative project preparation approach presented here offers a practical approach for the NbS, water and infrastructure finance communities to work together in driving an understanding, planning and financing revolutions.

Developing the investment case: zooming out and zooming in

Our approach proposes a process to structure NbS investment projects that is twofold:

Stage I: Strategic and economic cases

By zooming out and placing the NbS project into a larger economic development context, the chances and venues for its implementation and financing are expanded. The objective is to strengthen the strategic and economic case of the NbS programme by engaging actively outside the water or environment sectors to develop a shared vision, an explicit theory of change and an assessment of their strategic fit. We advanced on awareness and recognition of ecosystems as critical infrastructure and NbS as pillars of new sustainable and resilient economic development paradigm and political support are advanced through the development of this shared narrative.

This process increases the chances of generating additional sources of funding from multiple economic sectors as well as sources of revenues from multiple beneficiaries of the ecosystem services generated. The envisioned result are strategic investment pathways defining several clearly phased hybrid infrastructure clusters which are then to be further specified in stage II.

Stage II: Commercial, financial and management cases

By zooming in on specific NbS deals or hybrid cluster of projects and developing sound contractual and management strategies that minimize implementation and transaction costs, the bankability of these multifunctional projects is improved. This is done by:

- Designing a fit for purpose implementation arrangement
- Defining a governance structure and a coherent set of contractual and financial mechanisms that depart from a clear hierarchy of functions and levels services to be provided
- Allocating risks and responsibilities to the parties best able to carry them
- Creating greater alignment between the incentives of multiple actors to aim together for sustainability in service provision.

Aims, scope and purpose of the handbook

The main objective of this handbook is to guide the development of investable NbS propositions and bankable NbS projects for both public and private investors through different modes of governance, funding and implementation arrangements. The methodology it proposes - the Financing Framework for Water Security - is well suited for large scale NbS and combinations of NbS projects; hybrid strategies and project portfolios for water security, hydro-meteorological risk reduction and water supply.

This handbook offers operational advice and project preparation guidelines, including hands-on formats that project proponents can use continuously and iteratively to develop the entire business case of NbS, enabling them to go from the idea stage towards an investment proposal or investment project stage that can be effectively assessed by potential investors. To illustrate the use of these guidelines the handbook presents the results of their application to three cases in Europe within the NAIAD project and to one case in Asia that was part of the Water as Leverage for Resilient Cities Asia programme.

This makes the handbook a comprehensive and first of a kind document as it adapts the process

of developing a business case to the specificities of NbS investments for water security. As such the handbook introduces and illustrates the way on how to develop, for any kind of project, the five business cases required to justify the investment. In addition, the handbook also guides the design of a successful implementation arrangement, inspired by the Five Case Model of UK HM Treasury.

The Five Case Model

The objective of the business case is to ensure that programmes and projects on which scarce public funds will be invested meet their intended goals and objectives and deliver the intended benefits by making sure the proposed investments: a) make a robust case for change – the “strategic case”; b) optimise Value for Money in terms of economic, social and environmental benefits- the “economic case”; c) are commercially viable – the “commercial case”; d) are financially viable – the “financial case” and e) are achievable- the “management case”.

The Five Case Model is the approach for developing business cases recommended by HM Treasury, the Welsh Government and the UK Office of Government Commerce. It has been widely used across central government departments and public sector organizations over the last 10 years. The model forms the basis of project and programme business case guidance created by HM Treasury and the Welsh Government.

The tools offered to structure the planning and the entire investment cycle of a NbS project, to assess project bankability, analyse the institutional environment, map key players and analyse their role in the development and implementation of NbS along their entire lifecycle, map the potential investors and funding sources, define a hierarchy of services, and develop a procurement strategy and an allocation of risks. These different tools are usable worldwide.

The handbook can be used in combination with other key deliverables of the H2020 Project NAIAD to develop implementation arrangements for Natural Assurance Schemes (NAS). It can also act as a stand-alone document that can be used by NbS project proponents like NGOs, communities and government agencies wanting to learn about the investor’s perspective, concept and tools, and vice versa; investors willing to increase their exposure to NbS, ecosystem conservation or restoration projects for water security. The handbook through its seven chapters and three appendixes offers:

- **A step by step guide** for developing the NbS business case: how to choose a mode of governance for the project, a funding strategy, a financing strategy and a procurement strategy (Chapter 1)
- **A project preparation facility toolbox** with a compendium of all the analysis grid, checklist, methods to prepare in a collaborative way NbS projects and design a complete project preparation roadmap (chapters 1 and 3); starting with an intake assessment form (Appendix A) and in some cases requiring the development or further detailing of the NbS strategy through a strategic planning process (chapter 2), and including collaborative modelling protocols to guide the design of stakeholder engagement workshops.
- An **analysis of barriers** for public and private investment in NbS, of the specificities of NbS project and the bankability implications of building with nature (Chapter 4).
- **Illustration and inspiration** from three of H2020 NAIAD demo cases in the EU and one demo case in Indonesia from the Water as Leverage programme (Chapter 5), as well from pioneering and successful NbS implementation arrangements worldwide (Chapter 6)
- More generally, it offers a sound basis for capacity building in developing an investment plan.

More detailed instructions on how to read and navigate the handbook, as well as the what, for whom, why and how the Financing Framework for Water Security and related project preparation guidelines work are presented in the Easy Guide.

The future is in mosaic projects: need for innovation in procurement and contracting practices

The future is in mosaic projects, and their implementation requires innovative contracting practices. As concluded during the recent Environmental Market and Finance Summit: “Over and over, asset managers and market service providers told us that they are redesigning projects that can responsively serve multiple markets, depending on where the demand is. This allows them to stack funding from multiple sources: carbon offsets, sustainable forestry, water quality credits, recreational use payments, wetland and habitat mitigation, and other revenue streams.” Additionally, in a recent market sounding research process undertaken by Deltares in Peru, in cooperation with the Natural Infrastructure for Water Security (NIWS) project it was found that hybrid infrastructure projects are more attractive to project developers than green infrastructure projects alone.

That is why a central element in the FFWS is the development of hybrid infrastructure clusters. These are organized into hybrid multipurpose infrastructure projects and formal performance-based contracts that can be funded by different revenue streams; depending on local institutional conditions and context-specific preferences and the willingness to pay of beneficiaries.

However, the contracting of multiple services by different authorities and blending of funds from the public and the private sector that benefit from these services requires the development of new public procurement and contracting practices that can deal with this complexity. In the first instance, it requires clarification and agreements on a hierarchy of functions and associated levels of service that enable the making of trade-offs during the whole life cycle of green infrastructure: design, construction, operation and maintenance.

Conclusions and recommendations

Through our research and application of these guidelines we found out that:

Firstly, many NbS initiatives are at the project idea level without a clear solution scope. NbS demonstration projects are shaped often as awareness raising projects instead of investment projects. When shaped as investable propositions they could attract funds from either government agencies aiming at reducing a risk, private parties affected by these risks and/or impact investors willing to accept lower returns in exchange for social and environmental impacts. The missing link towards accessing funding and financing for implementation is the investment case. A complete investment case is composed of the five cases: the strategic, economic, commercial, financial and management case.

Secondly, to close the existing implementation gap new partnerships and types of expertise are needed. In the project preparation process it is key to consider the skills and expertise required to undertake with success all the activities involved in delivery a specified level of service – from planning up to decommission- at the lowest possible costs, maximising quality and minimising risks.

Thirdly, to drive implementation at scale mosaic projects hold a great potential and their successful implementation requires innovative contracting practices.

Fourthly, the insurance sector has a key role to play given their in-depth expertise in risk management and the extensive knowledge they have about the value at risk in different geographies. As insurance providers as well as institutional investors, the insurance sector could play an important catalyser role.

Fifthly, for the implementation of NbS at system scale, a new generation of project developers that go beyond conservationist organisations is required. The construction sector has the potential to play an important role in this new market. Traditional grey infrastructure project developers are crucial to the process of structuring bankable green/hybrid infrastructure projects and making green infrastructure suitable for performance-based contracting. Also, the latest advances of the industry in digitalising assets (e.g. BIM) and entire cities to improve asset management, are an unprecedented source of

data for the modelling of water risks and alternative risk management strategies.

Considering these findings, we recommend that future research programmes funded by the EC stimulate the creation of consortia with a different mix of expertise and roles. A different set of requirements and Key Performance Indicators for the evaluation of the new generation of mission driven research projects could speed up this process. A different composition of the implementing consortia, with higher presence of the private sector, the construction and insurance and financial sector could contribute significantly to the applicability of the knowledge and evidence developed in these research projects.

We have also developed a series of practical recommendations for NbS proponents and policy recommendations:

Practical recommendations for NbS proponents

1. The missing link: a complete business case

For programmes and projects to access funding and financing is necessary to develop a complete business case for the investment programme and each of the projects or cluster of projects that make part of it. Unfortunately, in most cases the proponents of NbS are organisations with an advocacy or scientific background with limited involvement in public and private investment planning processes. As a result, often NbS pilots and demonstration projects are shaped as awareness raising projects instead of investment projects. When shaped as investable propositions they could attract funds from either a public agency aiming at reducing a risk, a private company affected by these risks or an impact investor willing to accept lower returns in exchange for social and environmental impacts.

The criteria and level of detailing regarding implementation costs and risks differ greatly between the project descriptions of NbS proponents and the requirements for allocation of public funding or granting of loans by impact investors. What many NbS proponents consider a project, within investment cycles is often seen as a project idea but not yet an investment project. For this project idea to become an investment project that can be assessed for bankability and/or investability, many much more details and evidence needs to be gathered and more clarity needs to be achieved regarding the way NbS proposed will be implemented.

2. New partnerships and expertise required

In order to ensure a successful implementation of NbS as well as to guarantee stable levels of service over time; it is key to consider not only lifecycle costs and their distribution over time but even more the skills and expertise required to undertake the activities. Based on an identification of key implementation resources held by different actors, activities and risks can be assigned in such a way that the project can be delivered at the lowest costs, the highest quality while minimising risks. By considering these aspects, the implementing agencies can be guided in their choices of who should take care of which life cycle phases of the project. In other words, this understanding of cost elements and cost drivers can guide the process of allocation of risks, responsibilities and rewards between the key implementing actors that could be either from the public sector, the private sector or the community.

An in-depth analysis of the strengths of Public, Private, People actors is required to guide this risk allocation decision. Given the differences in implementation arrangements and actors between NbS and grey infrastructure up until recently, to find suitable implementing parties for large scale NbS projects may prove challenging.

3. Mosaic projects and the need for innovative contracting practices

Mosaic projects hold a great potential to drive implementation of NbS at system scale. Their successful implementation requires innovative contracting practices. The contracting of multiple services by different authorities, as well as blending funds from the public and private sectors that benefit from

these services, requires the development of new public procurement and contracting practices. We need contractual and financial mechanisms that can deal with this complexity. To that end, we need to clarify and agree on a hierarchy of functions and associated levels of services that enable suitable trade-offs during the complete life cycle of NbS: design, construction, operation and maintenance.

Mosaic project

Mosaic projects are projects that serve multiple markets, depending on where the demand is. This allows for the stacking of funding from multiple sources: carbon offset, sustainable forestry, water quality credits, recreational use payments, wetland and habitat mitigation, and other revenue streams. (Environmental Market and Finance Summit, 2019)

4. Pitfalls to be avoided

Three pitfalls that should be avoided, common in the stakeholder engagement protocol of many adaptive planning processes are:

- Single focus on authority when identifying stakeholders. This only gets you as far as the planning phase. We recommend the consideration of all resources required during the entire life cycle of the NbS asset, including expertise, money and networks.
- Assume subsidies and grants as the main source of capital, instead of only one of several sources of financing serving a catalytic role. A blended finance approach is recommended.
- Consider the private sector solely as a source of capital and involve them too late. Often private sector expertise and incentive structure is overlooked, while this is their greatest asset and one that enables them to make significant contribution to efficiency gains and sustainability in service delivery. Early private sector involvement is highly recommended to improve the quality and economic viability of the resulting preferred strategy.

Policy recommendations

1. The role of the insurance sector

The insurance sector has a crucial role to play given their in-depth expertise in risk management and the extensive knowledge they have of value at risk in different geographies. They could play a catalyser role and drive the implementation of hybrid infrastructure strategies by:

- a. Implementing risk-based premium based on models that consider the resilience dividends of ecosystems,
- b. Requiring minimum resilience standards and consideration of climate and water risks from the projects they finance as institutional investors and
- c. Offering new insurance schemes and products that allow for the monetisation of the resilience dividends of ecosystems.

An example of the latter is the parametric insurance policy to cover Mexico coral reef, developed through a cooperation between the state government of Quintana Roo, the tourism industry, TNC and SwissRe.

The first step insurance companies could take in supporting the development of transformational investment pipelines is by sharing their data on historic losses and damage with municipalities (i.e. *Finance Norway example*) and their expertise. By leading the discussion and development of catastrophic models that consider the effect of ecosystems in systemic resilience, they could motivate investors to look at the portfolio in a systemic way.

2. The role of the construction industry

For the implementation of NbS at system scale, a new generation of project developers that go beyond conservationist organisations is required. The construction sector has the potential to play an important role in this new market. Traditional grey infrastructure project developers are crucial to the process of structuring bankable green/hybrid infrastructure projects and making green infrastructure suitable for performance-based contracting. Also, the latest advances of the industry in digitalising assets (e.g. BIM) and entire cities to improve asset management, are an unprecedented source of data for the modelling of water risks and alternative risk management strategies (Altamirano, 2019).

3. Design of NbS Research Programmes

Considering these findings, we recommend that future research programmes funded by the EC stimulate the creation of consortia with a different mix of expertise and roles. A different set of requirements and Key Performance Indicators for the evaluation of the new generation of mission driven research projects could speed up this process. A different composition of the implementing consortia, with higher presence of the private sector, the construction and insurance and financial sector could contribute significantly to the applicability of the knowledge and evidence developed in these research projects. Along with a different mix of expertise in the consortia, it is important that the right type of coaching is given to the leaders of demonstration cases. Coaching that enables demonstration cases to achieve not only benefits in terms of awareness raising but to serve truly as pilots to validate the investability and bankability of NbS projects.

The new type of mission-driven research programmes aimed at implementation of NbS at scale to deal with climate and water risks, would benefit from the inclusion of additional mechanisms that increase accountability and leverage greater impact of research efforts. These mechanisms could include the setting up of advisory boards or users board for clusters of projects where key representatives from public procurement authorities, banks, impact investors and companies are represented and can give binding feedback about the knowledge and evidence being developed from early on in the project.

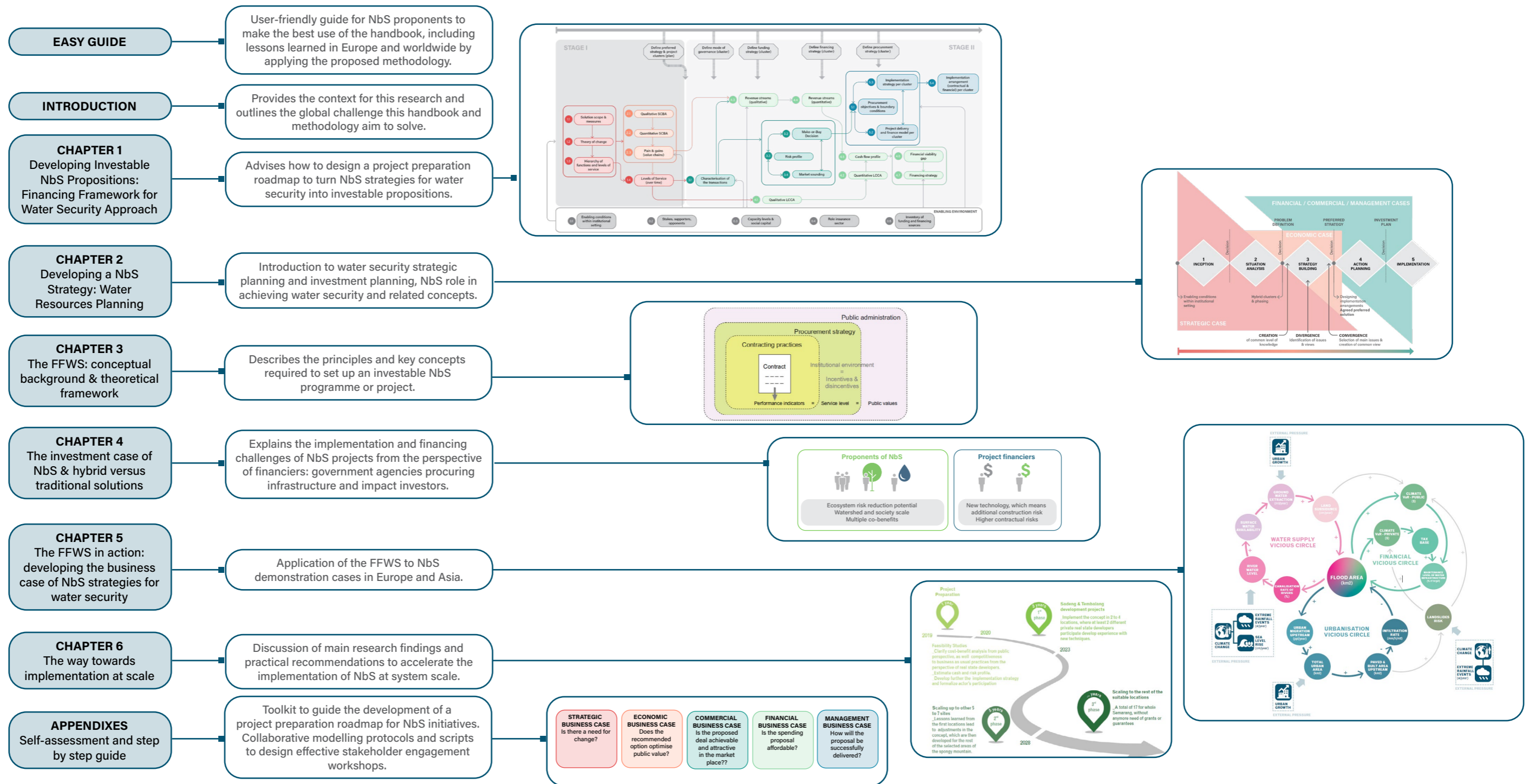
4. Closing the gap from two ends: project proponents and project sponsors

In the one hand, national public investments systems and procurement processes also need to be reconsidered and adjusted to accommodate the specific characteristics of NbS and hybrid infrastructure projects versus traditional only grey infrastructure. On the other hand, the proponents of NbS need to develop additional project preparation skills, work on building the required evidence and ultimately shape these projects differently to fulfil minimum requirements that back up the investment of scarce public resources and/or secure the minimum returns expected by private investors.

Public-Private-Science collaboration is also crucial to develop shared understanding of the mechanisms driving project risks and returns. This **revolution in understanding** could then inform a new generation of **planning**, project origination, project preparation and procurement tools and models that guide the selection of the most transformative and effective infrastructure investments. These decision support systems for a new type of planning together with the introduction of new disclosure requirements for the financial sector as the ones introduced by the The Task Force on Climate-related Financial Disclosures (TCFD) can enable the third required revolution: a **revolution in financing**.

How to read this handbook

The handbook includes an Easy Guide to start with, followed by a brief introduction, six chapters and appendixes.



Although many of the chapters could be read on their own and will make sense to anyone with a basic knowledge of NbS and/or project finance, this handbook intends to offer a comprehensive guide for project preparation and convey a sense of the overall process and learning involved in turning an NbS project idea into an investable proposition. We recommend starting the reading with the Easy Guide, the introduction and Chapter 1. Then, based on the interests of the reader, their level of knowledge of NbS, project preparation and/or water resources planning, proceed to read specific parts of this handbook and start making use of the formats for self-assessment and application of the guidelines presented in Appendix A, B and C.

The **Easy Guide** presents detailed instructions on how to read and navigate the handbook, as well as the what, for whom, why and how the Financing Framework for Water Security and related project preparation guidelines work. Towards the end of the Easy Guide, we provide an overview of the lessons learned in Europe and worldwide by applying the proposed methodology and recommendations to accelerate implementation at scale, including the role of the insurance sector.

The **Introduction** provides the context for this research and outlines the global challenge this handbook and methodology aim to solve.

Chapter 1 presents the basic methodological elements of the Financing Framework for Water Security (FFWS) approach and the stepwise approach to shaping NbS strategies for water security into investable propositions. Accordingly, the chapter includes:

- FFWS overall framework and process explained in a nutshell
- Explanation of the five cases required to make the investment case for water security strategies, including specific questions and reference the supporting formats to address them presented in the appendixes A, B and C.
- The FFWS process step by step. It illustrates how specific analytical and collaborative modelling activities supported by a number of formats and scripts presented the appendixes should be deployed as a process to build the evidence for the five business cases while developing an implementation arrangement for the NbS strategy.
- Guidance on how to design the overall process and to define the starting point for a particular NbS proponent and/or strategy, including how to combine desk research, internal project team meetings and stakeholder workshops making use of collaborative modelling protocols.

For the effective design of implementation arrangements for NbS strategies for water security or the “how”, it is crucial to develop a clear understanding of what NbS strategies for water security are. Implementation choices can only be made, based on sound understanding of the transaction or project being proposed. In other words, the “what” or more specifically so-called “preferred strategy” to achieve water security needs to be defined first. Accordingly, **Chapter 2** presents the planning process involved in developing a water security strategy and explains the role of NbS in achieving water security. The chapter also introduces key concepts regarding water security, Integrated Water Resources Management (IWRM), river basin planning and NbS, Natural Assurance Schemes (NAS) and clarify their relationship.

Chapter 3 is intended for readers less familiar with institutional economics, project finance, engineering design theory and public procurement and investment planning processes in general. The main objective of this section is to introduce these users to the theoretical framework and conceptual background on which the FFWS is based and in general increase understanding of the key elements required to set up a project in a way that is financially sustainable.

Chapter 4 presents the additional financing challenges faced by NbS projects given their innovative nature and considering the requirements of public procurement authorities as well as the expectations of private investors. In this section the specificities of NbS and green infrastructure from a project

finance and asset management perspective are presented and the divide between how NbS are assessed by their proponents (e.g. ecologists, biologists and/or eco-engineers) versus by the project finance and infrastructure community at large is explained. This chapters therefore could either serve infrastructure project developers wanting to understand NbS and green infrastructure assets; as well as by NbS proponents aiming to understand the Infrastructure Asset Management lens.

Chapter 5 illustrates the use of these guidelines in three of H2020 NAIAD demo cases in Europe and one demo case in Indonesia within the Water as Leverage programme. The process and results from the full implementation of these project preparation guidelines in four cases and its light implementation in all nine NAIAD demo's to develop a roadmap towards implementation of NbS at scale beyond the project are presented in this chapter. The first section of the chapter presents the three demonstration cases in Europe are: a) *Micro Urban Wetlands (MUW) for flood management in the city of Rotterdam*, the Netherlands ; b) *large scale groundwater-related ecosystem services in Medina del Campo*, Spain, for drought risk management and c) *wetlands restoration for flood risk management in the Lower Danube* in Romania. The second section presents results from the assessment of the NbS strategy's strengths and weaknesses in terms of bankability and maturity of the investment case of their programme or project. It also covers the practical next steps towards upscaling of NbS in the city of Lodz, the demo cases of La Brague and Thames basins.

To finalise the third and last section of this chapter presents the results of the application of the FFWS in the city of Semarang, in Indonesia. This has been one of the most comprehensive application worldwide of the FFWS approach as it took place in the context of an innovative urban resilience strategic planning process, counted with the extensive support of a large consortium of local partners, international pioneering urban design, planning and engineering firms and the continuous feedback of multilateral development banks. This application took place as part of the Water as Leverage for Resilient Asian Cities program funded by Government of the Netherlands in partnership with the Asian Infrastructure Investment Bank, the Global Centre on Adaptation and 100 Resilient Cities.

Water as Leverage for Resilient Cities Asia programme

Initiative of the Dutch government in cooperation with the Asian Infrastructure Investment Bank (AIIB), the Dutch Development Bank FMO, 100ResilientCities, Partners for Resilience, Architecture Workroom Brussels, International Architecture Biennale Rotterdam and the Global Center on Adaptation.

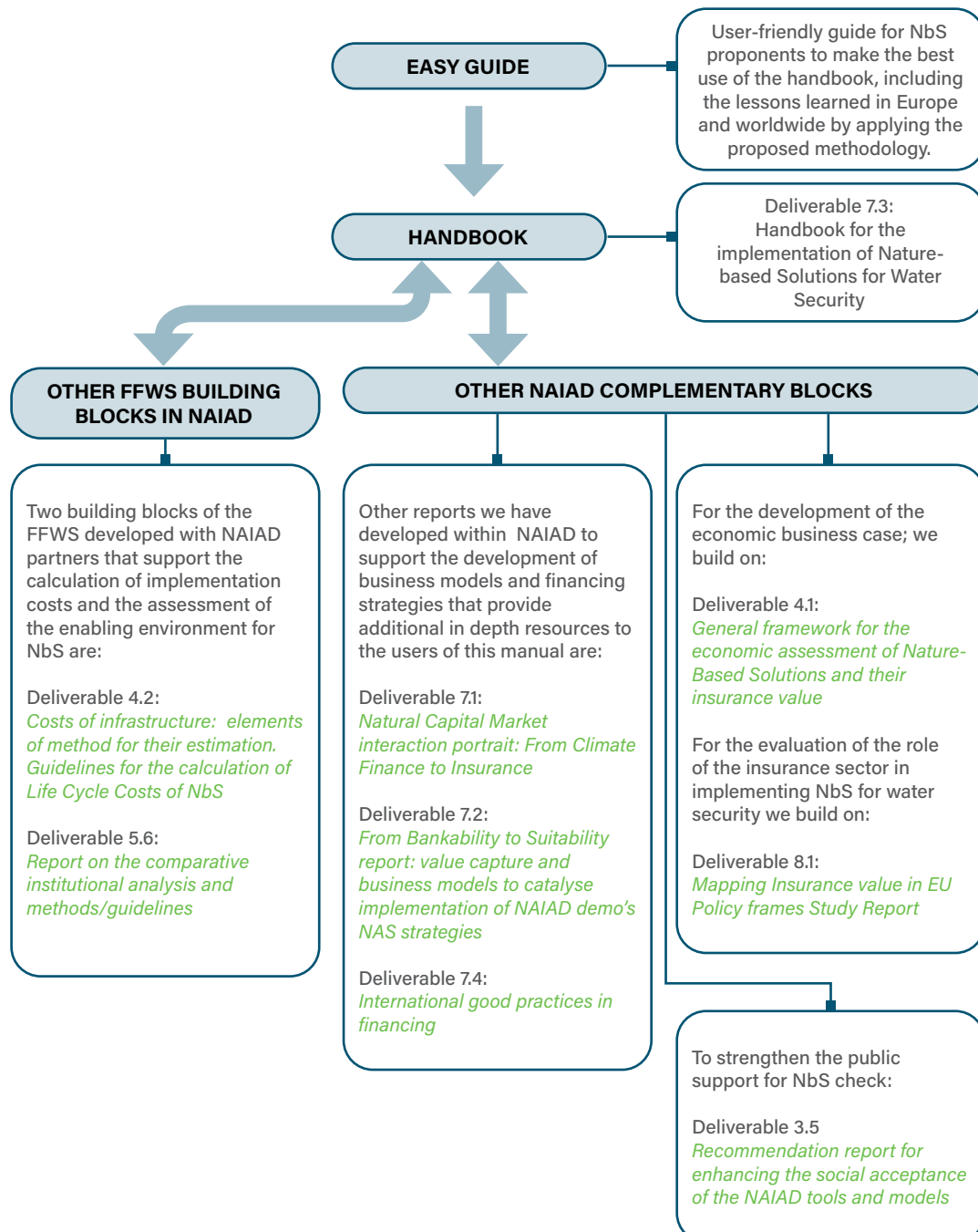
In addition to these results the handbook presents pioneer examples of implementation and financing arrangements from around the world in **Chapter 5**. Implementation arrangements that proved successful in achieving the implementation of NbS at scale, financial sustainability over the whole lifecycle of the NbS asset and therefore also sustainability in the provision of key water and ecosystem services for water security. This chapter presents examples per each of the four families of implementation arrangement: public procurement contracts, privately driven water stewardship investments, investment funds or collective investment schemes and ecosystem markets.

The handbook main body finalizes with **Chapter 6**, presenting the conclusions and recommendations to move ahead towards of NbS implementation at scale for water security in Europe.

Appendix A presents the complete bankability assessment intake form. **Appendix B** presents a step by step guide to design of the project preparation roadmap, all the formats including collaborative modelling protocols that can be used to develop the business case iteratively, through desk research, project team meetings and/or stakeholders' workshops. Finally, in **Appendix C** the FFWS institutional characterization format is presented and illustrated for the French demo site is the catchment of the Brague River where NbS are being considered for reduction of torrential floods in a quite urbanized area.

Additional material

This handbook (D7.3 of NAIAD) presents the core of the Financing Framework for Water Security (FFWS) methodology to develop the investment case of Nature-based Solutions (NbS) for water security. Complementary and related building blocks can be found in previous NAIAD deliverables. The added value of these deliverables to the development of the investment case is presented graphically below.



An overview of the NAIAD deliverables is available in <http://naiad2020.eu/media-center/project-public-deliverables/>

Easy Guide

For whom

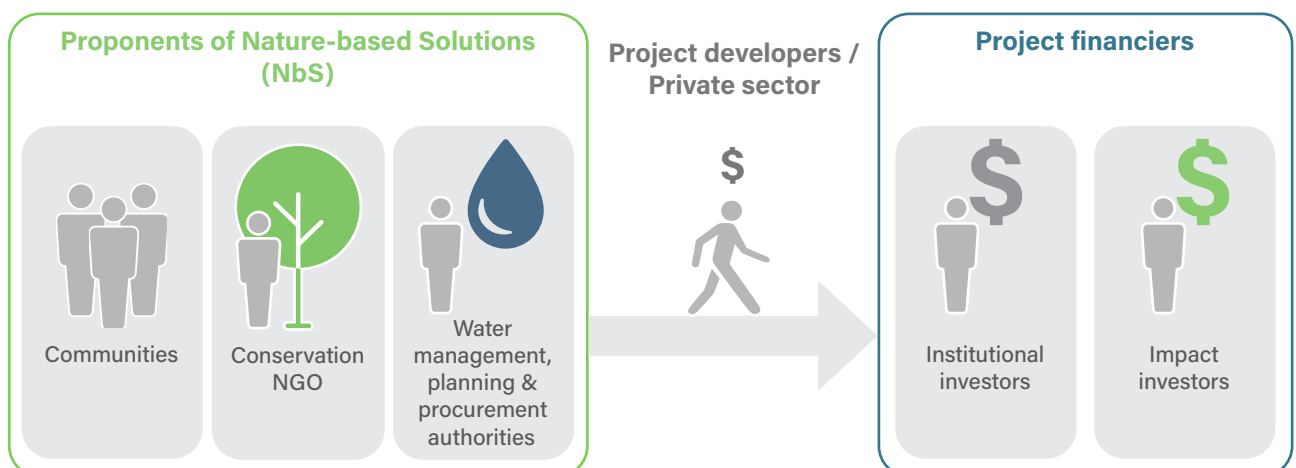
This handbook is intended for proponents of Nature-based Solutions (NbS) in general, acknowledging that these could come from very different backgrounds and groups. They could be either communities, environmental non-governmental organisations (NGO); as well as water management, planning and procurement authorities aiming at increasing the resilience of their communities through the implementation of NbS. Therefore, it has been written in a modular manner having in mind different levels of familiarity with project preparation: project finance, institutional economics, economics of infrastructures, public procurement and investment planning processes in general. This easy guide gives an overall introduction and will enable users with different backgrounds facing specific NbS implementation challenges to decide which sections would be most relevant for them.

Experience users, such as the ones from the financial and insurance sectors should start with **Chapter 1** and then **Chapter 4**, which present the basic concepts of water security planning and the specific characteristics of NbS versus traditional grey infrastructure investments.

Users with limited knowledge on project preparation and financial structuring are advised to first become familiarised with the concepts presented in **Chapter 3**. If you are unsure, **Appendix A** provides a complete overview to help you decide.

Nature-based Solutions (NbS)

“Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits” (IUCN)



What

This handbook outlines the project preparation process proposed by the Financing Framework for Water Security (FFWS). It presents in detail the analytical and collaborative modelling steps and activities required to develop a robust investment case for NbS strategies for water security, by developing in parallel a fit for purpose implementation arrangement. The design of an implementation arrangement includes the choice of a governance mode a funding, financing and procurement strategies for the project and/or clusters of projects that conform the NbS water security strategy.

Financing Framework for Water Security (FFWS)

Methodology to strengthen water resources and climate adaptation planning processes to bridge the gap between strategic planning and investment planning. It offers a set of guidelines to governments, private sector or communities to design an implementation arrangement for their preferred solutions and strategies. It was developed by Deltares and applied in several contexts, such as the Jalaur River basin in Philippines, the city of Semarang in Indonesia, Oaxaca City, Mexico, Guayaquil, Ecuador, and through the NAIAD project in three locations in Europe: Spain, Romania and the Netherlands.

Cluster

Combination of projects that can be tendered and/or implemented together. The rationale to propose cluster-based financing builds on the following reasons:

- System approach - Biophysical dependencies
- Potential economies of scale and scope
- Conditional access to finance
- Risk / resilience profile

The handbook includes a toolkit with detailed guidelines and formats to guide the design of the complete project preparation roadmap and the design of collaborative modelling workshops with stakeholders (Appendix). The project preparation process guides NbS proponents in designing a fit for purpose implementation arrangement. In doing so they also gather the required evidence to make the investment case for a public and/or private investments. The investment case includes five cases: the strategic, economic, commercial, financial and management cases.

Following this systemic process NbS proponents can mature a project idea into an investable proposition for public or private investors.

We expect that if NbS proponents have a more developed investment case – including an estimated cash and risk profile of the projects- and a sound implementation strategy, it will become much easier for them to engage with public or private project sponsors into the further preparation of the project until financial close.

Why

“Climate change is one of the greatest threats facing humanity, with far-reaching and devastating impacts on people, the environment and the economy... We need three revolutions for a better future: a revolution in understanding, a revolution in planning and a revolution in finance” (Global Commission on Adaptation, 2019)

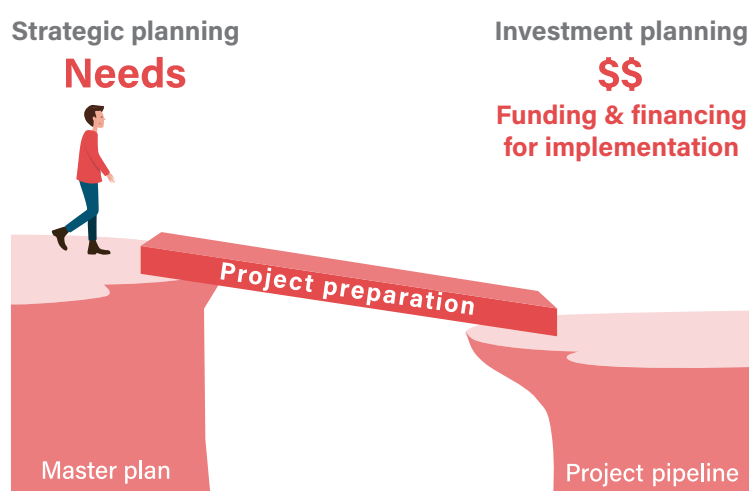
In the context of a climate and water crisis, the awareness about the need to change our economic development has increased. In this same context, the potential of NbS as pillars of this new model of

economic growth and as an important allied to mitigate water risks is being increasingly recognised. NbS not only contribute to mitigate water risks, but they also address societal challenges thanks to the multiple co-benefits they provide. They can be implemented at several scales, either by themselves or in combination with traditional (grey) infrastructure, which constitute a hybrid solution. Both NbS and hybrid solutions are more adaptive to future changes in climate and to climate variability than grey infrastructure alone. They also contribute to improve the resilience of our economies and cities as hotspots for development.

Hybrid solutions

Are a combination of a Nature-based Solution (NbS) and traditional (grey) infrastructure.

Unfortunately, the implementation of NbS at system scale remains a challenge. In the one hand, most NbS projects are being implemented as pilot projects of limited size and following parallel processes from mainstream procurement practices. On the other hand, we have Integrated Water Resources Management plans and water security strategies for cities at watershed or system scale that propose a synergetic combination of non-structural measures, green and grey infrastructure that seldom are implemented. In both cases the missing link is the translation of these plans or pilots into a clear and phased investment plan or pipeline of deals that convince public or private sponsors and financiers. This challenge is what we call the implementation gap. The FFWS aims to close this gap by creating a methodological interface between the project delivery and finance community, and the water resources planning and watershed conservation communities.



There are important evidence and knowledge gaps to make the investment case for NbS programmes and projects at the scale required to significantly change our development paradigm. The three most important gaps are: their expected cash flow and risk profiles and the levels of service they can provide over time.

Structuring investable NbS and hybrid deals: NbS versus grey infrastructure

Multiple factors slow down the rate of adoption of NbS for water security. Some of the more often cited are uncertain performance, higher risk – both real and perceived - and an unattractive cash profile of NbS projects. However, the most fundamental challenge is that public and private investment processes are geared towards grey infrastructure projects as investment units. Consequently they do not fit the characteristics of NbS investments. The way NbS strategies are seen by their proponents versus financiers and project developers, create an important divide in language and interests. The criteria they both apply to judge the potential of NbS and hybrid solutions versus grey infrastructure strategies are fundamentally different.

Key differences between NbS and grey infrastructure projects that need to be dealt with in the development of an implementation strategy are:

1. Cost-effectiveness. A key methodological aspect to be considered for the calculation of the Lifecycle Cost (LCC) and a proper comparison of NbS versus grey solutions is that *“green infrastructure design and performance is generally more context-specific than grey infrastructure. This difference translates on the one hand in greater complexity and uncertainty in ex-ante cost estimations and cash profile of NbS projects, while in the other hand also often on a greater value as they may address local concerns and values.”* (Altamirano and de Rijke, 2017)

Lifecycle Cost (LCC):

The total cost of an asset throughout its life including planning, design, construction, acquisition, operation, maintenance, rehabilitation and disposal costs.

2. Cash flow and risk profiles. The long-term operation and maintenance costs of NbS are expected to be lower compared to grey solutions, due to the adaptive and regenerating capacities of ecosystems. Nonetheless, NbS have unique financing challenges inherent to their cash profile and risk profiles. Benefits are often unique, delayed, dispersed, non-guaranteed and non-financial, complicating the estimation of an Internal Rate of Return (IRR). In general, capital expenditure of NbS is often spread over a longer term, in comparison to grey solutions. Often NbS show a distinct cashflow than grey infrastructure. They have a lower ratio between capital expenses (CAPEX) and operational expenses (OPEX) that them more difficult to finance through project finance. This is often related to the longer time NbS projects take to achieve full functionality. Total Costs of Ownership (TCO) are expected to be lower for NbS versus grey infrastructure in the long term and that strengthen their cost-effectiveness. However, a higher perceived risk results in higher costs of capital and a higher risk premium to be charged by project developers, ultimately making NbS projects more expensive than necessary.

Project finance

Is the financing of long-term infrastructure, industrial projects, and public services using a non-recourse or limited recourse financial structure. The debt and equity used to finance the project are paid back from the cash flow generated by the project. Project financing is a loan structure that relies primarily on the project's cash flow for repayment, with the project's assets, rights, and interests held as secondary collateral.

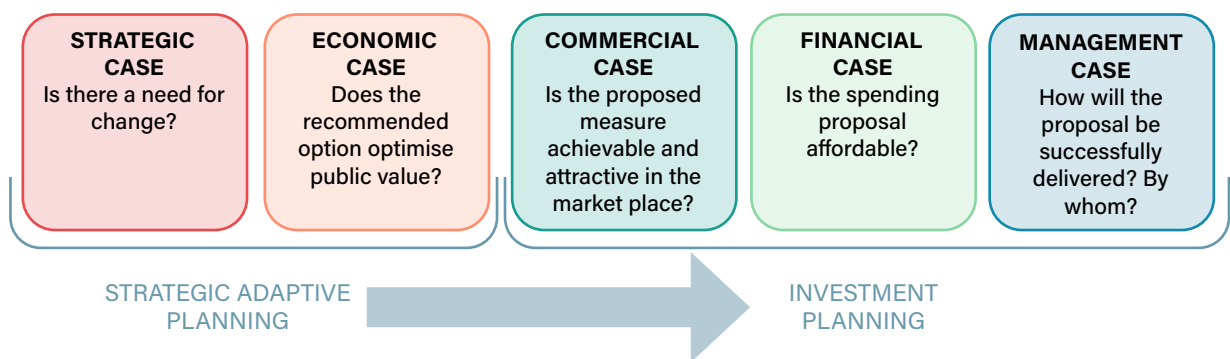
The proponents of NbS build the investment case on their capacity to fulfil multiple functions and to generate multiple co-benefits. This characteristic improves their cost-effectiveness and ideally lead to multiple sources of funding. However, in practice, many of these co-benefits do not translate into revenue streams. Multiple functions can however also translate into projects that need to contract by multiple principals (public and/or private project sponsors) and as there may be trade-offs between these functions this could easily translate into significant contractual risks, during construction and operation of these projects.

How

This handbook will allow the user to increase the chances of successful implementation of NbS programs or projects, by bridging the existing gap between the strategic and adaptive planning phase and the investment planning one. NbS proponents will benefit from the techniques described in this handbook and the lessons learned from the demonstration cases.

From Strategic Adaptive Planning towards Investment Planning for water security

For plans and projects to be able to access funds the case for investment needs to be made. One needs to justify how an investment in the proposed NbS project or programme optimises the use of scarce public or private fund to generate what is called Value for Money (VfM). The investment case includes the strategic, economic, commercial, financial and management cases. The FFWS contributes to this goal by setting in motion a project preparation process that creates a bridge between the strategic adaptive planning phase and the investment planning one. Within the former the strategic and economic cases for an investment are developed and within the latter, the commercial, financial and management cases.



The FFWS also enables a process of transdisciplinary collaboration. A process that involves all the relevant public, private and community actors that are key for successful implementation and support the translation of strategic plans into clearly phased NbS and hybrid infrastructure clusters. Project clusters structured enough to be absorbed by formal public investment planning processes and translated into several financially viable or even bankable deals, making use of a blended finance approach (Altamirano, 2019).

Developing the investment case: project preparation stages

Our approach proposes a twofold process to structure NbS investment projects based on the development of five business cases:

Stage I: Strategic and economic cases

By zooming out and placing the NbS project into a larger economic development context, the chances and venues for its implementation and financing are expanded. The objective is to strengthen the strategic and economic case of the NbS programme by engaging actively outside the water or environment sectors to develop a shared vision, an explicit theory of change and an assessment of their strategic fit. We advanced on awareness and recognition of ecosystems as critical infrastructure and NbS as pillars of new sustainable and resilient economic development paradigm and political support are advanced through the development of this shared narrative.

This process increases the chances of generating additional sources of funding from multiple economic sectors as well as sources of revenues from multiple beneficiaries of the ecosystem services generated. The envisioned result are strategic investment pathways defining several clearly phased hybrid infrastructure clusters which are then to be further specified in stage II.

Stage II: Commercial, financial and management cases

By zooming in on specific NbS deals or hybrid cluster of projects (that make part of a larger NbS programme and strategy) and developing sound contractual and management strategies that minimize implementation and transaction costs, the bankability of these multifunctional projects

is improved. This is done by designing a fit for purpose implementation arrangement, defining a governance structure and a coherent set of contractual and financial mechanisms that departing from a clear hierarchy of functions and levels services to be provided allocates risks and responsibilities to the parties best able to carry them and creates greater alignment between the incentives of multiple -public-private and community - actors to aim together for sustainability in service provision.

Designing an implementation arrangement

A fundamental element for the development of these five cases is the design of a suitable implementation arrangement for each NbS water security project or cluster of projects. The process of designing a fit for purpose implementation arrangement requires the following:

- **Characterise the transaction**, in terms of the technical and financial characteristics of the project and asset created and the type of economic good provided by the asset created by the investment
- State explicitly the **level of service** required over time

Level of service (LoS):

The defined service quality for a particular activity or service area against which service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental acceptability and cost. E.g. the quality of the flood mitigation service provided by an urban forest by storing rainfall. If we compare an urban forest when it is first implemented versus 15 years after, when the trees are adults, the quality of the service provided by the latter will be better.

- Assessing the **enabling environment** by analysing the institutional setting. Among others, this includes (a) stakeholder analysis, mapping the interests, resources and capabilities of stakeholders that drive or hinder implementation; and (b) analysis of incentives and disincentives created by different layers of formal and informal institutions are considered, including the ones created by national insurance systems.

The FFWS guides NbS proponents in a process of selection and design of an implementation arrangement. By considering the transaction or project characteristics, the level of service required over time and the institutional setting, they can come to a shortlist of most effective implementation arrangements. Guided by key questions and a repository of good practices worldwide, the proponents of hybrid solutions can choose from a wide range of project delivery and finance options. This range varies from purely public governance options up to the creation of regulated markets for private initiatives and innovative business models to emerge. This process enables them to continuously develop the evidence for the five cases iteratively.

The design of an implementation arrangement involves four decisions:

- **Define a mode of governance.** Define the main services the project will create, categorise these in types of economic goods, which will lead to the selection of the mode of governance. The services that the asset created by the investment project will provide are categorised and not necessarily the asset itself. For example, a forest may give services that can be considered private, yet the forest itself may be a public good and remain in public hands. This categorisation will then help us to define which types of funding could be appropriate to ensure cost recovery.

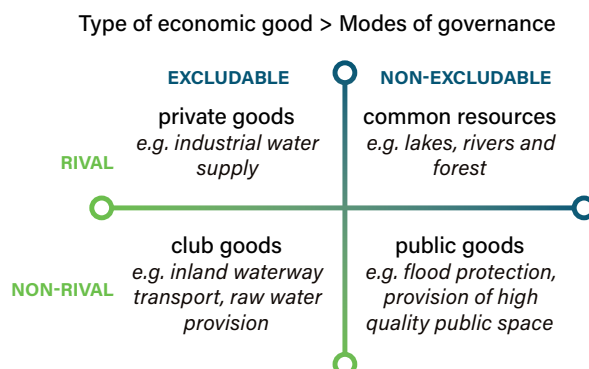
Modes of governance / Families of implementation arrangement

1. Public procurement
2. Private water stewardship
3. Collective watershed investment vehicles
4. Environmental markets

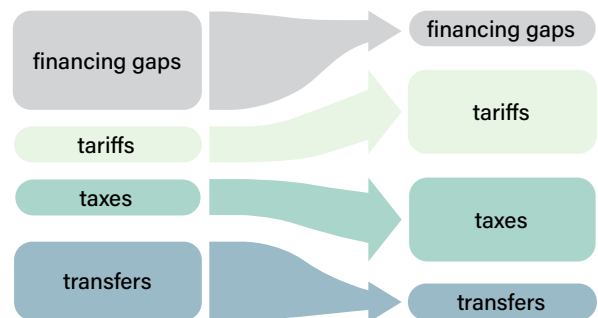
- **Define a funding strategy.** The funding of a project could be either public or private. In general terms the main sources of funding are what the OECD calls the 3 T's: Taxes, Tariffs or Transfers. Funding refers to the question of who ultimately will pay for the investments made. The two main options are taxpayers or users.
- **Define a financing strategy.** Depending on the type of project and whether the project sponsor is public or private, a variety of financing instruments could be used to mustering the up-front resources needed. These are to be repaid by the funding over time.
- **Define a procurement strategy.** Refers to the way in which the project sponsor – a government agency or private actor – responsible for the project can choose to make use or purchase the project. The figure on the right applies mainly to NbS or water security measures that have the characteristic of a capital project. This means that the project is capital intensive and through it an asset with a long lifecycle is created. Given the choice to delegate to a third party, the project sponsor can tender it as a fully integrated contract – covering multiple life cycle phases- or choose to assign different phases and activities to different parties.

These decisions guide the project preparation process and enable the development of the five business cases per cluster of projects.

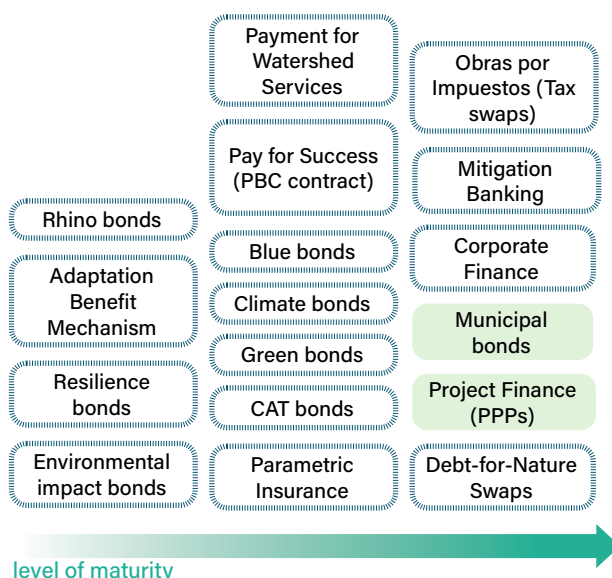
DEFINE A MODE OF GOVERNANCE PER CLUSTER



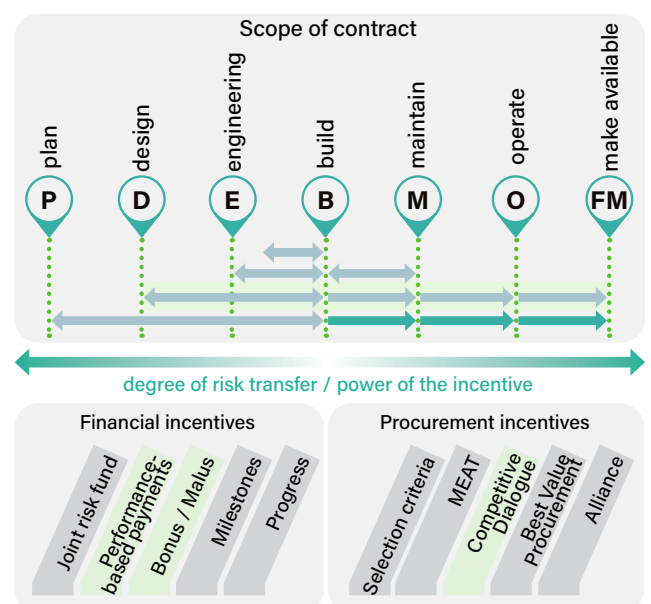
DEFINE A FUNDING STRATEGY PER CLUSTER



DEFINE A FINANCING STRATEGY PER CLUSTER



DEFINE A PROCUREMENT STRATEGY PER CLUSTER





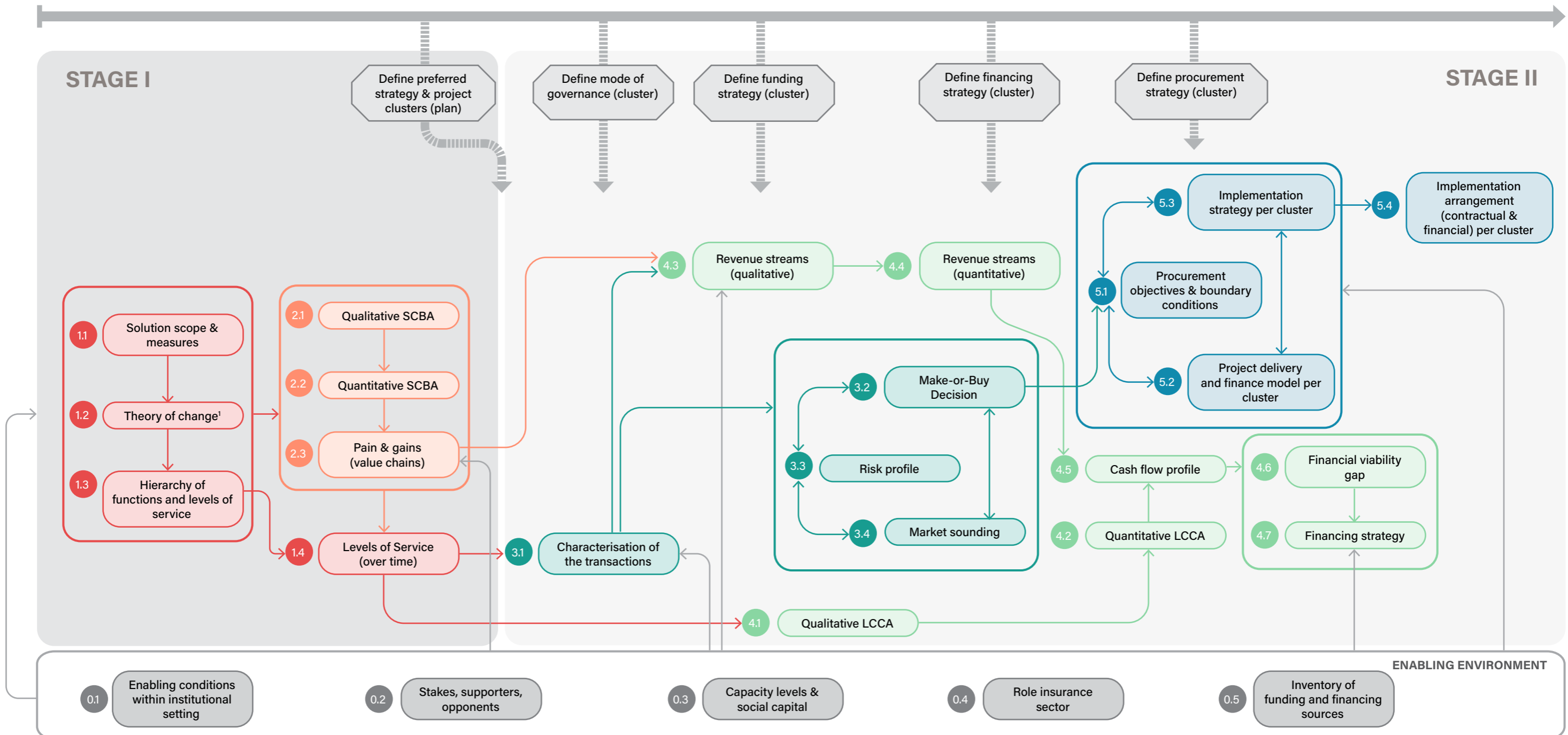
Roadmap

The handbook offers comprehensive guidelines including an auto diagnostic questionnaire and several collaborative modelling scripts and formats per module. These elements support the development of a roadmap tailored to the specific needs of the users as well as the design of effective stakeholder engagement workshops. Each module could be completed either based on internal project team meetings and desk research or on collaborative modelling workshops that engage a wider set of stakeholders. The entire project preparation process is graphically represented below, including the building blocks for an implementation arrangement, the business cases, and the project preparation stages.



SCBA: Social Cost-benefit Analysis
 LCCA: Lifecycle Cost Analysis

¹Ecosystem as building block of a new paradigm for economic development.



Validation

The FFWS approach and detailed formats and collaborative modelling session scripts presented in this handbook were used by demo leaders and tested in three H2020 project NAIAD demonstration cases, as well as in other cases worldwide. The investment case evidence collected and implementation choices they made based on this application are presented in **Chapter 5**.

Both the validity of the FFWS methodology and the typology of implementation arrangements for NbS developed as part of this research have also been tested by documenting and analysing successful implementation arrangements worldwide through the same theoretical and methodological lens. This analysis allowed us to validate the key assumptions and principles of the FFWS, comparing them to the lessons learned in NbS projects implemented and in operation for a reasonable amount of time. These refer most specifically to key success factors and crucial choices for effective NbS project delivery and sustainability in service provision.

Between 2016 and 2020 the FFWS has been continuously developed and successfully implemented by Deltares in seven countries at different scales:

Within Europe as part of the NAIAD project

- a. Micro Urban Wetlands (MUW) for flood management in the *city of Rotterdam, the Netherlands*
- b. Large-scale groundwater-related ecosystem services in *Medina del Campo, Spain*, for drought risk management and
- c. Wetlands restoration for flood risk management in the *Lower Danube in Romania*.

Worldwide

- a. Indonesia: urban resilience strategy for Semarang
- b. Philippines: Jalaur River Basin, IWRM strategy and the Masterplan for the Sustainable Development of Manila Bay
- c. Mexico: urban resilience strategy for Oaxaca
- d. Ecuador: climate adaptation strategy for the city of Guayaquil



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GLOSSARY

ASSET

A physical component of a facility which has value, enables services to be provided and has an economic life of greater than 12 months. Dynamic assets have some moving parts, while passive assets have none.

ASSET CLASS

An asset class is a grouping of investments that exhibit similar characteristics and are subject to the same laws and regulations. Asset classes are made up of instruments which often behave similarly to one another in the marketplace. Historically, the three main asset classes have been equities (stocks), fixed income (bonds), and cash equivalent or money market instruments. However recently most investment professionals include real estate, commodities, futures, other financial derivatives, and even cryptocurrencies in their asset class mix. Investment assets include both tangible and intangible instruments which investors buy and sell to generate additional income on either a short- or a long-term basis.

ASSET MANAGEMENT

The combination of management, financial, economic, engineering and other practices applied to physical assets to provide the required level of service in the most cost-effective manner.

ASSET MANAGEMENT PLAN

A plan developed for the management of one or more infrastructure assets that combines multidisciplinary management techniques (including technical and financial) over the lifecycle of the asset in the most cost-effective

manner to provide a specified level of service. A significant component of the plan is a long-term cash flow projection for the activities.

BENEFIT-COST RATIO (B/C)

The sum of the present value of all benefits (including residual value, if any) over a specified period, or the lifecycle, of the asset or facility, divided by the sum of the present value of all costs.

BEST VALUE FOR MONEY

Best value for money as defined by the UK Department of Finance refers to the most advantageous combination of cost, quality and sustainability to meet customer requirements. Where in this context: a) cost means consideration of the whole life cost, b) quality means meeting a specification which is fit for purpose and sufficient to meet the customer's requirements, and c) sustainability means economic, social and environmental benefits, considered in the business case.

BEST VALUE PROCUREMENT (BVP)

Best value procurement (BVP) is a procurement system that looks at factors other than prices only, such as quality and expertise when selecting vendors or contractors. In the best value system, the value of procured goods or services can be simply described as a comparison of costs and benefits.

BUSINESS-AS-USUAL SCENARIO (BAU)

A scenario for future patterns of activity which assumes that there will be no significant change in people's attitudes and priorities, or no major changes in technology, economics, or policies so

that normal circumstances can be expected to continue unchanged.

BLENDED FINANCE

Strategic use of development finance and philanthropic funds to mobilize private capital flows to emerging and frontier markets by the OECD and the World Economic Forum.

BLOCKCHAIN

A blockchain, originally blockchain, is a growing list of records, called blocks, that are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data (generally represented as a Merkle tree).

By design, a blockchain is resistant to modification of the data. It is "an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way". (<https://en.wikipedia.org/wiki/Blockchain> - cite_note-hbr201701-7) For use as a distributed ledger, a blockchain is typically managed by a peer-to-peer network collectively adhering to a protocol for inter-node communication and validating new blocks. Once recorded, the data in any given block cannot be altered retroactively without the alteration of all subsequent blocks, which requires consensus of the network majority. Although blockchain records are not unalterable, blockchains may be considered secure by design and exemplify a distributed computing system with high Byzantine fault tolerance. Decentralized consensus has therefore been claimed with a blockchain.

CAPITAL EXPENDITURE (CAPEX)

Expenditure used to create new assets or to increase the capacity of existing assets beyond

their original design capacity or service potential. CAPEX increases the value of the asset stock.

CAPITAL PROJECT

A capital project is a long-term, capital-intensive investment project with a purpose to build upon, add to, or improve a capital asset. Capital projects are defined by their large scale and large cost relative to other investments that involve less planning and resources. Capital projects often refer to infrastructure, like roads or railways, or in the case of a corporation, the development of a manufacturing plant or office.

CASH FLOW

The stream of costs and/or benefits over time resulting from a project investment or ownership of the asset.

CONTRACTUAL ARRANGEMENTS

Contractual arrangements are written mutual agreements, enforceable by law, between two or more parties that something shall be done by one or both. There are two major classes of contract which governments use in the management and administration of public forest lands.

Two key types of contracts regarding ecosystems such as forests are **resource utilization contracts** and **procurement contracts**. Resource utilization contracts for forest are also called tenure arrangements, forest **concessions**, forest **management agreements**, etc. Resource utilization contracts govern the rights of owners, users and others over forest land, timber and/or other assets by defining the way forests are held and utilized. They define the rights, duties and responsibilities of the two parties to the contract: the owners of the resource (the government in the case of public forest lands) and the user, the contractor. The rights, duties and responsibilities can vary widely under different forms of contract.

Meanwhile, in **procurement contracts**, or goods and services contracts, governments enter into agreements with other parties to provide goods or services for the management and administration of public forests; for example, for forest inventories, forest management activities, forest certification, tree planting, fire protection, etc.

COOPERATIVES

Cooperatives are people-centred enterprises owned, controlled and run by and for their members to realise their common economic, social, and cultural needs and aspirations. Cooperatives bring people together in a democratic and equal way.

COMPETITIVE DIALOGUE

Competitive dialogue is a way of tendering whereby you enter into a dialogue with several selected market parties. You work together with these parties towards finding the best solution for your organisation. Competition-sensitive information will remain confidential.

CLIMATE SERVICES

Climate services are essential for adaptation to climate variability and change. Climate services provide climate information to help individuals and organizations make climate-smart decisions. A climate service is a decision aide derived from climate information that assists individuals and organizations in society to make improved ex-ante decision-making.

CLUSTER OF PROJECTS

Combination of projects that can be tendered and/or implemented together. The rationale to propose **cluster-based financing and procurement** of water security investments in

builds on the adoption of a system approach that recognizes multiple biophysical and institutional interdependencies between projects. These could be exploited to achieve:

Economies of scale and scope that can be achieved by combining different types of activities

Improved risk and resilience profile thanks to risk diversification and/or consideration of biophysical interdependences and systemic risk levels

Financial viability, some functions can be combined to improve the revenue-generating potential of the project

Access to finance, the inclusion of additional functions could enable the whole project cluster to access different types of finance streams with better conditions. Reduction of transaction costs, there may be rules that grant a specific public organisation the authority to procure two technically different measures. All in all, the objective is to improve the bankability of the project.

CRITICAL INFRASTRUCTURE

Critical infrastructure (or critical national infrastructure (CNI) in the UK) is a term used by governments to describe assets that are essential for the functioning of a society and economy – the infrastructure.

DEAL FLOW

Deal flow is a term used by investment bankers and venture capitalists to describe the rate at which business proposals and investment pitches are being received. Rather than a rigid quantitative measure, the rate of deal flow is somewhat qualitative and is meant to indicate whether business is good or bad. The state of the

economy has a significant influence on the level of deal flow.

DEAL TICKET

A deal ticket, commonly known as a trading ticket, is a record of all the terms, conditions, and basic information of a trade agreement. The creation of a deal ticket comes after the transaction of shares, futures contracts, or other derivatives. Think of a deal ticket as a trading receipt. This receipt tracks the price, the volume of the trade, the names involved in the transaction, and the dates of a deal.

DEBT COVERAGE SERVICE RATIO (DCSR)

The DSCR is the ratio of cash available for debt servicing to interest and principal payments. In the context of project finance, it measures the ability of a project to cover the debt services. If the ratio is below zero, a project may default.

DETERIORATION RATE

The rate at which an asset approaches failure.

DISCOUNTING

A technique for converting cash flows that occur over time to equivalent amounts at a common point in time.

DISCOUNT RATE

A rate used to relate present and future money values, e.g. to convert the value of all future dollars to the value of dollars at a common point in time, usually the present.

ESG CRITERIA AND RISKS

Environmental, Social and Corporate Governance criteria are the base for responsible investing.

Asset owners, among other stakeholders, are increasingly concerned with the way asset managers, such as private equity firms, assess ESG risks to inform buyouts/acquisitions decisions, and subsequently manage those risks to protect the value and unleash value-generating opportunities during the holding period. ESG risks include those related to climate change impacts mitigation and adaptation, environmental management practices and duty of care, working and safety condition, respect for human rights, anti-bribery and corruption practices, and compliance to relevant laws and regulations. Responsible investment should also consider the impacts of megatrends (e.g. climate change), and emerging regulations or voluntary guidelines, such as the UK Modern Slavery Act, as well as the requirements of wider stakeholders for transparency.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, considering inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.

ENVIRONMENTAL MARKETS

In environmental markets, an ecosystem service itself is marketed and sold as a commodity to a beneficiary (usually an institution rather than individual) in the context of a dedicated market, usually subject to oversight by a regulatory body. Carbon credits and offsets are the most prominent example of such markets and the one with great potential but limited implementation in agroforestry systems, such as shade coffee.

They provide incentives to preserve ecosystems and the services they provide. These markets are

an innovative policy approach to increasing funding for environmental conservation and are often viewed as a complement to traditional conservation programmes. Current active and pilot markets exist for greenhouse gasses, water quality, water quantity, wetlands, and habitats.

EU FLOODS DIRECTIVE

It is a European Union Directive on the assessment and management of flood risks, that entered into force in 2007. It requires the EU Member States "to assess if all watercourses and coastlines are at risk from flooding, to map de flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk." (European Commission)

EU NATURA 2000

"Natura 2000 is a network of protected areas covering Europe's most valuable and threatened species and habitats. It is the largest coordinated network of protected areas in the world, extending across all 28 EU countries, both on land and at sea. The sites within Natura 2000 are designated under the Birds and the Habitats Directives" (European Environment Agency).

EU WATER FRAMEWORK DIRECTIVE (WFD)

It is a European Union directive which commits member states of the European Union to achieve a good qualitative and quantitative status of all water bodies by expanding the scope of water protection to all surface water and groundwater, with a water management approach based on river basins.

FINANCIER

A financier is a person or organisation whose primary occupation is either facilitating or directly providing investments to up-and-coming or established companies and businesses. A financier makes money through this process when his or her investment is paid back with interest, from part of the company's or project's equity awarded to them as specified by the business deal, or a financier can generate income through commission, performance, and management fees.

FINTECH

Financial technology (Fintech) is used to describe new tech that seeks to improve and automate the delivery and use of financial services. At its core, fintech is utilized to help companies, business owners and consumers better manage their financial operations, processes, and lives by utilizing specialized software and algorithms that are used on computers and, increasingly, smartphones. Fintech, the word, is a combination of "financial technology".

GREEN INFRASTRUCTURE

Green infrastructure is a subset of NbS that intently and strategically preserves, enhances, or restores elements of a natural system to help produce higher-quality, more resilient and lower-cost infrastructure services (World Bank, 2019).

GOVERNANCE STRUCTURES AND GOVERNANCE MODES

TCE as developed by Williamson (1979), **matches transactions with governance structures:** if the transaction has specific characteristics (asset specificity, frequency and uncertainty), then the most efficient governance structure (or mode of governance) for the organisation of such

transaction is a market contract, a hierarchy (public or a private firm), or a hybrid (Groenewegen and de Jong 2008).

Governance structures are designed to mitigate the hazards or minimize the costs, involved in economic transactions. Modes of governance or governance structures are the supporting structures, explicit or implicit contractual framework (including markets, firms and hybrids) within which transaction take place (Williamson 1981), specific ways to implement and operationalize the “rules of the game” as they are defined by the wider institutional environment (Menard 1995: 175).

INFRASTRUCTURE ASSETS

Stationary systems forming a network and service whole of communities, where the system as a whole is intended to be maintained indefinitely at a particular level of service potential by the continuing replacement and refurbishment of its components. The network may include normally recognised ordinary assets as components.

INSTITUTIONAL ENVIRONMENT

The **institutional environment** refers to the man-made constraints that structure political, economic, and social interactions. It delineates the rules of the game within which governance structures operate, by prescribing the rules of conduct within which human actions take place.

It consists of the basic **formal and informal rules** in society and the so-called **social capital**. The most important component of social capital is trust. Formal rules include laws and rules of society and the way these are enforced and monitored. Informal rules instead consist of common codes of behaviour, sanctions, customs, traditions, norms, values and beliefs; deeply rooted in society.

The main **differences between the institutional environment and governance structures** stated by Williamson (1996) are; firstly, that the former mainly defines or can be thought of as constraints on the environment of the latter; secondly that the level of analysis of each is very different. Governance structures operate at the level of individual transactions while the institutional environment deals with multiple levels of activity.

INSTITUTIONAL INVESTOR

An institutional investor buys, sells, and manages stocks, bonds, and other investment securities on behalf of its clients, customers, members, or shareholders. Broadly speaking, there are six types of institutional investors: endowment funds, commercial banks, mutual funds, hedge funds, pension funds, and insurance companies.

INTEGRATED WATER RESOURCES MANAGEMENT (IWRM)

Integrated Water Resources Management (IWRM) is a process which promotes the coordinated development and management of water, land and related resources to maximise economic and social welfare equitably without compromising the sustainability of vital ecosystems and the environment.

INTERNAL RATE OF RETURN (IRR)

The internal rate of return is a metric used in financial analysis to estimate the profitability of potential investments. The internal rate of return is a discount rate that makes the net present value (NPV) of all cash flows equal to zero in a discounted cash flow analysis. IRR calculations rely on the same formula as NPV does.

INVESTOR

An investor is a person or institution that allocates capital with the expectation of a future financial return or to gain an advantage. Types of investments include equity, debt securities, real estate, currency, commodity, token, derivatives such as put and call options, futures, forwards and others. This definition makes no distinction between the investors in the primary and secondary markets. That is someone who provides a business with capital and someone who buys a stock are both investors. An investor who owns a stock is a **shareholder**.

LEVEL OF SERVICE

The defined service quality for an activity (i.e. highway construction) or service area (i.e. street lighting) against which service performance may be measured. Service levels usually related to quality, quantity, reliability, responsiveness, environmental acceptability and cost.

LIFE

A measure of the anticipated life of an asset or component; such as time, number of cycles, distance intervals, etc.

LIFECYCLE

The cycle of activities that an asset (or facility) goes through while it retains an identity as a particular asset i.e. from planning and design to decommissioning or disposal.

LIFECYCLE COST

The total cost of an asset throughout its life including planning, design, construction, acquisition, operation, maintenance, rehabilitation and disposal costs.

LIFECYCLE COSTS ANALYSIS

Any technique which allows assessment of a given solution, or chooses from among alternative solutions, based on all relevant economic consequences over the service life of the asset. LCCA is a process of evaluating the economic performance of a building over its entire life. Sometimes known as “whole cost accounting” or “total cost of ownership,” LCCA balances initial monetary investment with the long-term expense of owning and operating the building.

By comparing the life cycle costs of various design configurations, LCCA can explore trade-offs between low initial costs and long-term cost savings, identify the most cost-effective system for a given use, and determine how long it will take for a specific system to “payback” its incremental cost.

MAINTAINABILITY

A characteristic of design and installation usually identified by the time and effort that will be required to retain an asset as near as practicable to its new or desired condition within a given period of time.

MAINTENANCE

All actions are necessary for retaining an asset as near as practicable to its original condition but excluding rehabilitation or renewal.

MAKE-OR-BUY DECISION

A make-or-buy decision is an act of choosing between manufacturing a product in-house or purchasing it from an external supplier. Also referred to as an outsourcing decision, a make-or-buy decision compares the costs and benefits associated with producing a necessary good or service internally to the costs and benefits involved in hiring an outside supplier for the

resources in question. To compare costs accurately, a company or public procurement authority must consider all aspects regarding the acquisition and storage of the items versus creating the items in-house.

MARKET VALUE

The estimated amount at which an asset would be exchanged on the date of valuation, between a willing buyer and a willing seller, in an arm's length transaction after proper marketing, and when the parties have each acted knowledgeably, prudently and without compulsion. Market value is based on the highest and best use of an asset and not necessarily the existing uses.

MARKET SOUNDING

In addition to public consultation, there is also a specific function and role for consultation with the private sector during the project implementation stages. This specific consultation is also called market sounding. The main objective of the market sounding is to test the private sector's ability to assume risks that are to be transferred via the concession contract from the public sector to the private sector. Market sounding should not be confused with public consultation but there are some similarities. Both should be carried out as early as possible in the project cycle so that the views of affected groups can be considered in project planning.

MOST ECONOMICALLY ADVANTAGEOUS TENDER (MEAT)

The Most Economically Advantageous Tender (MEAT) is a method of assessment that can be used as the selection procedure, allowing the contracting party to award the contract based on aspects of the tender submission other than just price.

NATURE-BASED SOLUTIONS (NBS)

Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (IUCN).

NET PRESENT VALUE

The value of an asset to the organisation, derived from the continued use and subsequent disposal in present monetary values. It is the net amount of discounted total cash inflows arising from the continued use and subsequent disposal of the asset after deducting the value of the discounted total cash outflows.

OPERATION

The active process of utilising and asset which will consume resources such as manpower, energy, chemicals and materials. Operation costs are part of the lifecycle costs of an asset.

OPPORTUNITY COST

Opportunity costs represent the potential benefits an individual, investor, or business misses out on when choosing one alternative over another. The idea of opportunity costs is a major concept in economics.

PARAMETRIC INSURANCE

Fundamentally, parametric (or index-based) solutions are a type of insurance that covers the probability of a predefined event happening instead of indemnifying actual loss incurred.

It is an agreement to make a payment upon the occurrence of a triggering event, and as such is detached of an underlying physical asset or piece of infrastructure. Two key components of this

insurance scheme are: a triggering event and a pay-out mechanism.

PAYBACK PERIOD

The times it takes for the cumulative benefits or saving of investment to pay back the original investment and other accrued costs.

PAYMENT MECHANISM

The payment mechanism defines how the private party to the PPP is remunerated. A payment mechanism is central to a Public-Private Partnership (PPP) contract, providing the agreed means of allocating risk between the public and private sector partners and incentivising the latter through performance-based payments.

Basic elements of a payment mechanism include user charges (revenue-based payment mechanism), government payments (based on usage or availability, or as upfront subsidies) and bonuses as well as fines linked to specified key performance indicators (KPI's).

PERFORMANCE INDICATOR (PI)

A qualitative or quantitative measure of a service or activity used to compare actual performance against a standard or other target. Performance indicators commonly relate to statutory limits, safety, responsiveness, cost, comfort, asset performance, reliability, efficiency, environmental protection and customer satisfaction.

PERFORMANCE MONITORING

Continuous or periodic quantitative and qualitative assessments of the actual performance compared with the specific objectives, targets or standards.

PROJECT DEVELOPER

The project developer is the entity or consortium tasked with developing the project further from concept to completed construction and bears the responsibility and associated risks of completing the project in a timely matter and on budget.

PROJECT FINANCE

Project finance is the financing of long-term infrastructure, industrial projects, and public services using a non-recourse or limited recourse financial structure. The debt and equity used to finance the project are paid back from the cash flow generated by the project. Project financing is a loan structure that relies primarily on the project's cash flow for repayment, with the project's assets, rights, and interests held as secondary collateral. Project finance is especially attractive to the private sector because companies can fund major projects off-balance sheet.

Project finance for BOT projects generally includes a special purpose vehicle (SPV). The company's sole activity is carrying out the project by subcontracting most aspects through construction and operations contracts. Because there is no revenue stream during the construction phase of new-build projects, debt service only occurs during the operations phase.

A sponsor (the entity requiring finance to fund projects) can choose to finance a new project using two alternatives:

- The new initiative is financed on the balance sheet (corporate financing)
- The new project is incorporated into a newly created economic entity, the SPV, and financed off-balance sheet (project financing).

PROJEC FINANCE SPONSOR

By participating in a project finance venture, each project sponsor pursues a clear objective, which differs depending on the type of sponsor. In brief, four types of sponsors are very often involved in such transactions:

- Industrial sponsors – They see the initiative as upstream and downstream integrated or in some way as linked to their core business
- Public sponsors – Central or local government, municipalities, and municipalized companies whose aims centre on social welfare
- Contractor sponsors – Who develop, build, or run plants and are interested in participating in the initiative by providing equity and or subordinated debt
- Financial sponsors/investors – Invest with a motive to invest capital in high-profit deals. They have a high propensity for risk and seek a substantial return on investments.

PROJECT PREPARATION

Project Preparation consists of all the work necessary to ensure that a proposed project is feasible and appropriate and that it can be successfully implemented. The process ensures the identification and elimination of key risks at the earliest possible time and maximises development opportunities by ensuring that projects are well conceptualised. Project preparation, which spans activities from conceptualisation and feasibility analysis to deal structuring and transaction support, is integral to creating bankable projects.

PROJECT PROPONENT

Project Proponents are the entities or individuals organizing, proposing, or advocating a particular

NbS project. The project proponents could be the project designer(s), developer(s) and/or investor(s), or other parties working on behalf of the project.

The term project proponent also refers to the entity that has primary responsibility for a specific project within a grant proposal. Project proponents receive grant funds through their relationship with the grant applicant. A broader variety of entities, such as tribal or federal entities, can be project proponents. For grant solicitations where there is a single project, the project proponent and the applicant can be the same entity.

PROJECT SCOPE

Project Scope includes all the work that needs to be done to create a product or deliver a service or result. Project Scope is all about the project; it defines the work required to create and deploy the product. The project manager prepares the project scope statement.

PROJECT SPONSOR

The project sponsor is that person or group who owns the project, who provides resources and support for the project, programme or portfolio for enabling success. Every project has one. They are the reason for the project. While they often don't manage the day-to-day operations of a project, they are above the project manager in terms of the project hierarchy. Most likely, the project sponsor has been involved with the project from the very beginning. They were the one who helped conceive it and advocated for it. The project sponsor can vary according to the project. For example, a government project is going to have a state official as a project sponsor who will work with the construction company's project manager.

PUBLIC-PRIVATE PARTNERSHIP

There is no one widely accepted definition of public-private partnerships (PPP). The PPP Knowledge Lab defines a PPP as "a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance". PPPs typically do not include service contracts or turnkey construction contracts, which are categorized as public procurement projects, or the privatization of utilities where there is a limited ongoing role for the public sector.

PUBLIC PROCUREMENT

Public procurement refers to the purchase by governments and state-owned enterprises of goods, services and works. As public procurement accounts for a substantial portion of the taxpayers' money, governments are expected to carry it out efficiently and with high standards of conduct to ensure high quality of service delivery and safeguard the public interest.

RETURN ON INVESTMENT (ROI)

Return on Investment (ROI) is a performance measure used to evaluate the efficiency of an investment or compare the efficiency of several different investments. ROI tries to directly measure the amount of return on a particular investment, relative to the investment's cost. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment. The result is expressed as a percentage or a ratio.

RISK/REWARD RATIO

The risk/reward ratio marks the prospective reward an investor can earn, for every dollar, he

or she risks on an investment. Many investors use risk/reward ratios to compare the expected returns of an investment with the amount of risk they must undertake to earn these returns. Consider the following example: an investment with a risk-reward ratio of 1:7 suggests that an investor is willing to risk \$1, for the prospect of earning \$7. Alternatively, a risk/reward ratio of 1:3 signals that an investor should expect to invest \$1, for the prospect of earning \$3 on his investment.

RISK ANALYSIS

Risk analysis is the process of assessing the likelihood of an adverse event occurring within the corporate, government, or environmental sector. Risk analysis is the study of the underlying uncertainty of a given course of action and refers to the uncertainty of forecasted cash flow streams, the variance of portfolio or stock returns, the probability of a project's success or failure, and possible future economic states. Risk analysts often work in tandem with forecasting professionals to minimize future negative unforeseen effects.

RISK COST

The assessed annual cost or benefit relating to the consequence of an event. Risk cost equals the costs relating to the event multiplied by the probability of the event occurring.

RISK MANAGEMENT

The application of a formal process to the range of possible values relating to the key factors associated with a risk to determine the resultant ranges of outcomes and their probability of occurrence. Once the value of the risks faced by the project is identified, each of them can be managed by avoiding it, sharing it, accepting it or controlling it.

RISK PROFILE

A risk profile outlines the type of risks, numbers of risks and potential effects of the risks. With this information, the project sponsor can evaluate the impact of the capital project and estimate an additional cost that may come. A risk profile also includes the project owner willingness to take risks and a risk management plan. A risk profile is used to reduce the potential threats and risks. It also plays a big role in determining an investment asset allocation for a portfolio.

SCOPE OF CONTRACT

It refers to the expected services or work as agreed to in a contract. With a clearly defined scope, the purchaser knows exactly what he or she is paying for, and the service provider can feel comfortable in knowing he or she doesn't have to work beyond what the scope details without extra pay. This is also referred to as the Scope of Work (SOW) where it is described the work to be performed by the agent hired by the principal.

SOCIAL CAPITAL

Social capital is defined by the OECD as “networks together with shared norms, values and understandings that facilitate co-operation within or among groups”. Networks are real-world links between groups or individuals. Shared norms, values and understandings are less concrete than social networks and are often unspoken and largely unquestioned rules. They do not become apparent until they're broken. Meanwhile, values may be more open to question. And yet values – such as respect for people's safety and security – are an essential linchpin in every social group. Combined, these networks and understandings engender trust and enable people to work together. Summarizing social capital provides the glue which facilitates co-operation, exchange and innovation.

SOCIAL COST-BENEFIT ANALYSIS (SCBA)

A SCBA is an evaluation method to assess the impact of policy decisions. It provides an overview of current and future pros and cons of a particular investment or policy project for society as a whole as objectively as possible. For this purpose, effects are denominated in Euros whenever possible and can be aggregated. The analysis then shows whether the project under evaluation leads to the desired increase in social welfare.

This means that SCBA differs fundamentally from a financial analysis (business case), which reveals the costs and benefits for a party. As SCBA assesses the overall public interest, certain financial costs and benefits that are included in a business case disappear as they are offset by benefits respectively costs of another party. A SCBA is based on a broad definition of the term 'welfare'. Besides goods and services, SCBA considers intangible effects and expresses them in monetary terms. These include effects on the environment, landscape, nature and spatial quality. The value of those effects is calculated in monetary terms through specific valuation techniques, as no market prices are readily available.

A SCBA compares the costs and benefits of one or more project alternatives with a so-called baseline or business-as-usual scenario (BAU). The baseline scenario is the most likely development that will occur when no policy decision is taken. The difference between the project alternative and the baseline is the starting point for SCBA. SCBAs are widely used in public infrastructure investment evaluations and other ex-ante policy evaluations in many EU countries.

SOLUTION SCOPE

The Product or Solution Scope is the characteristics, features, or function of the product or service that is to be built. Solution scope is all about the solution to be implemented: how will it look like, how will it function, and other characteristics, etc. A business analyst prepares the product or solution scope. The purpose of the solution scope is to conceptualize the recommended solution or strategy in enough detail to enable stakeholders to understand the impacts of it on their levels of service.

SPECIAL PURPOSE VEHICLE

A special purpose vehicle, also called a special purpose entity (SPE), is a subsidiary created by a parent company to isolate financial risk. An SPV is created as a separate company with its balance sheet. When used for project finance, the SPV functions as a holding company for the securitization of debt.

STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

A Strategic Environmental Assessment (SEA) is a systematic process for evaluating the environmental implications of a proposed policy, plan or programme and provides means for looking at cumulative effects and appropriately address them at the earliest stage of decision making alongside economic and social considerations.

STRATEGIC FIT

A situation that occurs when a specific project, target company or product is seen as appropriate concerning an organisation's overall objectives. In the context of a public investment project, it refers to the degree by which this fits the strategic drivers and policy context.

THEORY OF CHANGE

Theory of Change is essentially a comprehensive description and illustration of how and why the desired change is expected to happen in a particular context. It is focused on mapping out or "filling in" what has been described as the "missing middle" between what a programme or change initiative does (its activities or interventions) and how these lead to desired goals being achieved. It does this by first identifying the desired long-term goals and then works back from these to identify all the conditions (outcomes) that must be in place (and how these related to one another causally) for the goals to occur.

In the context of water security programmes and within the FFWS this requires not only a comprehensive illustration of how and why a desired change in a particular context is expected to be achieved through the NbS programme but also how the investment programme is expected to contribute and drive a paradigm shift in economic development models.

TOTAL COSTS OF OWNERSHIP (TCO)

The total cost of ownership (TCO) is the purchase price of an asset plus the costs of operation. Assessing the total cost of ownership represents taking a bigger picture look at what the product is and what its value is over time.

TRANSACTIONS

The fundamental unit of analysis in **Transaction Cost Economics (TCE)**, is the transaction. "A transaction occurs when a good or service is transferred across a technologically separable interface. One stage of activity terminates, and another begins" (Williamson 1996, 379). The transaction is therefore synonymous with the economic concept of exchange (Altamirano,

2010) and transaction costs refer to the costs incurred by all parties when engaging in economic trade.

USEFUL LIFE

May be expressed as either:

The period over which a depreciable asset is expected to be used, or

The number of production or similar units (i.e. intervals, cycles) that is expected to be obtained from the asset.

VIABILITY GAP FUNDING

VGF is a government support or upfront subsidy in the form of a contribution of some of the construction cost, given in cash to a PPP project that already economically viable but has not had financial feasibility. VGF can be given when there is no other alternative to make the PPP project financially feasible.

WATER STEWARDSHIP

The use of water that is socially and culturally equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that includes both site- and catchment-based actions. Water stewards engage in meaningful individual and collective actions that benefit people and nature.

INTRODUCTION

Evidence recorded over the last decade indicates that we are about to reach or have already reached a tipping point related to climate change. The Global Commission on Adaptation (GCA) (2019) report stated: "Climate change is one of the greatest threats facing humanity, with far-reaching and devastating impacts on people, the environment and the economy". The frequency of extreme events keeps increasing. In terms of overall losses, 2017 was the second-costliest year ever for natural disasters. Overall losses in 2017 (US\$ 330 bn) were far greater even than those in the extreme years of 2005 and 2008. Only in 2011 higher loss figures (US\$ 350bn) have been recorded and they were related to the Tohoku earthquake and floods in Thailand. The share of insured losses (US\$ 135 bn) is the highest figure in the period from 1980 to 2017. Munich Re NatCatSERVICE recorded 710 relevant loss events, which is above the average of 605 events per year of the last decade and much higher than the average of 490 events over the last 30 years (Munich Re 2018). According to the GCA, rising seas and greater storm surges could force hundreds of millions of people in coastal cities from their homes and generate losses of more than USD 1 trillion yearly by 2050 in coastal urban areas. Meanwhile, a 2016 World Bank report indicates that the impacts of Climate Change will be channelled primarily through the water cycle and that water scarcity could cost some regions up to 6% of their GDP.

To reverse these frightening trends in yearly losses that are the result of an increase in the frequency of hazards driven by Climate Change and an increase in exposure and vulnerability, it is urgent to understand the dynamics between our economic growth models and the environment. As urged by the GCA (2019), we need three revolutions for a better future: a revolution in understanding, a revolution in planning and a revolution in finance. It is key to understand the dynamics that emerge between our natural resources, socio-economic and institutional systems and identify the leverage points that may allow us to set in motion a different dynamic between them.

The ways we have achieved development in the last two centuries have resulted in an increasing depletion of our natural capital and exponential growth in our vulnerability and exposure to water, environmental and climate risks. A paradigm shift⁴ is required in the way we expand our cities and infrastructure networks and our economies in general. Can we conceive new ways to ensure wellbeing for citizens and achieve a paradigm shift towards low-carbon and climate-resilient development? An effective place to start is to challenge the way we invest and rethink (infrastructure) investment planning processes in the public and private sectors alike.

As promoted by the Task Force on Climate-related Financial Disclosures (TCFD)⁵, as well as the High-level expert group on sustainable finance (HLEG) the environmental externalities, cause by

investments as well as the climate risks these investments are subject to the need to be considered when deciding what to invest on. Changes are required in the process of project origination and project preparation. Considering that most impacts of Climate Change will be channelled through the water cycle; project origination should ideally follow from a strategic planning process that considers the dynamics of the water cycle, the watershed as a planning unit and the role of healthy ecosystems as buffers that protect us against extreme events⁶.

In the last decade, we have grown in awareness of the role of ecosystems and/or green infrastructure in achieving water security in an uncertain future. Accordingly, an alternative “Nature-based” or “Building-with-Nature” engineering approach has emerged. This approach is understood as the enriching of the traditional infrastructure planning process with green and hybrid (green and grey) solutions along with traditional grey infrastructure. Green infrastructure is defined by the World Bank (2019) as a subset of nature-based solutions (NbS) that intently and strategically preserves, enhances, or restores elements of a natural system to help produce higher-quality, more resilient and lower-cost infrastructure services⁷. Green infrastructures are multi-functional and adaptive, making them a promising and robust long-term solution. Due to their characteristics, they can contribute to climate adaptation as well as to climate mitigation. They can provide a cost-effective approach to address deep uncertainty related to climate change by avoiding or delaying lock-in to capital-intensive infrastructure, allowing for flexibility to adapt to changing circumstances (OECD, 2013).

This new generation of infrastructure projects may hold the key to new economic development paradigms. The development of investable NBS propositions is crucial for the implementation at scale of NbS and the achievement of climate and sustainable development goals by 2030. While it is more and more globally acknowledged that climate change cannot be tackled without ramping investments to protect and restore nature, according to recent studies NbS attract only 3% of global climate funding and private sector investments in NbS remain limited. As a recent H2020 study from the project Naturvation show for urban NbS in Europe, the vast majority of investments in NbS are carried out by the public sector.

This handbook proposes an alternative approach to project origination and investment planning (public and private) that aims at closing the implementation gap of NbS, hybrid (green-grey) water security strategies by tackling important barriers for public and private sector investments in green infrastructure. For water security strategies to translate into a pipeline of projects that are investable from a public and/or private perspective, a complete business case per deal that makes part of the strategy is essential. Therefore, in this handbook paper, we propose several steps required to advance the business case of hybrid (green-grey) infrastructure projects and/or project clusters that go beyond the strategic and economic one, into the commercial, financial and management business case.

The focus of the FFWS approach proposed on public investment planning cycles and procurement and contractual arrangements is based on several assumptions:

Firstly, regarding the economics of water and water risks: the management of water is an essential public good and a so-called natural monopoly. Failures in how water and water risks are managed can be catastrophic and therefore these risks can't be effectively and entirely transferred to the private sector. However, as the public sector is often unable to raise the capital needed to make all necessary water security investments, the mobilization of private capital is crucial. Water is a private good – a commodity that can be bought from a supplier- and a human right at the same time. As a human right water cannot be treated equally as other marketable goods. The public sector role regarding the provision of water therefore remains key. Consequently, the proposed approach focusses on the public investment process and public procurement as catalytic for an increase in Public-Private cooperation and ultimately of private investments in water security. The transaction costs faced by the private sector willing to invest in water security at the watershed level are prohibitive in the absence of government coordinated action.

Secondly, green infrastructure projects differ significantly from grey. The communities of practice that are behind design and project origination operate under significantly different business models and scientific approaches. Public investment processes and project delivery and finance mechanisms, in general, are geared towards the traditional grey infrastructure project. Therefore, it is key to understand the lenses of both, enable effective collaboration for the development of a middle ground and level playing field¹⁰. The approach proposed advocates for changes on both sides of the equation. While planning and investment decision making processes need to be redesigned and adjusted to accommodate a wider range of options - including hybrid (green-grey) projects-; the communities proposing green and hybrid infrastructure projects need also to develop the required evidence and shape these projects differently to fulfil minimum requirements that back up the investment of scarce public resources and/or secure the minimum returns expected by private investors.

Thirdly, blended finance strategies, unusual partnerships and innovative financing mechanisms are required to mobilize additional private resources towards hybrid water security strategies. The base for the use of most innovative financing mechanisms is performance-based contracts. As most hybrid projects have multifunctionality as the main advantage, performance-based contracts that allow for stacking of multiple benefits and revenue streams are key.

As concluded during the recent Environmental Market and Finance Summit, the future is in "mosaic" projects. Over and over, asset managers and market service providers stated that they're designing projects that can responsively serve multiple markets, depending on where the demand is. This allows them to stack funding from multiple sources: carbon offsets, sustainable forestry, water quality credits, recreational use payments, wetland and habitat mitigation, and other

revenue streams. Additionally, in a market sounding research process undertaken by Deltares in Peru in 2019 in cooperation with the USAID-Canadian-Aid funded Natural Infrastructure for Water Security (NIWS) project led by Forest Trends, it was found that hybrid (green-grey) infrastructure projects are seen as more attractive to project developers than green infrastructure projects alone. Therefore, in the methodology proposed a central building block are hybrid infrastructure clusters. These are organized into hybrid and multipurpose infrastructure projects and formal performance-based contracts that can be funded by different revenue streams; depending on local institutional conditions and context-specific preferences and willingness to pay of beneficiaries.

To summarise, we propose an approach for investment planning and project origination that require the active participation of the private sector, investors and (re)insurance companies in earlier phases of the strategic planning process. They are well-positioned to strengthen the effectiveness of strategic planning processes. By bringing financial sustainability and their investment criteria to the table early in the process they can enrich the process of shaping, prioritizing and phasing NbS and hybrid project clusters, which can be afterwards translated into a pipeline of projects with more attractive cash and risk profiles.

Turning NbS project ideas into investable propositions: Financing Framework for Water Security

For NbS water security strategic plans and projects to be able to access funding and/or financing is necessary to prepare a full business case for the entire investment program and each of the investment projects that make part of it. All investments, also public investments require a full business case (**Textbox 1**). Essential in the development of the investment case and its five elements - strategic, economic, as well as commercial, financial and management cases- is the development of a suitable implementation arrangement per measure. The success and creditworthiness of a given business case are guaranteed by a robust and fit-for-purpose implementation and financing arrangement per NBS project or cluster of projects.

Textbox 1. Five Case Model

The Five Case Model

The objective of the business case is to ensure that programmes and projects on which scarce public funds will be invested meet their intended goals and objectives and deliver the intended benefits by making sure the proposed investments: a) make a robust case for change – the “strategic case”, b) optimise Value for Money in terms of economic, social and environmental benefits- the “economic case”, c) are commercially viable – the “commercial case”, d) are financially viable – the “financial case” and e) are achievable- the “management case”.

The Five Case Model is the approach for developing business cases recommended by HM Treasury, the Welsh Government and the UK Office of Government Commerce. It has been widely used across central government departments and public sector organizations over the last 10 years. The model forms the basis of project and programme business case guidance created by HM Treasury and the Welsh Government.

Making use of system analysis, collaborative modelling techniques and applying New Institutional Economics principles, the FFWS enables a process of transdisciplinary collaboration that engages the (infrastructure) financing community and the proponents of NbS in developing the investment case for NbS while designing a fit for purpose project delivery and finance arrangements for hybrid (green-grey) projects. A process that involves all relevant public, private and community actors key for implementation and enables the translation of strategic plans (e.g. Integrated Water Resources Management -IWRM- plans) into clearly phased hybrid infrastructure clusters that can be absorbed by formal public investment planning processes and then translated into a number of financially viable or even bankable deals making use of a blended finance approach.

The Financing Framework for Water Security (FFWS) offers an interface between the project delivery and finance community and the water resources planning and watershed conservation communities. It guides the proponents of NbS and/or stakeholders involved in a water security planning process through several questions to develop the five business cases of the investment program proposed and design fit for purpose implementation arrangement. The main objective is to design an implementation arrangement with the highest potential to ensure sustainability in service delivery in the long term.

By taking into account: a) the transaction characteristics (technical and financial), b) the level of service required over time and c) the institutional setting (stakeholders interests, strengths of local government, private sector and community and the incentives created by formal and informal institutions) and considering good practices worldwide, NbS proponents can choose from a wide range of project delivery and finance options. These options vary from purely public governance options up to the creation of (regulated) markets for private initiatives.

Through this process, NbS proponents in consultation with all relevant stakeholders decide how to make the provision of the envisioned ecosystem and/or water services possible, what to do themselves, what to delegate and to whom and how to ensure financial sustainability of these investments. An implementation arrangement includes the choice of mode of governance, a funding, financing and procurement strategy.

Between 2016 and 2020 the FFWS has been continuously developed and successfully implemented (by Deltares) in seven countries at different scales. Within Europe as part of the NAIAD project in Spain (El Duero basin, ecosystem-based adaptation measures), Romania (Danube River flood and drought risk management plan), Rotterdam (urban micro wetlands) and worldwide through strategic water security planning processes in Indonesia (Semarang, urban resilience strategy), Philippines (Jalaur River Basin, IWRM strategy and Manila, Masterplan for the Sustainable Development of Manila Bay), Mexico (Oaxaca, urban resilience strategy) and in Ecuador (Guayaquil, urban green infrastructure plan for flood management).

Within the H2020 NAIAD project, we have worked together with 23 partners from across Europe in further specifying these guidelines to fit the specificities of Nature-based Solutions and test their added value in our nine demonstration cases, applying them fully in three of these cases. The results from this action research process and the final version of these guidelines are presented in this handbook.

The resulting collaborative project preparation approach presented here offers a practical approach for the NbS, water and infrastructure finance communities to work together in driving an understanding, planning and financing revolutions.

1 DEVELOPING INVESTABLE NBS PROPOSITIONS: FINANCING FRAMEWORK FOR WATER SECURITY APPROACH

1.1 Introduction

The basic methodological elements of the Financing Framework for Water Security (FFWS) approach and the stepwise approach it proposes to shape NbS strategies for water security into investable propositions are presented in this section.

Accordingly, this section includes:

- FFWS overall methodology and process
- Explanation of the five cases required to make the investment case for water security strategies, including specific questions and reference the supporting formats to address them presented in **Appendix B**.
- The FFWS process step by step. It illustrates how specific analytical and collaborative modelling activities supported by several formats and scripts presented in section eight should be deployed as a process to build the evidence for the five business cases while developing an implementation arrangement for the NbS strategy.
- Guidance on how to design the overall process and to define the starting point for a NbS proponent and/or strategy; including how to combine desk research, internal project team meetings and stakeholder workshops making use of collaborative modelling protocols and scripts (presented in section eight)

The FFWS approach aims at engaging the (infrastructure) financing community and the proponents of green infrastructure strategies for water security in the process of designing project delivery and finance arrangements that fit the characteristics of hybrid projects. A process that involves all relevant public, private and community actors key for implementation and enables the translation of strategic water security plans into clearly phased hybrid infrastructure clusters that can be absorbed by formal public investment planning processes and/or translated into a number of financially viable or even bankable deals making use of a blended finance approach

For the process to be as effective as possible, although some modules can be done via desk research or internal meetings; the overall analysis and choices regarding the entire roadmap to develop the full business case need to be discussed and agreed upon with all relevant stakeholders and future implementation partners.

It is also important to notice that while extensive guidance is offered; several choices and/or steps envisioned in the FFWS approach may still require the expertise of procurement and/or infrastructure finance experts and tacit expert knowledge about implementation arrangements and choices that work best with certain types of NbS projects in specific institutional settings. In designing a fit-for-purpose implementation arrangement there is, unfortunately, no silver-bullet solution, and the FFWS guidelines do not replace fully the professional criteria of experts.

The FFWS builds on a combination of New Institutional Economics, Transaction Cost Economics, Economics of Infrastructures and Engineering Design Theory; with key concepts from Engineering Asset Management and delivery and finance of (public) infrastructure networks. It relates them to the “five cases” approach used for appraising public investment by HM, the UK Treasury Department.

1.2 The process in a nutshell

The Financing Framework for Water Security (Altamirano 2017, Altamirano 2019) supports the objective by offering detailed guidance to develop a bridge between the adaptive planning phase and the investment planning phase; by enabling the development of a narrative and an implementation strategy that allows the stakeholders engaged in a planning process to go from the strategic case and economic business case – where one builds the evidence that supports the “preferred strategy” as the option that optimize the use of scarce public funds; towards the detailing of an investment plan and an action plan where the commercial, financial and management business case of the waters security strategy and the individual investments is made up are further detailed.

The FFWS is comprised of several steps for developing the investment case of the preferred water security strategy. This five cases model makes explicit why a project is “investable” for a certain actor, considering the questions outlined in **Figure 6**.

Although the five-case model approach has been developed in the context of justifying public expenditures, the evidence presented in these five cases is also crucial for private actors to decide whether a project is investable or not or for financing institutions to decide whether the project is bankable. A crucial element towards the development of the five cases is the development of a suitable implementation arrangement per measure.

The FFWS guides the stakeholder involved in a planning process in developing and “engineering” an implementation arrangement for water security projects including the development of a governance structure, a funding strategy, a financing and procurement strategy. By analysing and making explicit:

- a) **The transaction.** Technical and financial characteristics of the project, such as how capital intensive the project is, how asset-specific is the investment required (e.g. can the assets created be moved and reused for other purposes) and most important the main functions and services that will be provided through the asset being created by the investments as well as how these services can be classified in a type of economic good (private, common resource, club or public)
- b) **The level of service required over time,** specified through clear Key Performance Indicators (KPI's) per service,
- c) **The enabling environment** by analysing the institutional setting. Key stakeholders for implementation, strengths of local government, private sector and community and the incentives created by formal and informal institutions.

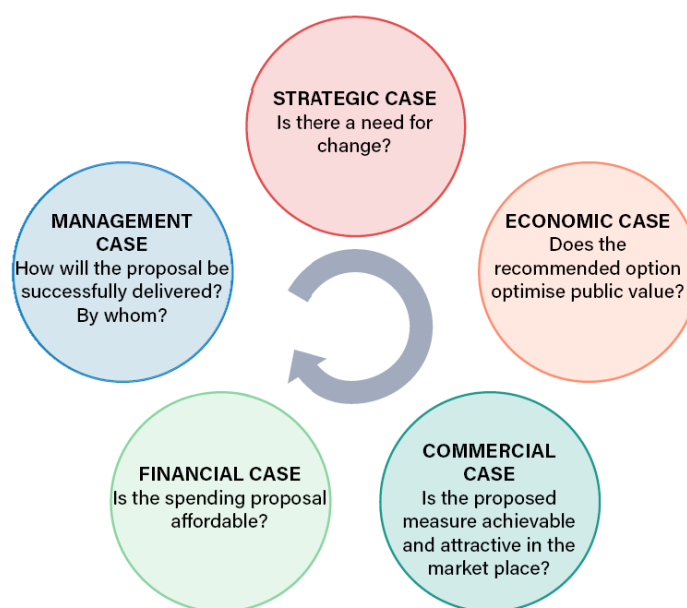


Figure 1. Five cases to justify public investments (Source: Five Case Model of the UK HM Treasury 2018)

It also considers lessons learned from best practices worldwide, the proponents or actors developing a water security strategy could choose an implementation arrangement with the highest chance to ensure financial sustainability and therefore sustainability in service delivery in the long term. They can choose from a wide range of project delivery and finance options. This range varies from purely public governance options up to the creation of regulated markets for private initiatives and innovative business models to emerge.

To better understand the role of the institutional context (also called institutional environment) and how it conditions the types of implementation arrangements that may be possible per investment project, it is important to introduce several basic concepts from New Institutional Economics. These can be found in **section 3.3**.

The FFWS considers the full spectrum of governance and finance options (project delivery and finance methods) for the whole gamma of water security measures and associated services. As it will be presented in greater detail in this chapter, the FFWS proposes several steps to gradually advance the five business cases from a conceptual and/or qualitative stage up to a more quantitative one. It offers guidance to the proponents of (Ecosystem-based) water security measures to answer a key question regarding the implementation model that ensures sustainability in service delivery:

- a How to fund the (Ecosystem-based) measure? (taxes, tariffs, transfers)- and who (public, private, citizens) will fund it?
- b How to finance (i.e. municipal bonds, project finance, corporate loans), and who will finance it?
- c Who should or is best positioned to implement and or “build” the measure?
- d Who should or is best positioned to operate the (green) infrastructure asset and deliver the water service? And
- e Who will monitor the Level of Service provision?
- f And for all different life cycle phases of the infrastructure who is best positioned to function as “principal” (the commissioner of the work) and who as “agent” (the one carrying out the work)? And which incentives could be built into the contract between them to ensure the **best value for money**?

The four main stages of analysis to design an implementation arrangement to follow are presented in **Figure 7**; in the following sections, we present the more detailed steps and entire process to advance the five business cases gradually as the process of strategic planning for water security advances.

It is important to clarify that while on the one hand the input to this first phase is expected to be a “preferred strategy” to achieve water security, for which there is a clear strategic and economic case; on the other hand the further specification of a hierarchy of services to be provided by the strategy and/or specific green infrastructure investments and the potential sources of revenue helps to further shape the strategic case of the investment programme being considered and may even lead to significant changes in the solutions being thought part of this preferred strategy.

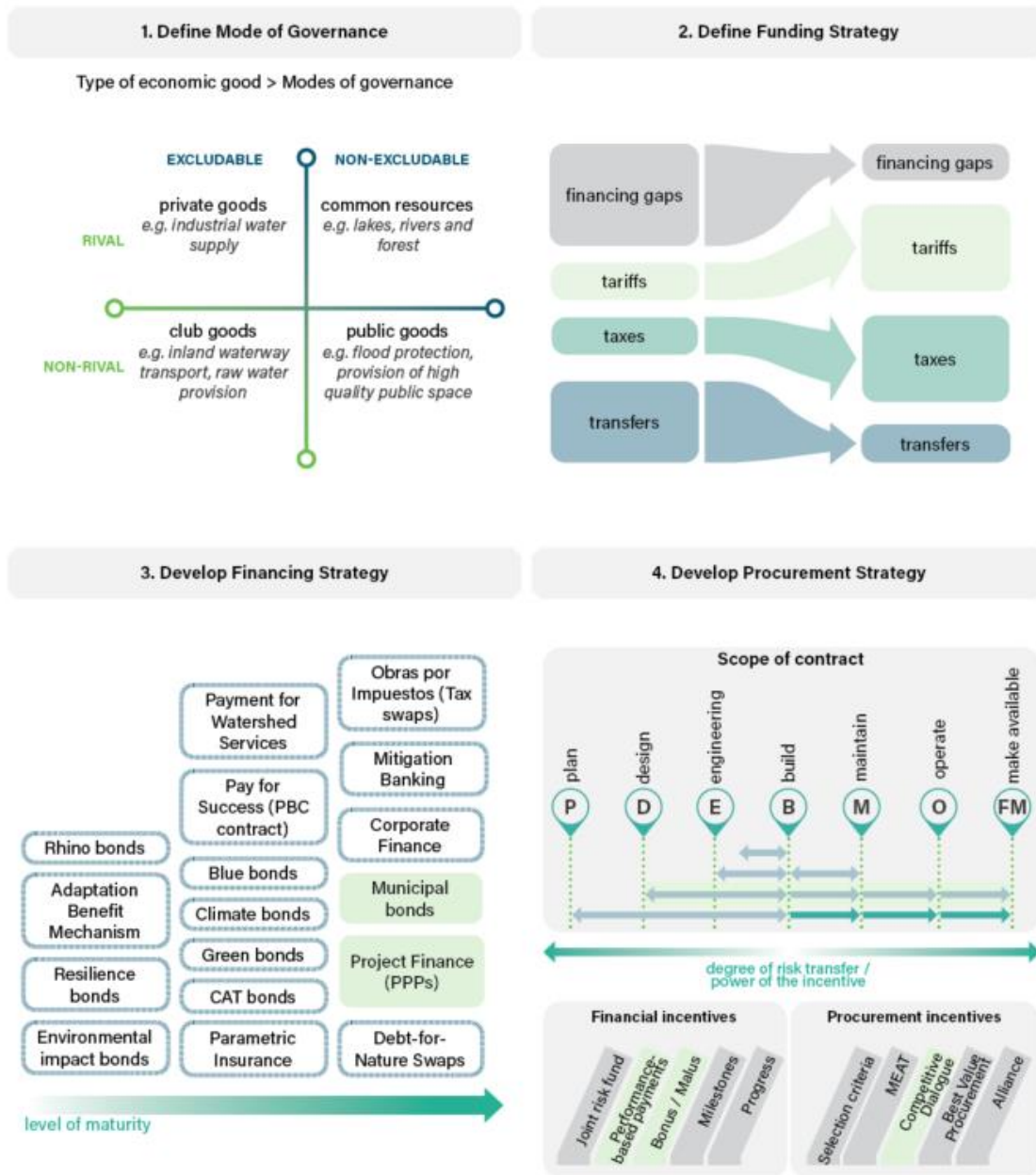


Figure 2. Main components of the implementation arrangement.

Textbox 2. Steps to design an implementation arrangement according to the Financing Framework for Water Security (Source: Altamirano 2019, page 13)

Step 1: define the main services the project will create and categorize these in types of economic goods.

It is important here to bear in mind that we categorize the services the asset created by the project delivers, not necessarily the asset itself. For example, a forest may provide services that can be considered private (such as reduction of sedimentation rate of hydropower plants), yet the forest itself may be a public good. This categorization enables the identification of which types of funding could be appropriate to ensure cost recovery.

Step 2: Funding strategy: the funding of a project could be either public or private. In general terms, the main sources of funding are what the OECD called the 3T's: Taxes, Tariffs or Transfers. Once the sources of funding – who ultimately pay for the project- are determined the mechanisms to arrange capital upfront (financing) and how to place the project on the market (procurement) are selected.

Step 3: Financing strategy: depending on the type of project and whether the project sponsor is public or private, a variety of financing instruments could be used. In the graph below we show for example a variety of innovative financing instruments for Climate Adaptation and DRR (Altamirano et al. 2019b).

Step 4: Procurement strategy: which refers to how the government agency or private project sponsor responsible for the project can choose to make use of or to purchase the project. The graph shown here applies mainly to public infrastructures, while other sectors or types of transactions may need a different approach, such as the design of regulated markets or bottom-up community-based initiatives. As is shown in this graph in the case of public procurement of infrastructures the government may choose to tender it as a fully integrated contract (e.g. involving the private sector from planning up to Operation and Maintenance) or choose for more traditional separate ones.

Making use of system analysis, group model building and other collaborative techniques along with principles of New Institutional Economics, the FFWS enables a process of transdisciplinary collaboration to design fit for purpose implementation mechanism for water security projects and strategies. This process involves all relevant public, private and community actors key for implementation and enables the translation of strategic water security plans into clearly phased hybrid infrastructure clusters that can be absorbed by formal public investment planning processes and then translated into several financially viable or even bankable deals making use of a blended finance approach (Altamirano 2019a, page 7).

The complete process could be split into two main phases. The first phase aims at defining the governance mode and funding strategy of the preferred water security strategy (step 1 and 2). The funding strategy refers to the sources of revenue, indicating who will ultimately pay back the investment; which in very general terms are either taxpayers or users. Depending on the nature of the service(s) being offered within a local context, the main sources of revenue may be taxes, tariffs or transfer. In general, the more public nature of the economic good, the higher share of revenues is expected to come via taxes; and the more private the more value one expects to capture via tariffs or user fees.

The main services to be provided by the project and made possible by the asset created by the investment and how these services are considered in a particular context in terms of the type of good of economic good (i.e. public or common goods versus toll or even private goods), are determining factors in defining the institution that will be responsible for the implementation. They will define in general terms the type of governance structure expected to be best suited to deliver the project and the service(s) derived from it.

In the process of identifying alternative revenue streams to improve the cash profile of water security projects and increase diversification in funding sources, it is important to make a distinction between a) the asset enabling the delivery of a service and the service or services this asset provides to different groups; b) the ownership of an asset and the rights to operate it.

While the economic nature of the asset itself – for example, an ecosystem- may be a common good and it would make sense to keep this asset under public ownership; the services it provides could be considered a private or toll good and it could be decided that temporally the rights to operate this asset could be given to a private party or community through concession rights. This will be explained more in-depth in **section 3.3**.

A **governance mode** refers to the organisational design that enables the transaction. The governance structures for NbS for water security that we have been able to identify through our research in NAIAD range from: a) public procurement contracts, b) privately driven water stewardship investments, c) collective investment schemes up to d) environmental and/or ecosystem markets.

To summarize, both the definition of the funding strategy and governance structure follows the matching logic from TCE. Accordingly, the characteristics of the transaction will define who should pay for it, and which type of project delivery and finance (governance) structure may be best suited to deliver the project in the most cost-efficient way.

The second phase details how to access the required capital to implement the project upfront (financing) and how to best procure or deliver the measures that make part of the preferred water security strategy making use of the competitive advantages of public, versus private or community actors. In this phase, the financing and procurement (public or private) strategy for the projects that make part of the water security strategy are developed.

Two core elements that define the commercial, financial and management business cases and that are worked out in further detail in this second phase are the **cash profile** and **risk profile** of green infrastructure projects, and the relationship between these two. As it will be revisited in greater detail in the following sections, the base for both is a clear definition of a hierarchy of functions, which are delivered by a combination of hybrid infrastructure measures (green and grey) and

complementary non-structural measures that together delivery several key functions (s) and enable the provision of a number of services to different beneficiaries.

The sources of revenues are linked to each of these services, and the implementation costs (i.e. Life Cycle Costs) are also tied to the functions one aims to ensure and the specific levels of services that need to be guaranteed. The higher the levels of services one needs to guarantee, often the higher the LCC will be and depending on the effectiveness of the implementation arrangement – one would also hope the higher the revenue streams will be as beneficiaries may be willing to pay more for higher levels of services.

Financiers – either public or private- that advance the cash required up front to implement the project require a clear indication of how these upfront investments will be recovered by revenue streams (cash profile), and would like to have a good overview of the circumstances where costs might turn higher or revenues lower than expected (risk profile) as well as a clear strategy from the implementing entity on how they plan to deal, mitigate and manage these different risk (risk management plan).

Once risks are identified and assessed and once has a clear risk assessment matrix, it is important to identify which stakeholder and/or organisation may be the best position to manage these risks at the lowest cost and allocate the risk accordingly. The general **risk allocation** principle for Public-Private Partnerships (PPP's) states that risk should be borne by the party (private or government) best able to manage it at least cost. This implies that the optimum risk allocation is not the same as maximum risks transfer to the private sector (Hine, Queiroz and Chelliah 2009). Following this principle, one creates the appropriate incentives for risk management and provides economic efficiency in terms of reduced valuation or those risks.

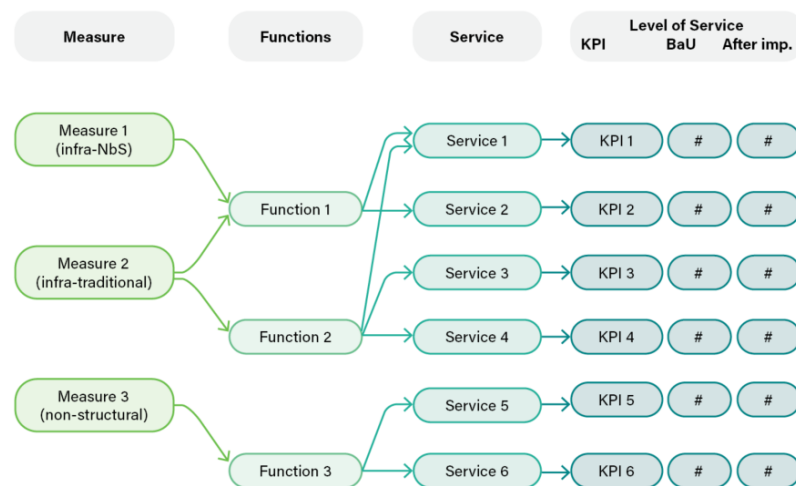


Figure 3. The commercial and financial business case: hierarchy of functions and related cash profile of project

Regarding the delegation of the delivery of public services or the operation and maintenance of common good resource to the private sector; for which different Public-Private Partnerships types of contracts may be used; it is important to state that for their successful implementation an **enabling environment** is crucial. More information about the main elements of an enabling environment for PPP's can be found in **Chapter 4**.

In this second stage, one develops a detailed financing and procurement strategy. The design of the procurement strategy is one of the most challenging and crucial elements in defining the success of the project. The most difficult task is to arrive at a balanced and acceptable sharing of responsibilities, risks and rewards together with the private sector (Altamirano 2010). Meanwhile, when opting for **Public-Private Partnerships** one must bear in mind that to successfully conclude a PPP project is a challenge. An effective design of the contract before the project start is crucial since often there is little more for a Public agency to do than ensure that all involved parties comply with their contractual commitments (Estache et al., 2000).

Procurement strategy and financing strategy are closely interlinked. Some forms of procurement make easier the unlocking of private finance. For example, if one opts for the use of PPP contracts; in most cases, the financing – not necessarily the funding- becomes the responsibility of the contractor. The most common form of finance for PPP and/or infrastructure projects is project finance. **Project finance** is a type of finance that is based upon the projected cash flow of the projects, rather than the balance sheets of its sponsors (i.e. mother companies of the Special Purpose Vehicle created to execute the project). Usually, a project finance structure involves several equity investors, known as 'sponsors', as well as a 'syndicate' of banks or other lending institutions that provide loans to the operation. Often these are non-recourse loans, which as explained before, are secured by the project assets and paid entirely from project cash flow, rather than from the general assets or creditworthiness of the project sponsors. The decision of the financiers is therefore supported by a great degree by financial modelling, where the cash and risk profiles of the projects under a number of scenarios are modelled to calculate the project **Internal Rate of Return (IRR)**, **Net Present Value (NPV)**, as well as the SPV expected **Debt-Service Coverage Ratio (DSCR)**.

While the involvement of the private sector in the delivery and even the financing of public services may secure important efficiency and sustainability gains, these can only be materialized if the different layers of the **institutional environment** (e.g. regulations) and the **contract design** are somewhat coherent and create the right incentives for the private sector – the agent- to act as much as possible towards the benefit of the government commissioning the works, so-called the principal. There is after all an intrinsic tension between the interests of both; as private entities aim at maximizing profits which may drive them to minimize efforts; while public institutions aim at maximizing impact for society, which may require higher levels of efforts.

Finally, it is important to point out that as explained at the beginning of this chapter; the analysis and choices of governance structure, funding, financing and procurement are enabled and constrained by the **institutional environment**. The institutional environment can be conceptualized as a layered structure of rules, created by institutions that change at a different pace. It ranges from long-lasting informal rules embedded in cultural codes of interaction to formal institutions codified in written codes enforced by political, juridical and bureaucratic organisations. Therefore, the choices in funding and governance structure, as well as financing and procurement strategy need to be based on a deep understanding of institutional constraints and enablers.

1.3 The five cases for investment in water security and their enabling environment

For water security programmes and/or projects to access funding, it is necessary to justify why the proposed investment optimizes the use of scarce public and/or private funds. Equally necessary, is to provide evidence that shows that the proposed investments in hybrid solutions and their procurement, will optimise the **Value for Money (VfM)**. In short, the case for investment needs to be made.

In the FFWS to further specify the investment case for public and/or private investments, we adopt the so-called “five case model”. The Five Case Model is the approach for developing business cases recommended by HM Treasury, the Welsh Government and the UK Office of Government Commerce. It has been widely used across central government departments and public sector organisations over the last 10 years and it is considered a best practice in the management of public investments worldwide.

The model states that the investment case for public investment has five key dimensions: the strategic, economic, commercial, financial and management dimensions, also called cases. A more in-depth explanation of the model is presented in **Chapter 3**.

A fundamental element for the development of the five cases is the design of a suitable implementation arrangement for each water security project and/or cluster of projects. By designing an implementation arrangement, the strategic and economic causes of the so-called “preferred strategy” in IWRM terminology or the “preferred option” in public sector investment practices, can be further worked out to make the commercial, financial and management case.

For the specific case of NbS and water security strategies, the strategic case requires the **project proponent** to make explicit how their initiative contributes to the reduction of key water risks in the short and long term. A clear diagnosis of the problem and quantification of present gaps in

terms of levels of service is required to make the “case for change”. In other words, the urgency and need for the investment need to be specified.

Additionally, to justify the investments in water security versus other public spending priorities, the promoters of the project need to frame their proposed investments within the larger socio-economic and development agendas of the city, region or country where the funding is to come from. This is called the “**strategic fit**”.

Once it is made clear why an investment needs to be made and how the proposed programme and new paradigm of water management contribute to the sustainable and resilient economic development of a community or society, they need to advance further in building the economic case¹ for these investments. The development of the economic case often involves the consideration of different options and concludes with a selected set of investments. In IWRM, these investments are called “preferred strategy”, while in the public sector investment these are called “preferred option”. They prove to be cost-effective in achieving the strategic goals defined in the strategic business case.

Once the **preferred water security strategy** has a clear scope and there is enough evidence that the benefits outnumber the associated costs, the FFWS further supports the NbS proponents in elaborating the commercial, financial and management case for these investments.

The FFWS guides the NbS proponents in a process of selection and design of an implementation arrangement. By considering the transaction or project characteristics (financial and technical), the level of service required over time and the institutional setting, they can come to a shortlist of the most effective implementation arrangements. In this process, they are guided by several steps (see **Figure 9**) that enable them to continuously develop the evidence for the five cases iteratively.

Guided by key questions and a repository of good practices worldwide (**Textbox 3**), the proponents of hybrid solutions can choose from a wide range of project delivery and finance options. This range varies from purely public governance options up to the creation of regulated markets for private initiatives and innovative business models to emerge (see **section 3.10**).

¹ For the development of the economic case in NAIAD we refer to the methodologies developed in Work Package 4; deliverables 4.1, deliverables 4.2 and 4.3; available in the project website: <http://naiad2020.eu/media-center/project-public-deliverables/>

Textbox 3. Repository of good practices

Repository of good practices for the choice and design of implementation arrangement (e.g. wastewater treatment plants, mangroves, etc.)

- **Revenue generation (funding) and financing mechanisms** that fit different transaction types and/or institutional settings
- **Contractual and project delivery arrangements** that fit different transaction types or the preferences of the agencies tasked with implementing the projects.

The result is the evidence for the five cases along with a selection of the implementation arrangements with the highest potential for effective project and service delivery. In other words, effective implementation arrangements need not only to ensure successful delivery of the investment project -within time and budget- in the short term but most importantly guarantee sustainability in service delivery in the long term.

1.3.1 The strategic case

The strategic case starts with the assessment of the “**strategic fit**” of the strategy proposed. This refers to the extent to which the proposed strategy is aligned with the strategic drivers, policy priorities and enabling conditions at the institutional level. A necessary step, therefore, is to work in clarifying the scope of the preferred solution(s) in terms of the type of measures; and continuing with the quantification of the level of service expected under a **business-as-usual scenario (BaU)** versus after implementation of the strategy.

In the context of the unfolding water and climate crisis, where we are realizing that our traditional economic development paradigms have driven us into exponential growth in vulnerability and environmental impact, the strategic case requires an assessment of the project transformative potential. In other words, a key element of the strategic case is the project or programme “**theory of change**”.

In the context of water security programmes and within the FFWS this step requires not only a comprehensive illustration of how and why a desired change in a given context will be achieved through the NbS programme but also how the investment programme is expected to contribute and drive a paradigm shift. A paradigm shift in our economic models towards low-carbon and climate-resilient development can be achieved by transforming the way we expand our cities, our infrastructure networks, food systems and our economies in general. In cases when this new paradigm is already underway, the investment programme needs to show how it further enhances it in the long term.

The FFWS methodology assumes that an effective place to start in driving this shift is by challenging the way we invest and rethinking our (infrastructure) investment planning processes in the public and private sectors alike. This includes, among others:

- **Changes in project origination and project preparation procedures.** Traditional project generation processes along with weak institutional settings may result in investment programmes focused on solving yesterday urgent challenges, little inclusive and without a strategic long-term and system perspective.

Table 1. Intake and assessment of the strategic case for water security investments

1. STRATEGIC CASE PREFERRED SOLUTION ALIGNMENT WITH PRIORITIES AND ENABLING CONDITIONS		MODULE
CRITERIA	Self-assessment questions	
Clarity of Solution Scope	Solution scope of the preferred strategy Is there a clear solution scope for the preferred strategy? are the measures and their typology included in the preferred strategy clear enough to be explained to all stakeholders? (yes/no)	1.1
Paradigm shifting potential	Theory of change: Is there a clear theory of change that explains the difference in system dynamics between the BAU situation versus the situation after the implementation of the preferred water security strategy? (yes/no)	1.2
Solution impact versus BAU	Are levels of service quantified for BAU and solution? (yes/no)	1.3
	Are these levels of services plotted and characterized over time? (yes/no)	1.4
Strategic fit: alignment with government priorities, strategic drivers, and wider policy context and enabling institutional environment	Enabling conditions: Have cultural values, standards, regulations, and policy priorities driving or hindering the implementation of the preferred solution been identified and analysed? (yes/no)	0.1
	Stakes, supporters and opponents Is there a general stakeholder analysis of supporter and opponents? (yes/no)	0.2
	Capacity levels and social capital and goodwill between the public, private and community stakeholders: community: is it clear whether the involvement of private, public, and third sector in the delivery of water security and associated services (e.g., water supply, protection, quality) is perceived as desirable? (yes/no)	0.3
	Role of the insurance sector: Is there a clear role for the insurance sector in (driving) the implementation of the programme/project/water security strategy? (yes/no)	0.4
	Inventory of funding and financing sources: has an inventory of potential public and private sources of funding and/or financing been realised? Have existing financing facilities and financing instruments been identified (yes/no)	0.5

- **Planning at watershed scale for effective Climate Risk Management.** *“As promoted by the Task Force on Climate-related Financial Disclosures (TCFD)² as well as the High-level expert group on sustainable finance (HLEG)³ the environmental externalities caused by investments as well as the climate risks these investments are subject to, need to be considered when deciding what to invest on. Considering that most impacts of Climate Change will be channelled through the water cycle (World Bank 2016), project origination should ideally follow from a strategic planning process that considers the dynamics of the water cycle, **the watershed as a planning unit** and the role of **healthy ecosystems as buffers** that protect us against extreme events.” (Altamirano 2019, p.3)*
- **Recognising the catalytic role of water:** Water as connecting stream between so many sectors (energy, food, health) holds a great risk and a great opportunity. Water can be used as leverage⁴ for impactful and catalytic change.
- Recognizing healthy **ecosystems as buffers** against climate variability and extreme events and conceptualizing them as **critical infrastructures**.

The **theory of change** as graphical representation shows how the preferred strategy alters existing vicious circles compromising water security and the sustainable development of the region and creates and/or reinforces existing virtuous circles. The theory of change is the main building block for structuring a convincing narrative of change that triggers commitment between all stakeholders benefiting from the solution and increases their willingness to financially support the intervention.

1.3.2 The enabling environment

The strategic case and more specifically the **strategic fit** are further strengthened with an institutional analysis. The FFWS institutional analysis focuses on a thorough assessment of the **enabling environment** for the successful implementation and financial sustainability of the proposed NbS strategy. As is presented in greater detail in **NAIAD Deliverable 5.6: Report on the comparative institutional analysis and methods and guidelines** and supported by formats **0.1 to 0.5** in **Appendix B**; this step requires between others:

² More information on TCFD available here: <https://www.fsb-tcfd.org/>

³ More information on the HLEG available here: https://ec.europa.eu/info/publications/sustainable-finance-high-level-expert-group_en

⁴ In **section 5.4** an example of this different process of investment origination applied in the city of Semarang as part of the Water as Leverage for Resilient Asian Cities program is presented.

a) **Enabling conditions and incentives gap:** an analysis of all the incentives and disincentives created by formal and informal institutions towards NbS uptake. The four-layer scheme of Williamson (1998 and 2000) proves particularly useful in this respect.

b) **Stakes, supporters and adversaries:** stakeholder analysis, identification of their interests and position towards a change in the **business-as-usual scenario (BaU)** and between alternative solutions (green or grey) being proposed for the water challenges they face.

c) **Capacity levels, social capital and goodwill between the public, private and community stakeholders:** identification of all actors relevant for implementation along the entire NbS asset lifecycle, analysis of the strengths of the public sector, private sector and community actors and trust levels and bonds between them.

d) **Role of the insurance sector:** analysis of the incentives created by national insurance and reinsurance schemes towards the active involvement of the insurance community and private asset owners in general in the mitigation of water-related disaster risks. An important source of information for this section is to be found in **NAIAD Deliverable 8.1: Mapping Insurance value in EU Policy frames Study Report**.

e) **Inventory of funding and financing instruments:** here a scan is made of existing economic instruments and other mechanisms to generate funding for the implementation of the strategy from both public and private sector sources. An inventory is made of existing financing instruments and financing facilities that could enable the financing of the implementation or even of advanced feasibility and project preparation activities. The analytical framework used to assess the potential of alternative sources funding and financing mechanisms to close the implementation gap for NbS for water security has been developed by Deltares and is presented in greater detail in NAIAD deliverables **Deliverable 7.1: Natural Capital Market interaction portrait: From Climate Finance to Insurance**. Key lessons are presented in **section 3.6.3** Also, a worldwide database of pioneering examples of both financing mechanisms and financing facilities has been developed and a selection of cases are presented in the **annexes 6.2 and 6.3 within Deliverable 7.4: International good practices in financing**. In **Appendix A** the format that can guide a quick identification of these instruments is presented in **B.0.5 Inventory of funding and financing sources**.

1.3.3 The economic case

The economic case aims to define whether it is from a societal perspective worth investing in the preferred strategy, the proposed NbS programme. The development of the economic case for NbS for water security and the required cost-benefits analyses requires, makes use of the methodologies developed in in work package five. These are presented in two main deliverables:

a) **D4.1 General framework for the economic assessment of Nature-Based Solutions and their insurance value**, b) **D4.2 Costs of infrastructures: elements of a method for their estimation. Guidelines for the calculation of Life Cycle Costs of NbS.**

Additional to the analysis carried out based in NAIAD following these two methodological guidelines, the economic case within the FFWS aims to identify the economic sectors and concrete stakeholder within these value chains that are impacted both by the BaU as well as by the situation when the preferred strategy has been implemented.

This allows an economic analysis of higher granularity to define who is losing and who is winning, considering that both scenarios impact productive value chains in the watershed. By undertaking this **“pain and gains” (module B.2.3)** analysis the FFWS enable a first step towards the identification of actors that might be willing to pay for the services generated by the NbS asset. At the same time allows the identification of actors that may need to be compensated if the preferred strategy is to be implemented. **Table 4** details the specific questions to address in the economic case. It also includes the link to the formats (and methodology).

Table 2. Intake and assessment of the economic case for water security investments

2. ECONOMIC VALUE OF INVESTING IN THE PREFERRED STRATEGY OR PREFERRED OPTION FROM A SOCIETAL PERSPECTIVE		MODULE
CRITERIA	Self-assessment questions	
Benefits versus Costs	Qualitative Social Cost-Benefit Analysis Is there a qualitative analysis of the avoided damages, societal benefits and opportunity costs of BAU versus the preferred strategy implemented? (yes/no)	2.1
Job creation potential of NbS strategy implemented versus BAU	Quantitative Social Cost-Benefit Analysis Is there a quantitative analysis of the avoided damages, societal benefits and opportunity costs of BAU versus the preferred strategy implemented? (yes/no)	2.2
	Pain and gains Have the value chains on the watershed, and their dependence on water been analysed? Have specific winners and losers of BAU versus implementation of NbS Strategy been identified? (yes/no)	2.3

1.3.4 The commercial case

The commercial case aims to answer three main questions: a) Is the preferred strategy viable? Is there a supplier or private sector market player who can meet the defined needs and levels of service envisioned? Can the programme or project be implemented in such a way that a deal that achieves value for money can be secured?

In this case, a key element is the outsourcing decision. This also called **“Make-or-Buy Decision”** requires an assessment of the envisioned role of the public and private sectors in the delivery of

the NbS investment programme and associated services. In this step, it is required to assess whether the private sector is capable and interested in assuming services or tasks that the procuring authority and/or authorities may be willing to delegate or would be even willing to undertake these activities on own initiative. The last is the case with unsolicited proposals. Within this case, the contour of the procurement strategy is set, and the first assessment of key contractual issues is also undertaken.

Accordingly, the first step within the commercial case is proposing a mode of governance that seem best suited for governing the delivery of the service(s) and the asset (green or grey) that makes these services possible. For this analysis, we follow the conceptual and theoretical background explained in **section 3.3** and the relationship explained there between the typology of economic goods and governance structures.

As explained in **section 3.5** the modes of governance for the delivery of water services include a way array of options between public procurement, regulated private markets, and networks. Networks may include formal and informal contractual arrangements. Public-Private cooperation or private sector and community-driven collective action and investments in water security can take place through formal contractual arrangements and/or informal (non-binding) arrangements based on community customs and trust.

More specifically investment in NbS for water security and watershed conservation could take any of the following four forms:

1. Public procurement contracts,
2. Privately driven water stewardship investments,
3. Collective investment vehicles, and
4. Environmental and/or ecosystem markets

In most cases, the delivery of water services and NbS projects will involve some degree of public involvement, either through public procurement and/or through market regulation. Given existing market failures in the delivery of watershed conservation investments, we expect that in the short and medium-term the implementation of NbS at scale will require public procurement.

Accordingly, the rest of the commercial case aims at identifying which tasks and risks are best to be assumed by the public authorities or delegated to market players. The risks identified in the commercial case refer to those compromising the successful implementation, sustainable financing and key performance indicators over the entire useful life of the asset. Performance indicators are often an operationalization of the required **level of service** for the service(s) to be provided by the NbS or **hybrid infrastructure assets**.

The final element of the commercial case requires a thorough inventory of private and other non-public organisations capable of assuming specific tasks or activities along the entire public investment cycle or capital project lifecycle and related risks. **Table 5** details the specific questions to address in the commercial case. It also includes the links to formats (and methodology).

Table 3. Intake and assessment of the commercial case for water security investments.

3. COMMERCIAL		MODULE
IS THE PRIVATE SECTOR CAPABLE AND/OR INTERESTED IN ASSUMING THE ACTIVITIES OR SERVICES INVOLVED IN DELIVERING THE PROJECT?		
CRITERIA	Self-assessment questions	
Dependence on the regulation of the commercial activity involved in delivering the services	Characterisation of the transaction Is there a clear understanding of the transaction at hand? Have the capital-intensive elements of the water security strategy been identified? Have the services to be delivered by the asset created/ enhanced by the investment being classified in terms of the type of economic goods (e.g. public, toll or private good)? (yes/no)	3.1
Quality of the procurement strategy	Make-or-Buy Decision Is there a clear understanding of the tasks involved in delivering the water (security) services and who (public sector, private sector or community actors) is best able to assume each of these tasks and associated risks? (yes/no)	3.2
Technical implementation Risks ESG. Risks	Risk profile Is there a characterization of the risks involved in the implementation of measures that make part of the water security strategy, along the entire life cycle? Is there a plan to manage these different risks? (yes/no)	3.3
Private sector interest in implementing and/or investing.	Market sounding Have private and other non-public organisations (e.g. third sector or communities) capable and willing to assume the required activities/tasks and related risks been identified? (yes/no)	3.4

1.3.5 The financial case

The financial case aims to assess to what extent the project is affordable, fundable, investable and bankable. To demonstrate that the project is affordable from the public or private sponsor perspective, the case needs to provide evidence to demonstrate that the **implementation costs**⁷

⁵ Environmental, Social and Environmental risks

⁶ This is to a great degree linked to: a) Dependence of the commercial activity on regulation and its enforcement (enabling environment) and b) Revenue generating potential (Financial case)

⁷ Within NAIAD economic assessment framework implementation costs refer to total lifecycle costs involved in the implementation of the NbS project or cluster of projects included in a Natural Assurance Scheme (NAS)

or **lifecycle costs** are realistic and affordable and that the required funding is available and supported.

Accordingly, the process to develop the case starts with a more detailed identification of the drivers of value linked to specified levels of service that if guaranteed can generate revenues. In generic terms revenue, streams or funding sources for the project can come from taxpayers or beneficiaries through a wide range of taxes (general or earmarked), tariffs and transfers (subsidies). In this step, the identified revenue sources are weighed against implementation costs (i.e. **lifecycle cost** or **total costs of ownership (TCO)**); and these two – positive and negative projected cashflows- define the basis of the cash profile.

Investors assess different investments often using a **risk/reward ratio** that allows them to compare the expected returns of an investment with the amount of risk they must undertake to earn these returns. The **cash flow profile** – adjusted to risks- as explained before is the basis for the analysis of returns on investments, which is the key criteria used by equity and debt investors alike. The financial case makes explicit how the cash flow profile must be adjusted to the risk profile of the project. That means that risks eventually impacting the project (identified previously in the commercial case) are internalized as an extra cost – during construction or operation phases- or reduced revenues. Ultimately, equity or debt investors will calculate their **return on investment (RoI)** based on the adjusted cash profile of the project and the **opportunity cost**, represented by the cashflow discounted at a market rate of interest.

To finalize, the financial case identifies financial gaps and the funding and financing instruments that might be effective in closing these gaps. As it is expected that in most cases there will be a significant financial viability gap when aiming at implementing NbS and water security strategies, within the FFWS an important step is the design of blended finance strategies.

Blended finance strategies for the implementation of NbS at scale make strategic use of concessional and philanthropic sources of finance (i.e. grants) to leverage greater private sector participation and/or mobilize additional sources of finance to emerging markets. Blended finance as stated by the IFC (2018) is a critical tool that can mitigate early-entrant costs or project risks, helping re-balance risk-reward profiles for pioneering investments and enabling them to happen.

An example is the so-called Viability Gap Funding (VGF). This financial mechanism is used by a few governments around the world for the successful completion of projects that are economically justified but not financially viable. VGF involves a transfer in the form of an upfront subsidy or grant given to the private project developer. **Table 6** details the specific questions to address in the commercial case. It includes the link to the format (and methodology).

Table 4. Intake and assessment of the financial case for water security investments

4. FINANCIAL IS THE PROJECT AFFORDABLE, FUNDABLE, INVESTABLE AND/OR BANKABLE?		MODULE
CRITERIA	Self-assessment questions	
Affordability of the solution	Lifecycle Costs Analysis (LCCA) qualitative Is there a qualitative analysis of the implementation costs for the water security strategy/measure; e.g. life-cycle costs, Capital Expenses (CAPEX) versus Operative Expenses (OPEX)? (yes/no)	4.1
Effect on local/regional tax base	Lifecycle Costs Analysis (LCCA) quantitative Have implementation costs (CAPEX and OPEX) been quantified according to the characteristics of the preferred strategy or option over time? (yes/no)	4.2
Revenue-generating potential	Revenue streams (qualitative) Have revenue streams been identified, is there a qualitative analysis of these streams considering a wide range of Taxes, Tariffs and Transfers? (yes/no)	4.3
	Revenue streams (quantitative) Have revenues streams been quantified over time? (yes/no)	4.4
Funding available and or secured	Cash flow profile of the project Has the project cash flow profile been estimated? (yes/no)	4.5
	Financial Viability Gap Have the remaining revenue gap and required of the financial Viability Gap Funding been calculated? (yes/no)	4.6
	Financing Strategy Have high potential funding sources and financing been identified? Has the potential of existing financing facilities and instruments for water security and NbS projects been analysed? Has government funding for the project or concessional funds that can leverage private sector participation been secured? (yes/no)	4.7

1.3.6 The management case

The management case aims to assess whether the investment programme and/or project proposed is achievable. This assessment involves demonstrating that the project sponsor can deliver the project successfully and professionally and has a robust system and processes in place for project and risk management. It is key to count with enough capacity and expertise at both, the public procurement agency and the private or community-based project developer. As it will be explained in **Chapter 4**, here lies also one of the main bottlenecks to the implementation of NbS at a watershed scale. There are few to none suppliers with a proven track record in many regions of the world upon which the public sector can delegate their construction or restoration and the following operation and maintenance activities required to keep the green infrastructure asset working as required to deliver the specified level of service.

In this case, the FFWS aims at supporting the development of robust contractual arrangements to deliver the deal or transaction (i.e. project or cluster of NbS projects) successfully.

This step within the FFWS focuses on the project or cluster of projects that make part of a water security strategy that can be eventually commissioned or outsourced to third parties. In this step, a whole array of **contractual arrangements** is considered. These contractual arrangements are called project delivery and finance models in the infrastructure world. These contractual arrangements are closed between a public authority and a private contractor, a private company investing in the watershed and another party they outsource the project to or even between multiple stakeholders in a watershed.

Therefore, in the first step, the strategic objectives and boundary conditions for the procurement strategy are defined. These include the project sponsor and/or proponent main ambitions and concerns, taking into consideration the already identified stakeholders that play a crucial role or could provide essential resources (Money (\$), Authority (A), Expertise (E) and Networks (N)) for successful implementation and sustained service delivery.

Consequently, the management case makes explicit the allocation of risks, rewards and responsibilities involved in the delivery of the water security strategy and/or NbS cluster of projects. In this allocation, all life-cycle phases per asset created by the investment are considered explicitly. This includes planning, design, build, maintain, operate and monitoring; up to decommission if applicable. Financing can also be in some cases part of the contract scope.

Essential to the management case is to define the implementation strategy per project and/or cluster of projects by defining who contributes to implementation, with which resources and when within the entire life cycle. It is important to clarify that resources do not include only money (for funding or financing) but also expertise, authority and networks/trust. Based on this general perspective, the management case defines the potential procurement strategy, including contract scope, **payment mechanisms** (i.e. financial incentives) and other tendering incentives such as awarding criteria. When complete, the management case provides a comprehensive picture of the (contractual) relationships between multiple stakeholders involved in the delivery of the water security strategies and/or specific measures.

Table 5. Intake and assessment of the management case for water security investments.

5. MANAGEMENT ARE THERE ROBUST CONTRACTUAL AND ORGANISATIONAL ARRANGEMENTS TO SUCCESSFULLY DELIVER THE PROJECT?		MODULE
CRITERIA	Self-assessment questions	
Capacity of (public) agency to procure successfully the project	Procurement objectives and boundary conditions (Ambitions, concerns and key implementation stakeholders) Have the ambitions and contribution of different stakeholders for the sustainable implementation of the water security strategy/ measures been identified? (yes/no) Project delivery and finance model: contract scope, financial and tendering incentives Has a procurement strategy been chosen/design, including contract(s) scope, payment mechanisms and other procurement incentives for all measures involved in the water security strategy? (yes/no)	5.1
		5.2
Monitoring and evaluation systems considered	Implementation strategy per NbS/Cluster Have responsibilities for implementing the water security strategy, considering all life-cycle phase per measure been allocated? (yes/no)	5.3
	Implementation arrangement per NbS/Cluster Have interdependencies between key implementation stakeholders been made explicit? Have formal agreements (e.g., contractual) required between them for the successful delivery and sustainability in service provision been designed/ analysed? (yes/no)	5.4

1.4 Designing the project preparation roadmap

In this section the users of the FFWS are guided in how to design the project preparation process, considering their starting point within the strategic planning process and the maturity of their NbS investment programme or project in terms of the five cases and the intake forms presented before. The complete assessment form is presented in **Appendix A**.

While the water infrastructure and NbS funding gap seem insurmountable, the major constraint for investments in these types of projects is not a lack of finance, but the lack of well-prepared and bankable projects. As stated by the Global Infrastructure Hub (2019) in their blog titled: "Project Preparation – Introduction: Laying the foundations and charting a way forward", *"Inadequate support at the project preparation stage can result in critical projects being scrapped prior to implementation or increasing the cost of implementation to a prohibitive degree. Project preparation, which spans activities from conceptualisation and feasibility analysis to deal structuring and transaction support, is integral to creating bankable projects."* (Global Infrastructure Hub, 2019)

As previously explained, the FFWS is a collaborative and transdisciplinary project preparation approach for water, adaptation and NbS projects contributing to watershed conservation and the reduction of floods, droughts and pollution risks. In this section, practical recommendations are given about how to design and facilitate the project preparation process.

1.4.1 Defining the starting point and facilitation process

The FFWS process starts ideally once the preferred NbS and/or water security strategy has been agreed upon and it is at the solution scope level of detailing. The purpose of the solution scope is to conceptualize the recommended solution or strategy in enough detail to enable stakeholders to understand the impacts of it on their levels of service.

As explained in section one, in the process of strategic planning for water security the so-called preferred strategy is defined within the first three steps: inception, situation analysis and strategy development.

Provided these steps have already taken place and there is a clear “preferred strategy” the FFWS starts with strengthening the strategic case. This is done by appraising the expected impact of the preferred strategy in comparison to a Business-as-Usual or do-nothing scenario, on the wider macro-economic and development goals.

In case the preferred strategy has not been agreed upon, it is recommended to the proponents to engage in formal planning processes and work with the public authorities in charge of these processes and develop this strategy using the adapted planning and implementation framework presented in **Chapter 1**.

In case it is not possible to engage in a formal strategic planning process; another possibility is to carry out a *lite* version of a strategic planning process. This *lite* analysis can follow the indications of a collaborative Theory of Change activity, questioning whether different alternatives lead to the required paradigmatic shift to ensure sustainable and resilient economic development of the communities, city, or region dependent on the selected watershed.

Within the NAIAD demonstration cases, we found that some initiatives did not have the level of solution scope. Therefore, complicating the process to advance towards structuring the commercial, financial and management cases.

In other cases, a single measure within the preferred strategy may have already been implemented as a pilot project. This was the case in the NAIAD demonstration case in Rotterdam, the Netherlands. In this case, the application of the FFWS focused on finding strategies to go from pilot to up-scaling and mainstreaming of the proposed NbS.

To summarise, the starting point for the application of the FFWS may vary. Accordingly, the FFWS methodology presented in this handbook acknowledges that there are multiple maturity levels for water security and NbS initiatives and that the NbS proponent may be connected to ongoing formal planning processes or not.

Consequently, for the effective use of the FFWS process, it is important to assess the starting point of the water security strategy and/or NbS initiative and based on that focus on the most relevant next steps in developing investable and bankable NbS programmes and projects.

To finalize, it is important to clarify that, FFWS is not intended as a checklist or static data collection tool. The application of the FFWS involves a collaborative, medium-term process that engages all relevant stakeholders and trigger commitment between those who are investing and/or those who will profit from water (security) services. Through this process, the five cases are progressively developed from a qualitative stage towards a more quantitative stage. More accurate assessments enable convincing multiple public and private parties to invest financially or in-kind in the implementation of the water security strategy and/or measures.

1.4.2 Developing a collaborative business modelling roadmap

Some general tips to have in mind when designing collaborative modelling workshops and the overall facilitation strategy are:

- Define the **core facilitation team** in charge of carrying out the process. This team would ideally be different from the main responsible for the project (the project owner). This autonomy enables a wider range of action for articulating the NbS promotor interests and the other stakeholders needed for a successful implementation.
- Then, the core facilitation team should structure an intake to identify what a successful outcome is according to the promotor of the NbS and assessing the current stage of **maturity** of the water security strategy and/or NbS initiative. For this assessment, we recommend the use of the self-assessment form for the five cases (**Appendix A**). This serves as a vehicle for collecting data and engaging in an open dialogue with the project owner, identifying also the areas that need further research. An example of this assessment is presented in **section 5.4**.
- In some cases, the water authority is the project sponsor or project proponent. In other cases, the **project proponent** is a private entity or NGO assuming the role of the **project developer**. As has been mentioned before, the key to success is understanding the positioning of these project proponents within the wider institutional setting. Therefore, it is important to identify and make an inventory of the existing concerns of project proponents, project sponsors and ongoing initiatives in the form of programmes, activities and projects that will be implemented by different government layers within the medium and long terms in the watershed or other planning unit being adopted. In these

programmes, regardless of specific financing arrangements, the different sources of funding and types of governance structures are defined.

1.4.3 Designing a collaborative modelling workshop

Important tips for the design of each of the stakeholder engagement workshops are:

- **Choosing a collaborative modelling protocol.** A facilitation process typically takes the shape of a workshop session. Possible workshop activities are detailed in **Appendix B** of this handbook, and its selection should consider the added value for making steps towards the implementation. Therefore, there should be a clear understanding of the step to advance either in defining the governance and funding structure (Stage 1) or defining the financing and procurement structure (Stage 2).
- Bear in mind that project sponsor often know what the most challenging barrier is. A way to reveal and capture that knowledge is by asking: what is a successful outcome at the end of the workshop? Then, make sure you identify a step in the process and tables that are aligned with the idea of success framed by the project owner. After the intake and the first round of data collection, you should aim at structuring a collaborative session with key stakeholders to address the bottleneck.
- Structure the activity around one or two sub-tables, supporting the zoom out - understanding the strategic case of the entire water security strategy- or zoom in process, going in-depth on the processes and evidence required to build the commercial, financial and management business case. Only on a few occasions, you will have the chance to address the complete road towards an implementation arrangement. Consequently, your objective is maximizing the opportunity for building an agreement upon a specific point.
- **Validation of results through interviews.** Ideally, after the workshop, you will conduct ex-post interviews with the actors identified as crucial for implementation. It might be the case that the workshop findings point to an implementation barrier previously not considered. In both cases, ex-post interviews reflecting on workshop outcomes will allow the identification of key concrete next steps towards developing an investable NbS proposition.

1.5 First stage: zooming out and defining mode of governance and funding

The detailed steps for the entire first stage of the FFWS leading to the definition of the governance structure and funding mechanisms for the NbS strategy for water security are shown in **Figure 9**. In this figure, the entire process roadmap is depicted, with the corresponding key sub-questions and/or analyses required to develop the strategic, economic, commercial, financial and management cases at the level required to choose governance structure and funding mechanisms.

In this first stage, the idea is to zoom out to strengthen the strategic case of water security investments. This is done by positioning the NbS water security project or programme in the context of a wider economic development agenda. Accordingly, the first step is to define the **theory of change** in the proposed investment programme.

The **theory of change** explains graphically how the water security strategy contributes to shifting the existing paradigm of economic development that may be detrimental for ecosystem health and vulnerability to climate change or to reinforce a shift already made. The first three steps are accordingly: **B.1.1 Solution scope and measures**, **B.1.2 Theory of change** and **B.1.3 Hierarchy of change and levels of service over time**. In defining these three subcomponents of the strategic case one needs to consider the institutional enablers identified in **B.0.1 Enabling conditions within institutional setting**. After completing these analytical steps, it is advised to carry out the first collaborative modelling session with key stakeholders to validate the theory of change.

The economic justification for investing public resources in the implementation of a water security strategy - including NbS solutions- is based on **social cost-benefit analysis (SCBA)** and a definition of a hierarchy of functions delivered by the strategy. This hierarchy of functions reflects socio-economic priorities linked to the theory of change, SCBA and value chains affected by the water security strategy.

Accordingly, at this stage, it is advised to carry out the following analytical activities: **B.2.1 Qualitative Social Cost-benefit Analysis (SCBA)** and (if possible) **B.2.2 Quantitative Social Cost-benefit Analysis (SCBA)**, and **B.2.3 Pain and gains (value chains)**. In the development of these three analyses, it is important to consider the findings from the stakeholder analysis defined in **B.0.2 Stakes, supporters and opponents**. The definition of functions and the hierarchy can be first informed by expert knowledge and then adjusted and validated by key stakeholders through the organisation of a collaborative modelling workshop.

Considering the findings from these economic and stakeholder analyses it is important to revisit the hierarchy of functions developed earlier in the activity **1.3 Cascade of measures, functions and levels of service**. Additionally, we advise the translation of the preferred strategy into a distinct number of project clusters. **Clusters** refer to groups of measures that due to their complementary in biophysical, functional or financial terms would be best implemented jointly and that could be further analysed as one transaction, investment project or deal.

If clusters are developed, we advise making the subsequent analytical steps for each of these clusters. At this point, it is also advisable to organize a second collaborative modelling session with key stakeholders. The objective of this session is validating the cascade of measures, functions and levels of service in the light of the theory of change, economic analyses and stakeholder analyses.

The functions need to be further formulated in terms of their contribution to the delivery of specified levels of service over time. Here, you are advised to carry out **module 1.3**, to define the levels of service over time. By doing so, the FFWS provides a first narrative of the cost generating activities to deliver the specified service at the level of (e.g. in terms of quality and reliability) at which the beneficiaries would be willing to pay for them and assume all related costs. Additionally, specifying explicitly the required levels of service over time allows for a thorough identification of risks in terms of circumstances that might compromise the delivery of the service at the expected cost and quality.

At this point, you may consider carrying out another collaborative modelling workshop. During this workshop, stakeholders could plot together with the levels of services and gain a shared understanding of how the system and the problems they experience now would evolve if time if the preferred strategy is implemented. Through this process, they can also gain an understanding of the cost generating activities and risks associated with the delivery of the NbS programme or project. These building blocks and shared understanding of the hierarchy of measures and the associated cash flow and risk profile is needed for the second stage of analysis within the FFWS: the development of the programme/project financing and procurement strategies.

To proceed in the project preparation process towards the development of a funding strategy is important to understand first how all the services to be provided can be classified in terms of types of economic goods in the given institutional setting. Based on this **Characterisation of the transaction** it is possible to identify the most suitable family of governance structures for their provision or mode of governance. From this moment on, a shorter list of all possible governance structures are considered and inspiration from good practices worldwide, as well as more detailed guidance for those, can be searched.

The suitability of a governance structure is defined in terms of the potential of this structure to deliver the programme or project effectively, efficiently and guaranteeing long term sustainability

in service delivery. The process of selection follows the logic of Transaction Cost Economics (TCE). As explained in depth in **section 3.3.1**, TCE as developed by Williamson (1981), matches transactions with governance structures. If the transaction has specific characteristics (asset specificity, frequency and uncertainty), then the most efficient governance structure (or mode of governance) for the organisation of such transaction is a market contract, a hierarchy (public or a private firm), or a hybrid (Groenewegen & De Jong, 2008). It is important to add that in this choice it also matters how those services are conceived by the population at large. What is considered a public good in a country may be accepted as a club good in another country. It is a matter of public values and these differ per national, regional or even the local institutional environment.

An overview of the possible types of governance modes possible for the delivery of water and ecosystem services is presented in greater detail in **section 3.3**.

To define which structure is best suited to govern the transaction you are advised to carry out in **module B.3.1 Characterisation of the transaction**. To arrive at a well-informed decision through this analysis we advise to make use of the insights generated through the following modules:

- **Module B.1.3 Hierarchy of change and levels of service over time**
- **Module B.0.1 Enabling conditions within institutional setting**, which contributes boundary conditions for choosing the governance form are given
- **Module B.0.3 Levels of capacity and social capital** whereby identifying the goodwill between public, private and community actors also contributes to choosing feasible governance structures.

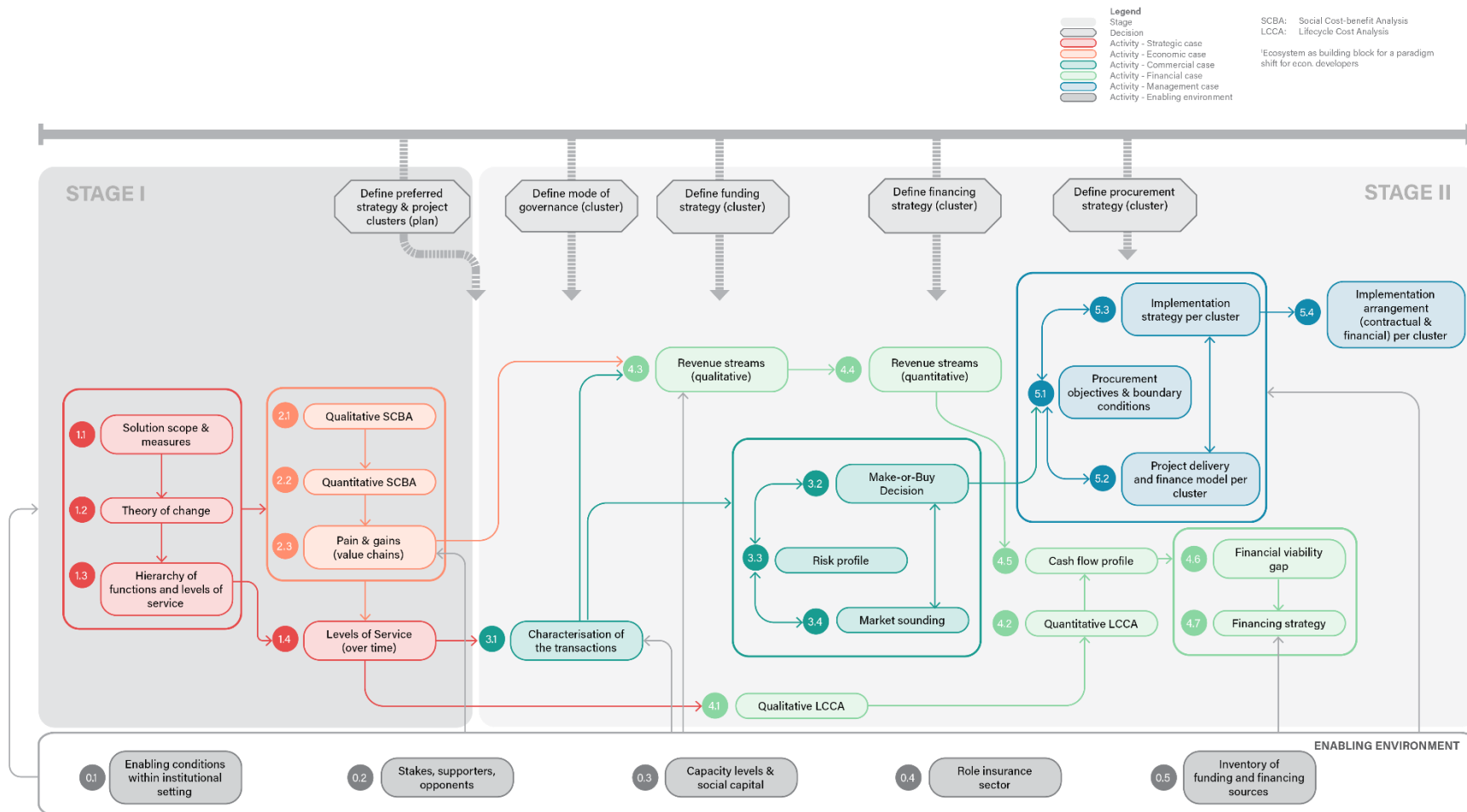


Figure 4. Financing Framework for Water Security project preparation roadmap, including both stage I and II

This process of classifying water and ecosystem services as economic goods also enables the identification of **who** should be ultimately paying for the delivery of the service. This revenue can take the form of **taxes** from citizens, **tariffs** from clients or **transfers** (i.e. grants or subsidies) from regional, national or international organisations. In simple terms, investments can be paid either by taxpayers (taxes and transfers) or by users (tariffs).

To identify possible sources of revenue, you may use module **B.4.3 Revenue streams (qualitative)**. In this process you may use as input the insights from:

- The identification of winner and losers from the economic case in **B.2.3 Pain and gains (value chains)**
- The stakeholder analysis carried out in **B.0.2 Stakes, supporters and opponents**
- The results from the analysis of the role of the insurance sector realized in **B.0.4 Role of the insurance sector**

At this point in the project preparation process, important choices regarding the funding and governance strategy have been made. To the first stage of the FFWS you are advised to organize a collaborative modelling workshop to create commitment between those who will ultimately bear the costs and/or carry direct responsibility for implementing different activities or phases of the projects or clusters of projects that form the preferred water security strategy.

1.6 Second stage: zooming in to develop financing and procurement strategies

The second stage of the FFWS can be seen on the right side of **Figure 9**. Here the main objective is to zoom in into the contractual and financial details that need to be decided so that the project or programme can effectively be implemented. As it will be explained more in detail in chapter 4 while from the economic perspective is an advantage of NbS that they can serve multiple functions and deliver multiple services; from the financial and contractual perspective, the same quality deems these projects risky and difficult to materialize.

The objective of this second stage is precisely to lead the proponents of NbS to analyse the nitty-gritty details of the investment programme or project and supports them in developing a workable financing and procurement structure. Accordingly, as is shown in **Figure 9** several modules guide the process of detailing the commercial, financial and managerial case.

Please note that this second stage mainly applies to projects or clusters of projects that for their implementation could be framed as projects. The **project sponsor** for these investment projects could be either public authorities, private actors, cooperatives or an association of them that

together act as the principal or commissioner of the project. What is important is that the **transactions** (i.e. NbS/water security measures) that needs to be implemented has the typical characteristics of a **capital project**. As such these projects could also be financed through **project finance** or corporate finance, in addition to traditional direct public finance.

In practical terms this means that this second stage can support the development of specific transactions or capital-intensive projects funded by any of the governance structures possible for NbS projects: public procurement contracts, privately driven water stewardship investments, collective investment vehicles or environmental and/or ecosystem markets.

Again, in this case, some of the modules could be advanced through collaborative modelling workshops that build commitment from all crucial stakeholders around choices made. As in the choice of governance mode and financing strategy, the choices to be made regarding the financing and procurement structure need to be aligned with the institutional enablers and constraints identified through the analysis of the institutional environment.

One of the first key steps to define the financial and procurement structure is the development of the project risk profile. An overview of the risks typically phased by infrastructure projects – especially when implemented as PPP making use of a project finance scheme - is presented in **Table 8**. For detailed instructions on how to develop a project risk profile go to 3.3 Risk profile in **Appendix A**. To advance towards the risk profile definition you are advised to further clarify the stages of the project and related activities, based on the graphical representation of the different project stages developed in **B.1.4 Levels of service (over time)**.

After a thorough identification of risks per project phase, you are advised to develop a risk management protocol and define the most appropriate response to the identified risk. Be aware that risks can also be related to the institutional environment and the organisational and implementation capabilities of different actors assuming responsibilities in the delivery of specific tasks and services. Accordingly, in the characterisation, we advise you to consider as input the findings from:

- Enabling institutional conditions within the institutional setting
- Stakes, supporters and opponents
- Capacity levels and social capital

Additionally, as the insurance sector plays an important role in carrying the risk associated with specific project events, it could be of added value for the development of the risk management protocol and the choices regarding the transfer of some risks to take into account the findings from **module B.0.4 Role of the insurance sector** regarding the role of the insurance sector in the management of disaster risks in specific jurisdictions.

Table 6. Risks in PPP projects per project phase (Source: Carbonara et al 2015)

PROJECT DEVELOPMENT PHASE	CONSTRUCTION PHASE	OPERATING PHASE	TRANSFER PHASE
Pre-investment risk Site risks Land use and acquisition/resettlement and rehabilitation risk Site condition Site preparation Financial closure risk (project finance) Design risk	Construction risks Cost overruns Delay in completion Failure to meet performance criteria	Operating risks Operating cost overruns Delays or interruption in operation A shortfall in service quality Revenue risks Changes in taxes/tariff Demand/usage risk	Asset service level risks
PROJECT LIFE CYCLE			
Financial risks -Interest rate increase -Exchange rate -Debt servicing risk		Force majeure risks Regulatory/political risks -Changes in legislation -Political interference	

This thorough assessment of project risks and alternative lays the foundations for an informed process of **risk allocation**. In this step is decided whether the project owner retains project responsibilities in-house, transfer or share these responsibilities with other organisations (**B.3.2 Make-or-Buy decision**). These tasks are delegated usually to organisations with minimum levels of technical expertise and a proven track record with similar projects.

In the development of the commercial case you also need to specify the actual capability and interest of different market players or professional organisations to execute specific tasks. This can be done through a **Market sounding**. A market sounding exercise also has the additional advantage of providing expert insights into implementation costs and risks, by which you may discover either the risks you had overlooked or design variations not yet considered.

A correct risk allocation, making responsible for the delivery of certain project tasks and associated risks trustworthy parties – organisations with a proven track record - reduces the perceived risk by investors and/or financing institutions. Therefore, you are advised to carry out: **B.3.3 Risk profile**, **B.3.2 Make-or-Buy decision** and **B.3.4 Market sounding** as iteratively as possible.

At this point, you may consider carrying out a new collaborative modelling workshop. The workshop main objective is to conduct a market sounding, facilitating an open discussion between the project sponsor(s) (e.g. procurement authority or company in a watershed) and the market players that could act as implementing parties. The objective is to assess market interest and capacity to implement the project or programme as structured by this point.

The second key element to define the financial and procurement structure is the **cash flow profile** of the project. Its definition is relatively straight forward, yet it requires intensive data collection and analysis. All positive cashflows (revenues) and the negative ones (capital and operative costs) for the entire infrastructure lifecycle need to be estimated. While one can start with a qualitative indication of lifecycle costs (**B.4.1**) and revenues (**B.4.3**) a more accurate assessment of the financial viability gap (**B.4.5**) and the project cash flow profile (**B.4.6**) demands a quantitative Lifecycle Costs Analysis (**B.4.2**) and quantitative estimation of revenues (**B.4.4**). The project **Cash flow profile (B.4.6)** makes possible the calculation of the **internal rate of return (IRR)**, which is the indicator used by commercial investors to assess the attractiveness of an investment opportunity⁸.

The process of developing a financing strategy and associated mechanisms and structures requires the calculation of the **Financial viability gap (B.4.5)** and the results from the inventory **of funding and financing instruments (B.0.5)**. As explained in further detail in **section 3.6** multiple instruments can be used to finance the planned investments. Each of these instruments makes use of different contractual mechanisms, and different finance providers make use of different evaluation and awarding criteria. In the development of a financing strategy, within the FFWS approach, we adopt the concept of blended finance. The application of a blended finance approach enables the combination of different sources of funding and financing, from multiple ministries or government agencies, as well as from different private players. In this way budget sources aimed at investments in different sectors; e.g. conservation finance and infrastructure finance could be combined to make possible the implementation of a hybrid infrastructure cluster.

Important co-financing sources for water security in the context of a changing climate are the global special funds for Climate Adaptation and/or Disaster Risk Reduction such as the Green Climate Fund (GCF) and the Global Environment Facility. The first overview of these instruments and their suitability to finance NbS is presented in **section 3.6.3 of NAIAD D7.1** as well as in **Appendix B** in the formats **B.0.5 Inventory of funding and financing sources** and **B.4.7 Financing strategy**. However, it is important to mention that a well-designed financing strategy requires often expert and contextual knowledge to identify the opportunities to unlock public and private financing. The bottom line is that the clearer the internal return on investment and expected socio-environmental impacts, the easier to mobilise financing.

⁸ Usually investors demand a risk adjusted cash profile, which includes the price for the risk identified. This is a complex operation that require expertise difficult to replace by written guidelines. In our opinion, it is enough to present the cash profile and risk profile to decision-makers. This first indication can be the basis of a more detailed financial engineering task for which we have not included detailed instructions in this version of the FFWS.

The development of a procurement strategy per project or project cluster lays its foundations on the project **Risk profile (B.3.3)**, **Make-or-Buy decision (B.3.2)** and **Market sounding (B.3.4)**. The development of the procurement strategy goes hand in hand with the development of the management case and is where the commercial case is further detailed. Hence, you might need to revisit the commercial case as you further structure the management case.

The first step in the development of a procurement strategy is the identification of the goals and ambitions that project sponsors would like to achieve per project or project cluster. Then one can move to the analysis of the main contribution of different stakeholders during the planning, design, construction and operation and maintenance phases (**B.5.1**). It is important to consider in this analysis again the boundary conditions created by a given institutional setting:

- **B.0.1 Enabling conditions within the institutional setting**
- **B.0.3 Levels of capacity and social capital**
- Stakes that different actors have on the matter, and the list of expected supporters and opponents (**B.0.2**).

Furthermore, during this process of allocating tasks and responsibilities for the implementation one also needs to consider the choices made during the **Make-or-Buy decision** modules (**B.3.2**) and the findings from the **Market sounding** exercise (**B.3.4**).

Then you need to carry out further analysis per project or cluster of projects. Clusters or projects are projects that packaged in a single deal and therefore considered as the unit for the commercial analysis.

Per project or cluster of projects, you are advised to define how to bundle the different activities, tasks and lifecycle phases involved in the sustainable delivery of specified services. The choice could be for a completely integrated and performance-based contract, or more traditional, output-based smaller contracts. In this process also the financial and procurement incentive is defined by choices in the payment schemes and awarding criteria and processes (**B.5.2**). Based on this chosen **scope of contract** you may revisit once again the role of different actors in the implementation of each project or cluster of projects (**B.5.3 Implementation strategy per cluster**). Notice also that the specification of stakeholders' roles along the entire lifecycle may result in changes on your previous choices realized in **B.5.1 Procurement objectives and boundary conditions (Ambitions, measures and key implementation stakeholders)**.

Finally, all choices regarding contractual and financial mechanisms to be applied to implement a project or cluster, are presented in a single matrix (**B.5.4**). Considering that the analyses realised in **B.5.1**, **B.5.3** and **B.5.4** were carried out for a single measure or project cluster, you may need to repeat the process for all the clusters that make part of the preferred water security strategy.

The complete set of projects or deals defined by the procurement strategy (**B.5.2**) represents the project pipeline that can be tendered in the short, medium and long term. If properly prepared and structured, these could attract the interest of either project developers willing to implement them – and possibly invest equity- and/or of financing institutions wanting to invest in water security. The later could provide finance to either the public or private sector sponsors of the projects.

2 DEVELOPING AN NBS STRATEGY: WATER RESOURCES PLANNING

2.1 Introduction

For the effective design of implementation arrangements for NbS strategies for water security or the “how”, it is crucial to develop a clear understanding of the “what” NbS strategies for water security are. Implementation choices can only be made, based on a sound understanding of the transaction or project being proposed. In other words, the “what” or more specifically so-called “preferred strategy” to achieve water security needs to be defined first.

Accordingly, in this section, we present the planning process involved in developing a water security strategy and explain in further detail the role of NbS in achieving water security. We also introduce key concepts regarding water security, Integrated Water Resources Management (IWRM), river basin planning and NbS, and clarify their relationship.

To finalize a strategic planning and implementation process aimed at increasing the uptake of hybrid green-grey infrastructure strategies and the implementation of water security strategies, in general, is proposed. The relationship between the water resources planning process proposed by the Framework of Analysis and the Financing Framework for Water Security is clarified.

In this section, we also give a short introduction to a central concept in NAIAD, the so-called “Natural Assurance Schemes” (NAS).

The FFWS, IWRM and NAS share the goal of contributing to a water and climate secure future by considering the true value of water, water risks and water-related ecosystems to our economies. They differ on the emphasis they put in different phases of the planning cycle and the degree of operational guidance they offer in turning water security strategies into investable propositions. The FFWS distinct contribution is in making operational in public and private investment decisions the insurance value of ecosystems. This is done by supporting the development of implementation arrangements that support the internalization of the resilience dividends in the development of strategic investment pathways on both the public and the private sector.

2.2 Planning for water security: Water Resources Planning

2.2.1 Defining water security

The OECD report, *Water Security for Better Lives* (OECD, 2013), proposes a fundamental shift in our approach to tackling water security, applicable to both OECD and non-OECD countries. Achieving water security objectives means maintaining acceptable levels for four water risks:

1. Risk of shortage (including droughts): lack of sufficient water to meet demand (in both the short- and long-run) for beneficial uses by all water users (households, businesses and the environment)
2. Risk of inadequate quality: lack of water of suitable quality for a particular purpose or use
3. Risk of excess (including floods): overflow of the normal confines of a water system (natural or built), or the destructive accumulation of water over areas that are not normally submerged
4. Risk of undermining the resilience of freshwater systems: exceeding the coping capacity of the surface and groundwater bodies and their interactions (the "system"); possibly crossing tipping points and causing irreversible damage to the system's hydraulic and biological functions.

2.2.2 Integrated water resources planning

Integrated Water Resources Management (IWRM) is one of the system-thinking approaches that emerged in the 1990s to enabling planning for water security. Ever since the 90s, it has been applied in many contexts and regions of the world. The systems approach helps in resolving the dominant siloed approach to water management and public investments in many countries and regions.

Integrated Water Resources Management (IWRM) is defined by the GWP as a process that promotes the coordinated development and management of water, land, and related resources to maximize the resultant economic and social welfare equitably without compromising the sustainability of vital ecosystems (GWP, 2011). This strategic approach to basin planning (ADB, 2013) is characterised by:

- Considering the trade-offs between alternative economic, social and environmental objectives. Where basins have become heavily developed, it is no longer possible to meet all water demands.

- Recognising the importance of aquatic ecosystem functioning in providing goods and services for social and economic development, as well as natural infrastructure resilience to change sophisticated environmental requirements.
- Giving much important to first understanding basin interactions. As a range of hydrological, ecological, social and economic systems and activities take place within a basin and make use of the water resources of the basin, a comprehensive understanding of the interactions and causal relationships between these systems (and their elements) is critical before one engages on basin planning.
- Requiring a robust scenario-based analysis. Basin planning typically addresses uncertainty in future development and climate, by assessing the challenges and opportunities associated with alternative hydro-economic scenarios. This allows for strategic prioritization and trade-offs.
- Requiring multidisciplinary teams to jointly consider the role of water in the economy and society.

The ultimate objective of an IWRM plan is reaching water security.

2.2.3 The framework of Analysis for Water Resources Planning⁹

The process of Water Resources Planning or Strategic River Basin Planning as proposed by IWRM requires a comprehensive, systematic and transparent process in constant collaboration with the region's planners, decision-makers, and the interested and affected public (Loucks van Beek 2017, p.568). As each water resources system is unique, the application of any planning and analysis approach needs to address the particular issues of concern in that system as well as to adapt to the political environment in which decisions are made.

A water resource planning study generally comprises five general phases, as illustrated in **Figure 5**. Although the use of any rigid framework is not recommended, a few distinct phases and activities can be recognised and used to structure the analysis as a logical sequence of steps. The description of these phases, the activities in them and the interactions among the activities in them, is referred to as the Framework of Analysis. A coherent set of models is typically used for the quantitative analyses aimed at identifying and evaluating alternative beneficial measures and strategies.

⁹ This section is based on Chapter 13 Project Planning: Putting It All Together from Loucks, D. P., & Van Beek, E. (2017). Water resource systems planning and management: An introduction to methods, models, and applications. Springer.

A decision process is not a simple linear sequence of steps but involves feedbacks to earlier steps. Part of the process is thus iterative. Communication and interaction with the decision-makers are essential throughout a planning project and the implementation of the selected development. Decision-makers and stakeholders should be involved in each of the five (idealised) stages of this framework.

Stakeholder involvement brings both knowledge and preferences to the planning process—a process that typically will need to find suitable compromises among all decision-makers and stakeholders if a consensus is to be reached. The framework involves a series of decisions at the end of each stage. The **divergence–convergence** process for involving stakeholders in decision-making on the five analysis stages is illustrated in the rhombus approach of **Figure 5**. These stages are:

1. Inception: The stage of the process identifies the subject of the analysis (what is to be analysed and under what conditions), the objectives (the desired results of the analysis), and constraints (its limitations). Based on this analysis, during which intensive communication with the decision-makers is essential, an agreement on the approach for the remainder of the analysis needs to be achieved. The results of the inception stage can be presented in an inception report, which includes the work plan for the other phases of the analysis.

2. Situational analysis: in this stage, the tools for the analysis of the water resource system are selected or developed. Major activities in this phase typically include data collection and modelling. The models will be used to quantify the present and future problems in the system. Scenarios will be developed to describe the future boundary conditions for the system. Identifying and screening alternative decisions can occur in this phase. If possible, no regret measures will be identified for immediate implementation.

3. Strategy building: In this stage alternative strategies will be developed and discussed with the decision-makers/stakeholders. This will include adaptive management elements to ensure that the preferred strategy is sufficiently robust and flexible in case the future develops differently than expected.

4. Action planning: in this stage, the selected strategy will be prepared for implementation. An implementation plan will be developed that describes what will be done, by who, how it will be financed, etc. This stage often requires also additional work on components of the strategy (such as feasibility and design studies), and environmental impact assessments (EIA). Promotion of the selected strategy is needed to “sell” the proposed measures to the public. Finally, institutional arrangements will have to be made to ensure a smooth implementation.

5. Implementation stage: in this stage, the actual implementation is expected to take place. The so-called preferred strategy that results from the planning process is always an optimal

combination of structural measures (green and grey infrastructure) and non-structural measures to manage water supply and demand and water risks; such as Early Warning Systems, Operational Water Management Systems and economic and legal instruments.

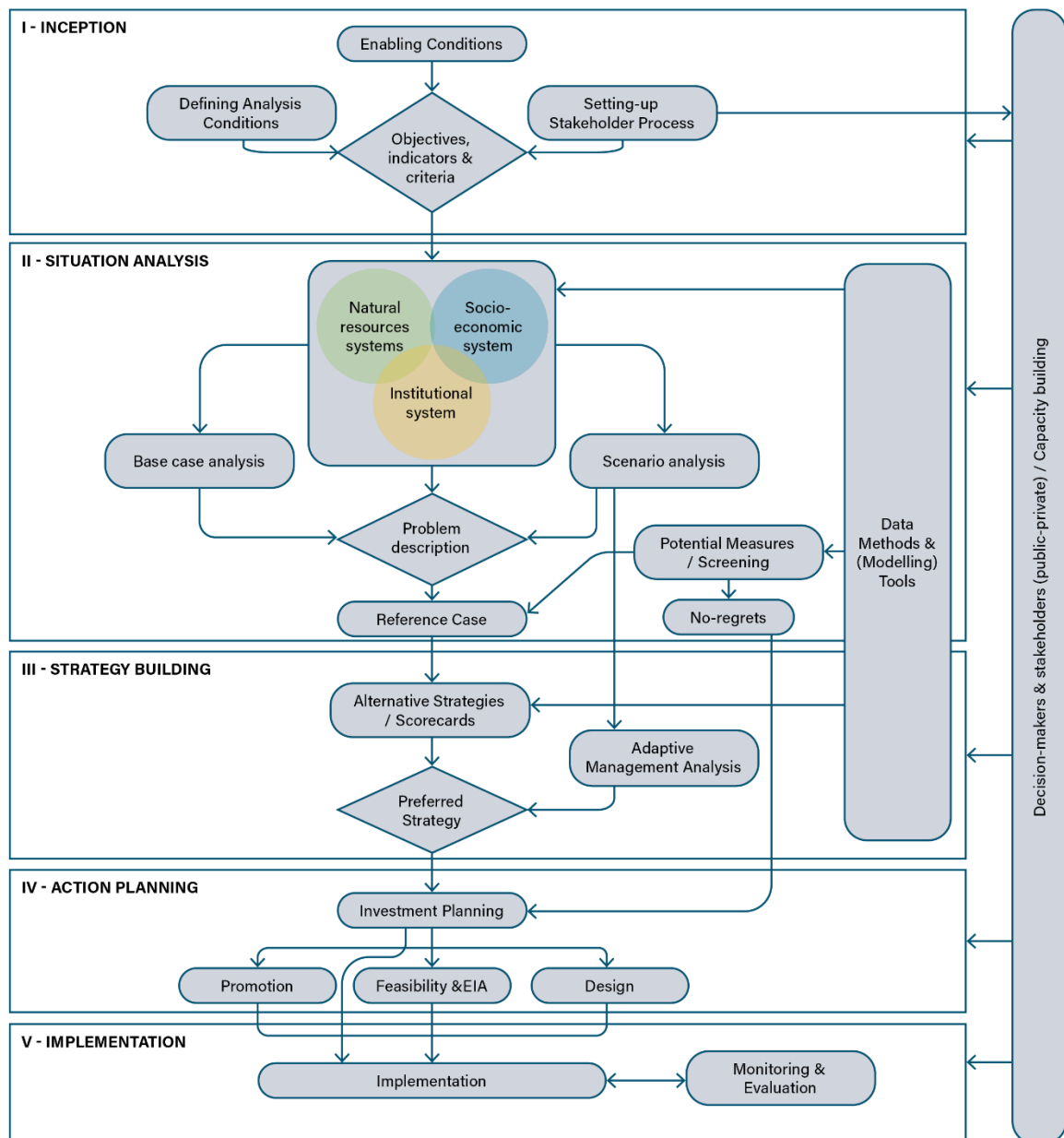


Figure 5. Framework for analysis and implementation of water resources projects (Source: Louck and van Beek, p. 577)

2.3 Closing the gap between adaptive and investment planning: Developing an investable water security planning strategy

The Financing Framework for Water Security (FFWS) aims at closing the implementation gap in levels of concreteness and project preparation between strategic adaptive planning and investment planning. This is done by enabling more intensive transdisciplinary collaboration, involving intensively the private and financial sector right from the start of the planning process, keeping in mind implementability and bankability criteria right from the beginning and allowing for an iteration between the “what” and the “who” and “how” of each of the solutions proposed.

With the development of the FFWS, we have enriched the existing framework of analysis of Luck and Van Beck with additional steps. These steps increase the chances of implementation of the preferred strategy by developing investable water security propositions.

The additional proposed steps intend to bring to the analysis financial and implementation-related constraints to the start of the water resources planning process. This aims to improve the long-term financial sustainability of the final selection of measures. This can be achieved by involving as early as possible the private sector and other actors who have crucial knowledge and resources for the successful implementation of the different measures. In addition, we stakeholders could be engaged on a two-way and open communication about their needs and wants, as well as their willingness to contribute to the implementation. Their contribution could be through their effort or in-kind contribution or through payments for the services to be delivered if the strategy is implemented. Accordingly, we propose some additional analyses already in phases I, II and II.

The resulting graphical representation of this enriched planning and implementation framework is presented in **Figure 6**, where all the green coloured blocks are the additional analytical and process steps we propose which is part of the FFWS. The additional steps recognize the specific challenges involved in the implementation of NbS and hybrid solutions at system scale. Moreover, they enable the translation of the preferred strategy into clear hybrid infrastructure clusters.

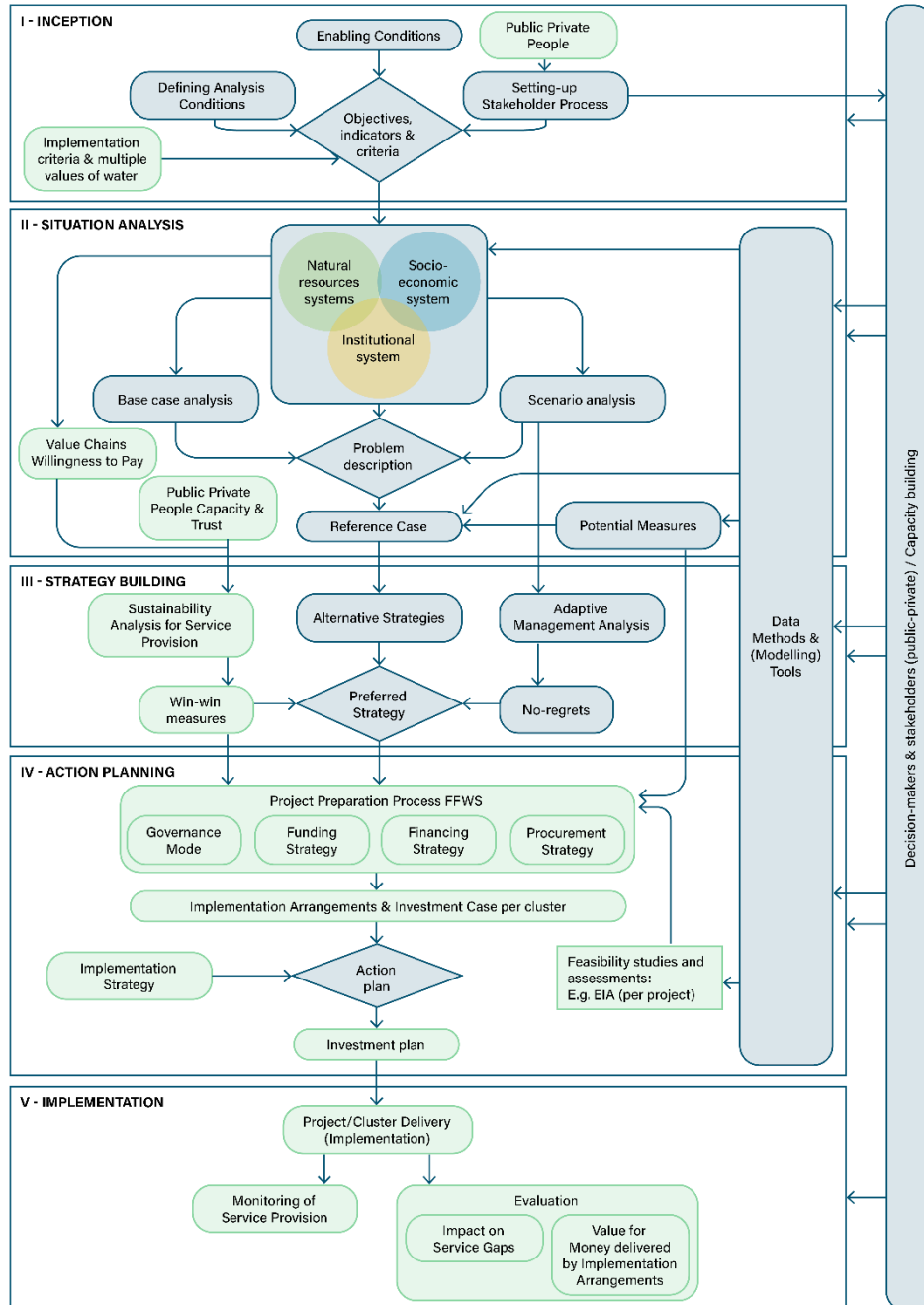


Figure 6. Framework of Analysis: integrated water security planning and implementation framework (Adapted from Louck and Van Beck, 2017)

Some of the additional steps presented in **Figure 6** are:

- **Objectives and criteria, enriched with implementation criteria and considering the multiple values of water:** besides all the objectives and criteria of the authorities undertaking the plan and the stakeholders in the watershed, criteria that capture key implementation related success factors need to be considered. These could include key criteria used by the private and the financial sector in their decision to fund and/or implement a measure. These could be discovered by adding additional intake questions, like who is likely to be the problem owner for different water challenges, which assumptions or minimum requirements are adopted by the institutions driving the planning process need to be considered as they are important pass/fail criteria for the implementation of measures. All in all, considering these criteria may increase the clarity of the strategy and the process to implement it, shared commitment to implementation by participants and agencies involved, support for implementation by all government layers and financial means and expertise available for implementation.
Finally, in the final selection of criteria to be included as part of a Multicriteria Analysis, it is important to take into consideration the multiple values and meanings of water to all groups in society, not only the economic value of water but also the cultural, spiritual and emotional values. For more information read the Bellagio Principles on Valuing Water¹⁰.
- **Setting-up stakeholder process taking into account all relevant Public, Private and People** actors and defining stakeholders not only by their vicinity or direct stake in the current situation but also by their capacity to bring additional solution options and means to the planning process. Important means are not only authority and funds, but also expertise and networks.
- **Value Chains and Willingness to Pay:** it is important to identify the different productive value chains and analyse their composition (e.g. many small farmers versus few large ones), the pains they experience in the Business as Usual situation and their willingness to pay for improvements in current levels of services.
- **Public, Private, People capacity and trust:** analyse current role, strengths and future potential of the public sector, the private sector and community agents, as well the enabling environment for private sector participation and investments in water and sanitation, climate adaptation and resilience; including social capital and trust between all key actors for implementation.

¹⁰ Available at:

https://sustainabledevelopment.un.org/content/documents/15591Bellagio_principles_on_valuing_water_final_version_in_word.pdf

- **Sustainability analysis for service provision:** analysis of measures in terms of their feasibility to be successfully implemented as well as on their strengths in terms of ensuring financial and institutional sustainability for continuity in service provision in the long term.
- **Win-win measures:** analyse and identify measures that have the highest potential for co-financing, by analysing the gains they may deliver to different actors in the watershed productive value chains and economic sectors.

Once the preferred strategy has been chosen, already considering these implementation constraints, one can go into detail in applying the FFWS project preparation roadmap per project or cluster of projects (see section 1.4). The relationship between the planning steps and chain of decisions as presented in the Framework of Analysis and the Financing Framework for Water Security process to develop the five business cases that justify investments is presented in **Figure 7**.

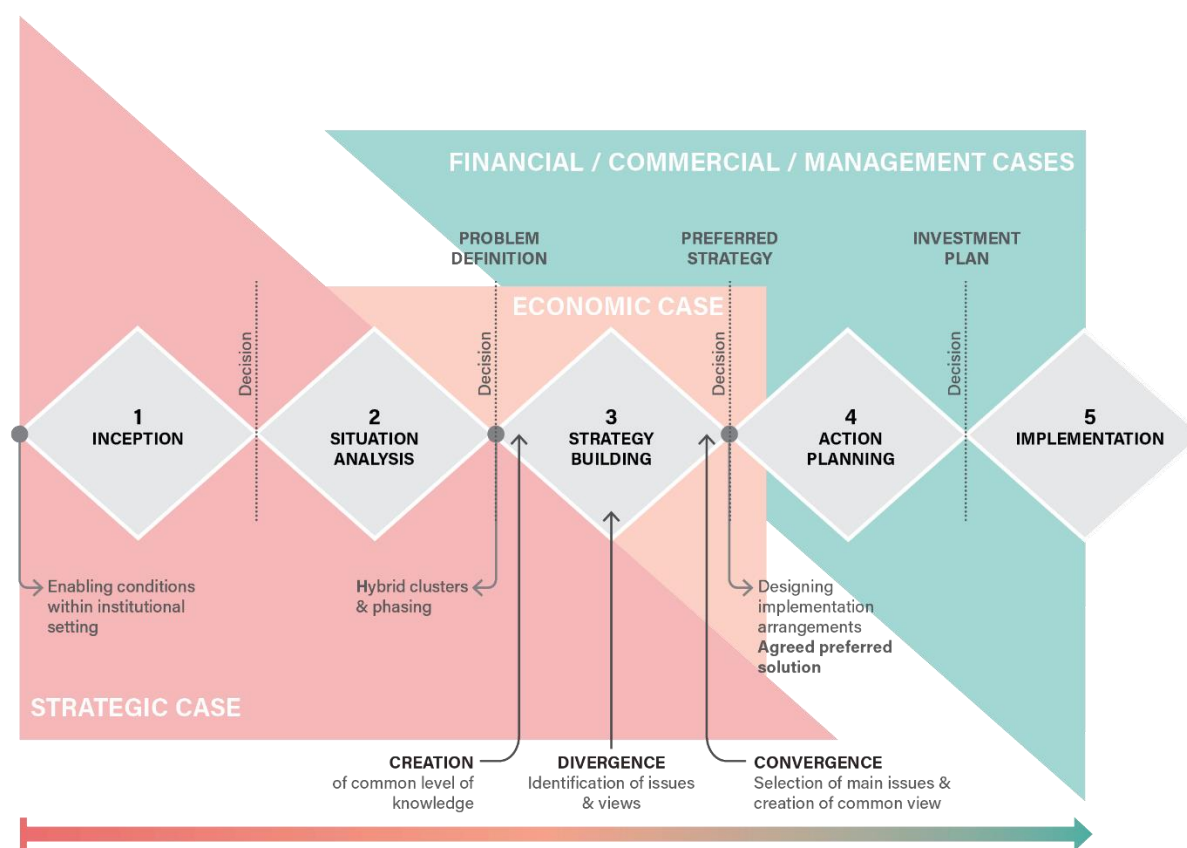


Figure 7. Master planning process according to the Framework of Analysis and the FFWS integrating the five business cases (Adapted from Altamirano, M. A., 2018)

With the FFWS we propose an approach that engages the (infrastructure) financing community and the proponents of green infrastructure strategies for water security in the process of designing project delivery and finance arrangements that fit the characteristics of hybrid projects. The process involves all relevant public, private and community actors key for implementation and enables the translation of strategic plans (e.g. Integrated Water Resources Management -IWRM-plans) into clearly phased hybrid infrastructure clusters that can be absorbed by formal public investment planning processes and then translated into several financially viable or even bankable deals making use of a blended finance approach.

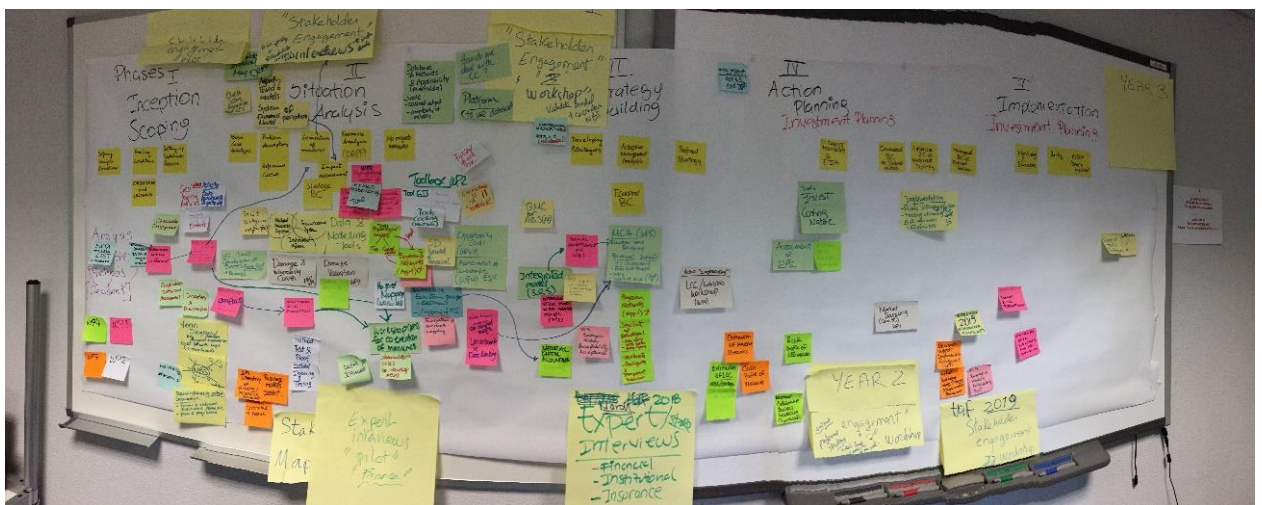


Figure 8. Demo roadmap to support stakeholders in closing the implementation gap, combining different disciplines and tools during developed in NAIAD WP Leaders and DEMOs Leaders meeting Madrid, April 25, 2017.

This project preparation process to close the gap between adaptive planning and investment planning requires intensive transdisciplinary collaboration and the use of various methodologies to generate the evidence required for the five cases: the strategic, the economic, the commercial, the financial and the management cases. As was shown earlier in **Figure 4**, the entire roadmap from inception until implementation has been a central element of our approach in NAIAD. In **Figure 8** one can see the contribution of all different disciplines and work packages to this strategic planning for water security roadmap, as it resulted from a collaborative modelling exercise facilitated by the authors during the second General Assembly in Madrid in 2017.

2.4 Nature-based Solutions and their role in Water Security Strategies

In this section, we explain the relationship between water security strategies and Nature-based Solutions (NbS).

2.4.1 NbS and hybrid (green-grey) infrastructure strategies

An alternative “Nature-based” or “Building-with-Nature” engineering approach has emerged in the last decade. This approach is characterized by the enriching of the traditional infrastructure planning process with green and hybrid (green and grey) solutions along with traditional grey infrastructure. Green infrastructure is defined by the World Bank (2019) as a subset of NbS that intently and strategically preserves, enhances, or restores elements of a natural system to help produce higher-quality, more resilient and lower-cost infrastructure services.

Green infrastructures, also called natural infrastructure in Latin America, are multi-functional and adaptive, making them a promising and robust long-term solution. Due to their characteristics, they can contribute to climate adaptation as well as to climate mitigation. They can provide a cost-effective approach to address deep uncertainty related to climate change by avoiding or delaying lock-in to capital-intensive infrastructure, allowing for flexibility to adapt to changing circumstances (OECD, 2013). **Table 7** presents examples of hybrid water security strategies, that combine both NbS and traditional (grey) infrastructure.

Table 7. Hybrid strategies for water security (World Bank and World Resources Institute 2019, page 5)

SERVICE	GREY INFRASTRUCTURE COMPONENTS	EXAMPLES OF GREEN INFRASTRUCTURE COMPONENTS & THEIR FUNCTION
Water supply & sanitation	Reservoirs, treatment plants, pipe network	Watersheds: improve source water quality and reduce treatment requirements Wetlands: filter wastewater effluent and thereby reduce wastewater treatment requirements
Hydropower	Reservoirs and power plants	Watershed: reduce sediment inflows and extend the life of reservoirs and power plants
Coastal flood protection	Embankments, groynes, sluice gates	Mangrove forests: decrease wave energy, storm surges and reduce embankment requirements.
Urban flood management	Storm drains, pumps, outfalls	Urban flood retention areas: store stormwater, reduce drain and pump requirements
River flood management	Embankments, sluice gates, pump stations	River floodplains: store floodwaters, reduce embankment requirements
Ecological and agricultural practices	Barrages/dams, irrigation and drainage canals	Agricultural soils: increase soil water storage capacity and reduce irrigation requirements

2.4.2 Nature-based Solutions and Natural Assurance Schemes versus IWRM strategies

The European Commission defines **Nature-based Solutions (NbS)** as “Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions.”

The H2020 NAIAD project focuses on NbS for water security and works with two main concepts: The **Insurance Value of Ecosystems (IVE)** and **Natural Assurance Schemes (NAS)**. NAS refer to a risk management system and institutional arrangement where the Insurance Value of healthy ecosystems is captured. Under a NAS, the integrated contribution of natural infrastructure to Disaster Risk Reduction is valued in the context of an identified growing need for climate robust infrastructure. NAS refers to Disaster Risk Management Strategies that “capitalize on the services provided by fully functioning ecosystems” (Denjean et al., 2017, p. 25) and the increase in systemic resilience they offer to our socio-economic systems given ecosystems function as buffers that help regulate and protect us from extreme weather or climate events. Comparing these different concepts make us conclude the following:

Firstly, there is a great overlap between the elements of an IWRM strategy and NbS as defined by IUCN, when also non-structural measures to manage demand are included.

Secondly, as the focus of NAIAD is on NbS for water security and IWRM strategies the main objective is to achieve water security, it is possible to adopt the Framework of Analysis (FoA) and the Financing Framework for Water Security (FFWS) without major methodological challenges. The types of measures considered in NAIAD and IWRM plans show a great overlap.

Thirdly, to be able to go more in depth into specificities of ecosystems as buffers against risk and operationalize the IVE, when developing implementation arrangements and understanding the financial business case of NbS measures, we will give special attention to the structural sub-set of NbS called “green infrastructure”; where we adopt the World Bank (2019) definition introduced before.

Finally, as the FFWS aims at ensuring financial sustainability and sustainability in service delivery for all types of water security measures; while we will consider NAS arrangements as high potential options to capture the IVE, a wider range of governance structures and implementation arrangements will be considered. Having in mind that the objective is to close the financial viability gap of NbS projects we will consider all the benefits and services that ecosystems provide as of equal importance. In other words, we will go beyond disaster risk reduction benefits and consider in the design of an implementation arrangement local specific drivers for implementation and

value generation. This may well result in an implementation arrangement where continuous services provided by ecosystems such as the provision of higher quality water provide the main source of funding and play a decisive role in the design of the required contractual arrangements.

2.4.3 Typology of policy instruments to achieve water security

The strategies for reaching water security include a wide range of non-structural and structural measures, one of which is biological components or green infrastructure.

For the FFWS, **Table 8** defines the measures to be considered in the Financing Framework and introduces the different typologies. It is important to point out that, usually, most project preparation efforts are needed for measures that are capital intensive and involve the creation or enhancement of a physical asset (green or grey infrastructure or technological devices) that will also require operation and maintenance expenses over time. Nevertheless, every case should be examined by their right and per case decide which elements will need more analysis. In some cases, the main implementation challenge may be to achieve behavioural change, and so more attention will have to be devoted to non-structural measures such as the design of economic instruments.

Table 8. Typology of policy instruments required to achieve water security in IWRM plans

IWRM TYPE	DEFINITION	SUBTYPES
Promotion of economic reconversion (Non-structural)	Aims at providing new livelihood options to local actors that make poor use of water resources in their existing activities. It also includes financial incentives that enable the population to adopt sustainable behaviours.	Economic incentives and subsidies for activating a sustainable economy
		Investments in infrastructure networks for economic development (e.g., roads for increasing eco-tourism)
		Technology (adoption) projects that improve water use, at the individual/firm-level for improvement in water demand (reduction)/ water supply (increase). E.g., drip irrigation
Market-Based Instruments (MBIs) or Economic Instruments (Non-structural)	MBIs and economic instruments aim to trigger the adoption of more sustainable behaviour and practices; as they affect the cost/benefit ratio of alternative actions.	Tradeable offsets and permits to negotiate with each other and agents to ensure overall compliance, without this being necessarily enforced on all producers at the same level.
		Taxes, charges, and fees are potentially useful policy instrument to influence private behaviours towards public objectives.
Institutional strengthening (Non-structural)	Aiming at behavioural change, either by raising local capacities of key implementing institutions, raising awareness and/or enforcing regulations.	Capacity development to enhance the know-how of key actors and institutions in the watershed
		Awareness-raising by communication or socialization campaigns that increase population awareness about the value of water and the urgency of mitigating increase water risks, considering also the resilience dividends of ecosystems. The overall aim is to increase stakeholder support for the implementation of water security and NbS strategies.
		Binding formal rules to specify the behaviour required of organisations or individuals enforced by law.
		Soft regulation options, including self-regulation and co-regulation, technical standards, recommendations, d) open method of co-ordination and information.
		Other institutional measures, including the enforcement of existing rules, community empowerment, intersectoral coordination, organisational reforms and plan development.
Information, Warning and Monitoring Systems (Non-structural)	The set of capacities needed to generate and disseminate timely and meaningful information to enable individuals, communities and organisations threatened by a hazard to prepare and to act appropriately and on time to reduce the possibility of water risk.	
Traditional infrastructure (Structural)	Measures based on physical and chemical processes, involving the delivery or management of an asset required for the development of water resources.	
Green Infrastructure (Structural)	Green infrastructure is a subset of NbS that intently and strategically preserves, enhances, or restores elements of a natural system to help produce higher-quality, more resilient and lower-cost infrastructure services (World Bank, 2019).	
Hybrid Infrastructure (Structural)	Combinations of traditional and green infrastructure that work in synergy to deliver several specified water and risk mitigation services.	

3 THE FINANCING FRAMEWORK FOR WATER SECURITY: THEORETICAL AND CONCEPTUAL BACKGROUND

3.1 Introduction

This chapter is intended for readers less familiar with institutional economics, project finance, engineering design theory and public procurement and investment planning processes in general. The main objective of this section is to introduce these users to the theoretical framework and conceptual background on which the FFWS is based.

As previously explained, the FFWS is a collaborative and transdisciplinary project preparation approach for water, adaptation and NbS projects contributing to watershed conservation and the reduction of floods, droughts and pollution risks. The FFWS is based on the conceptual framework for cross-national lesson drawing on Public-Private collaboration for project delivery and financing of infrastructure networks developed by Altamirano (2010). Accordingly, it builds on a combination of economic theories (Agency theory, New Institutional Economics, Old Institutional Economics and Evolutionary Economics), with Engineering Design Theory, Engineering Asset Management and System Analysis techniques. The methodological innovation undertaken to support the development of innovative financing mechanisms for NbS for water security has been in enriching and tailoring this model to generate the evidence required to build the “five cases” for public investments. The five cases model is the approach used for appraising public investment by HM, the UK Treasury Department.

3.2 Principles of the Financing Framework for Water Security

The FFWS aims to contribute to financial sustainability in the delivery of water services by driving innovation in investment origination and project preparation processes. In concrete terms, the FFWS aims to strengthen the theory of change of water security investments as well as enable innovation in the project delivery and finance options considered to deliver water security projects. In general terms the FFWS adopts a New Institutional Economics perspective on environmental issues (Menard 2011, Menard and Shirley 2018).

3.2.1 Delivery and financing of water services

In guiding the choice of a fit for purpose implementation model that ensure sustainable financing two main aspects need to be balanced. On the one hand the need for cost recovery through

higher collection rates (OECD, 2016) and on the other hand the fact that water and sanitation are basic human rights (UN, 2016).

The overall envisioned outcome is sustainable provision of water services through sustainable financing. In this context innovative project delivery and finance mechanisms the framework support in developing, are not a goal in themselves but simply means towards the sustainable enjoyment of water and sanitation services leaving no one behind. Innovative project delivery and finance mechanisms are means, not goals.

Accordingly, the principles the FFWS adopts regarding delivery and finance of water services are the following:

- a) Focus on service delivery and not project delivery. Therefore, if during the analysis the sustainability of the measure is challenged due to the constraints in resources for its implementation and maintenance over time, other design options may be considered that optimize levels of service over time. In an equal manner, the allocation of risks and responsibilities need to cover the whole life cycle of the measure and/or asset.
- b) Blended Finance approach to financing public goods – considering innovative mechanisms being developed in the Innovative Financing for Development (Addis Ababa Agenda) and the Climate Finance communities and in line with the 2030 SDG Agenda.
- c) There is no silver bullet in implementation arrangements. There is no implementation and governance arrangement that would be effective in all contexts, even for the same type of measure and/or project. The success of a specific arrangement, its implementation and its monitoring depend on how this arrangement relates to the suite of institutional arrangements within which it sits. The implementation arrangement is embedded in a specific institutional environment and its effectiveness is highly dependent on the presence or absence of an enabling environment.
- d) Funding strategy is dependent on economic nature of services being provided: different types of measures given their main goal, the nature of the service (e.g. private versus public) they aim to provide, and their risk and cash profiles will require different funding strategies.
- e) A mix of structural and non-structure measures is required: achieving water security requires structural measures that aim to change the performance of the water system as well as non-structural measures that aim to change the behaviour and practices of stakeholder that exacerbate water risks.

- f) Risk allocation: assign responsibilities, risks and tasks to the stakeholder best able to implement and manage them in the most (cost) efficient way; acknowledging the complementary strengths of the public sector, private sector, NGO's and community-based organisations.

3.2.2 Development of blended financing arrangements

Within the FFWS the development of bankable and/or investable water and climate adaptation projects is supported by a unique action research approach (Altamirano, 2018) in which the cash and risk profiles of projects are improved by:

- a) Bridging different worlds of expertise, making use of collaborative modelling techniques to create a shared understanding of the system dynamics between different sectors and disciplines (e.g. Project Finance, Water Resources Management, Ecology and others). Through this process sound technical, biophysical and socioeconomic assessment of the system can be developed and the problem(s) the investment programme and/or project is supposed to alleviate are made clear. As it is explained later, through this process a clear Theory of Change for the proposed - water security or NbS- investment programme is developed.
- b) Blending different sources of funding and financing – a deep understanding of the drivers of water risks and the multiple benefits of the proposed strategy is a sound start point for the development of a blended finance strategy that mix different thematic concessional funds (ODA Water, Climate Finance, Conservation Finance, and others) and then in a synergetic way stimulate the creation of private markets. The blended finance (OECD and WEF 2015, OECD 2018) approach is central to mobilize private capital flows to emerging and frontier market and leverage greater private sector participation.
- c) Advocating for a nexus approach to National Investment Systems: Developing innovative cross-sectoral PPP's and multi-functional infrastructure – that enable capturing the value of significant externalities of water security investments
- d) Introducing climate risk management considerations in PPP schemes and infrastructure investments to incentivize private sector investments of financial and technical resources in the improvement of infrastructure networks resilience,
- e) Developing social business models at the local and/or community level to reduce national funding gaps for the maintenance of structural and non-structural adaptation measures; and
- f) Embracing the possibilities of technological innovations into shaping existing institutional and governance constraints, such as Fintech and Blockchain.

3.2.3 Innovation in investment planning cycle and deal origination

The FFWS methodology assumes that an effective place to start in driving a paradigm shift in our economic models is by challenging the way we invest and rethinking our (infrastructure) investment planning processes in the public and private sectors alike. This includes, among others:

- Changes in project origination and project preparation procedures. Traditional project generation processes along with weak institutional settings may result in investment programmes focused on solving yesterday urgent challenges, little inclusive and without a strategic long-term and system perspective.
- Planning at watershed scale for effective Climate Risk Management. *"As promoted by the Task Force on Climate-related Financial Disclosures (TCFD)¹¹ as well as the High-level expert group on sustainable finance (HLEG)¹² the environmental externalities caused by investments as well as the climate risks these investments are subject to, need to be considered when deciding what to invest on. Considering that most impacts of Climate Change will be channelled through the water cycle (World Bank 2016), project origination should ideally follow from a strategic planning process that considers the dynamics of the water cycle, the watershed as planning unit and the role of healthy ecosystems as buffers that protect us against extreme events." (Altamirano 2019, p.3)*
- Recognising the catalytic role of water: Water as connecting stream between so many sectors (energy, food, health) holds a great risk and a great opportunity. Water can be used as leverage¹³ for impactful and catalytic change.

Recognizing healthy ecosystems as buffers against climate variability and extreme events and conceptualizing them as **critical infrastructures**.

¹¹ More information on TCFD available here: <https://www.fsb-tcfd.org/>

¹² More information on the HLEG available here: https://ec.europa.eu/info/publications/sustainable-finance-high-level-expert-group_en

¹³ In Chapter 5 an example of this new investment origination and planning process realized in the city of Semarang as part of the Water as Leverage for Resilient Asian Cities program is presented.

3.3 Funding and financing strategies

3.3.1 Funding versus financing

It is important to highlight here the difference between funding and financing. On the one hand, funding refers to the question of who ultimately will pay for the investments made. Financing on the other hand refers to mustering the up-front resources needed to be repaid over time by the funding. Funding could come from three generic sources: taxes, tariffs and transfers or so-called the 3Ts. The concept of the “3Ts”, developed by the OECD (2009), has become a common way of approaching debates on the financing of water services; especially concerning the water supply and sanitation (WASH) sector.

Financing could make use of a variety of instruments such as loans, bonds and others. Funding and financing mechanisms can be both, public or private. The new blended finance approach brings the option to mix and blend all these different options and public and private flows of capital. **Blended finance** is defined by the OECD as “the strategic use of development finance and philanthropic funds to mobilize private capital flows to emerging and frontier markets” can help in mobilizing private financing for Climate Adaptation.

Accordingly, in the format, we have developed to make an inventory of financial instruments we make a distinction between public and private funding and financing mechanisms, both of which could be channelled to end beneficiaries through specific financing facilities.

As it is shown in **Figure 9**, the objective is to reduce the funding gap and improve the long-term financial sustainability of water security measures by reducing transfers (e.g. subsidies and grants from donors or other government layers) and increase domestic resources by collecting more taxes and tariffs. In an EU context, transfers refer to the use of Structural Funds and Cohesion Funds and in the context of developing countries refer often to Official Development Assistance (ODA).

Depending on the type of project and whether the project sponsor is public or private, a variety of financing instruments could be used. In the graph below we show for illustration a variety of innovative financing instruments for Climate Adaptation and DRR (Altamirano2020), and in the module 4.7 Financing strategy of **Appendix B** one could find a more complete menu of funding and financing options that can guide the search and design of a funding and financing strategy

What the 3Ts concept states in simple terms is that all water financing is based on a cash flow made up of Tariffs, Taxes (subsidies) and Transfers (from aid or philanthropy). These cash flows are used to pay back for capital expenses (CAPEX) as well as for operational expenses (OPEX) involved in the implementation of a project or cluster of projects and the continuous provision of related water and/or other ecosystem services. In practice, the use of future cash flows to secure

upfront investments is widely employed in the infrastructure world. This type of financing is called **project finance**.

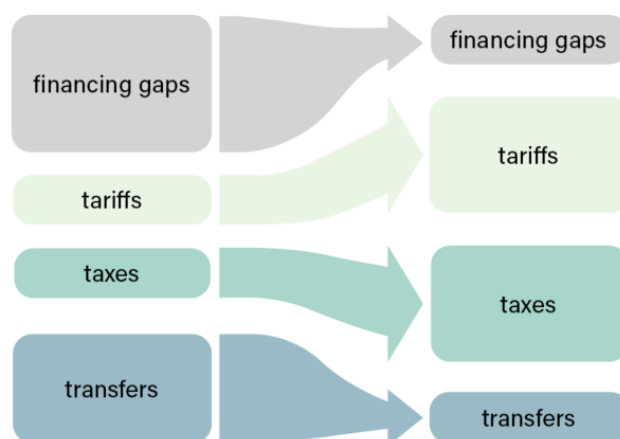


Figure 9. The 3Ts role in closing the financing gap for water security (Adapted from Catarina Fonseca, 2015)

3.3.2 Asset versus services the asset provides: the ecosystem versus ecosystem services

As explained before, in the process of identifying alternative revenue streams to improve the cash profile of water security projects and increase diversification in funding sources, it is important to make a distinction between a) the asset enabling the delivery of a service and the service(s) this asset provides to different groups; b) the ownership of an asset and the rights to operate it. While the economic nature of the asset itself – for example, an ecosystem- may be a common good and it would make sense to keep this asset under public ownership; the services it provides could be considered a private or toll good and it could be decided that temporally the rights to operate this asset could be given to a private party or community through concession rights. This will be explained more in-depth in **Chapter 3**.

Especially in the context of NbS and green infrastructure the application of this principle requires that when classifying the type of economic good a clear distinction is made between the asset (i.e. the ecosystem being created, conserved or enhanced by the project) and the services (i.e. ecosystem services) the asset makes possible to deliver. Below two examples:

- Most freshwater ecosystems (e.g. lakes and ponds, rivers, streams, springs, bogs, and wetlands) could be considered a common resource which means that governmental

involvement, in general, will be prominent. However, that should neither prevent the introduction of user fees for specific services provided delivered by these ecosystems (e.g. fee per m³ of raw water delivered to a utility) nor preclude private sector involvement in the management and operation of these ecosystems for the delivery of specific services.

- A forest required for the provision of erosion management services is a common resource itself that requires public ownership in some cases, the erosion management services it gives to for example hydropower companies could be considered a private economic good and tariffs could be required for that service.

3.3.3 Identifying funding and financing sources for Nature-based Solutions

An approach to document and analyse the potential of alternative funding and financing mechanisms for NbS for water security as well as a worldwide database has been developed as part of the FFWS and is presented in greater detail in NAIAD deliverables **Deliverable 7.1: Natural Capital Market interaction portrait: From Climate Finance to Insurance** and the annexes 6.2 and 6.3 within **Deliverable 7.4: International good practices in financing**. However, we presented here the most important elements.

The approach for the identification of financing opportunities builds on the methodology developed by the authors for the Dutch Disaster Reduction Team and tested in DRR missions in Peru, Ecuador and Costa Rica (Altamirano 2016). The basics of this methodology further tailored for NbS and adapted to NAIAD goals are explained below.

To identify the possibilities for implementation of NbS for DRR and water security as proposed by our project, it is key to understand the funding and financing options (e.g. funds available and financing instruments), as well as the rules of the game in the public and the private financing spheres. Additionally, given the climate adaptation, green, infrastructure and DRR nature of these measures it is important to understand the local relevance of climate, DRR, conservation and infrastructure finance dedicated funds.

Firstly, we conducted a literature review based on which developed a menu and typology of funds and financing instruments that make part of each pillar in the private and public spheres. Secondly, based on this menu of options we undertook research to identify which of these funds and financing mechanisms – including Financing Facilities- were present in the demo cases countries. When possible, we documented each of these funds and financing instruments and analysed them according to a series of factors that enable us to make a first estimation of their potential for the implementation of NbS.

Thirdly, after having the inventory of options available in all four pillars, plus conditional financing in the public and private spheres (e.g. insurance) we have gone further to analyse the potential

they have for the implementation of NbS based on the magnitudes of money flows they signify as well as whether their investment criteria and evidence requirements are in line with the profile of NbS projects. If these funds and financing mechanisms have already been used to implement NbS, one may argue that such instruments seem of high potential. When no green infrastructure or NbS has been funded in the past, further analysis of the decision and investment criteria used per instrument or by the financing facility is required to estimate its potential.

Fourthly, based on this evaluation we identified the gaps that needed to be bridged. These gaps could be bridged either with the development of new financing instruments or else by shaping NbS projects differently or developing additional evidence for these projects to meet the investment criteria of existing funding and investment options.

Table 9 table shows the different thematic or sectoral financial streams within the public, private and climate finance pillars, as well as the conditional financing set of mechanisms. In **Table 9** a short explanation of each thematic pillar and why it needs to be considered in our inventory given their relationship with the financing of ecosystem-based Disaster Risk Reduction or NbS measures is presented.

Table 9. Public, private and conditional financing streams for DRR measures (Adapted from Altamirano et al., 2016, p.67)

PILLAR	ELEMENT	RELATIONSHIP TO THE FINANCING DRR MEASURES
Public Finance/ National Public Investment System	National Public Investment System procedures	Set the rules of the game on how project and project phases are financed. Who has to take the initiative, who has to endorse it and which funds and/or loans can be accessed by different actors? The system quality and transparency are good indicators for the private sector on how safe is to invest and/or participate in national tenders and projects.
	Disaster Risk Management aspects – within National Investment Systems	How risks are managed along the project cycle of infrastructure investments (where water management is relevant) and how these risks are shared with the private sector indicate of: A) which sector – public or private- is responsible for managing these risks and therefore willing to invest in DRR measures. B) improvements that could be made in these systems through more understanding of the impact of ecosystems health on systemic risk and resilience levels Besides, the distribution of water-related disaster risk management responsibilities between government layers and their budgeting indicates the financial feasibility of the proposed NbS for water security measures.
	Development Cooperation	Important to identify additional and concessional sources of funding that could help develop blended finance strategies. Also, important to identify strategic partners that could support local counterparts in the development of transformational NbS and water security strategies and implementation strategies.

PILLAR	ELEMENT	RELATIONSHIP TO THE FINANCING DRR MEASURES
	including technical assistance ¹³ F 14.	
Climate Finance and Innovative Finance	Public Climate Funds – for Climate adaptation projects & Private Climate Finance	<p>Climate Finance is the term given to a new set of funds and financing instruments set in place by the international community to speed up the process of implementation of climate adaptation and climate mitigation actions. Example are concessional loans, trust funds, guarantees and other instruments that improve the financial viability of projects and/or de-risk particular project phases. These funds can be accessed by the public but also by private actors.</p> <p>In the EU context, these funds are different from what is called climate finance in the international community, mainly aimed at developing countries. The objective of these funds are similar, only target regions differ. A particularly relevant source of climate finance for the EU in the next years is the European Green Deal¹⁴ F 15.</p> <p>As NBS in NAIAD aims at the mitigation of water and climate risks, these are important sources of funding to be considered.</p>
Private Finance for Infrastructure	PPP and private initiative modalities	Understanding these modalities and how financing and funding for each of them are arranged completes the overview of public financing options. PPP's and private initiatives are an increasingly used option by countries within their national strategies for infrastructure investments.
	Capital Markets & Project Finance	While PPP modalities give the overview of the ways a government is open to private financing and the attractiveness of these modalities to the private sector, capital markets and their depth determine if private parties are able or not to access the loans they need to (pre)finance such projects.
Infrastructure Finance		The most capital intensive NBS, which could also be considered green infrastructure are alternatives to structural measures for DRR and therefore may be comparable to infrastructure investments. In this case financing mechanisms like project finance may apply.
(Public) Funds for Disaster Risk Reduction		<p>Many countries may have special funds for disaster risk management and disaster risk reduction. These could be for instance earmarked taxes or other public budgets for the implementation of important directives such as the Flood Risk Directive or the Water Framework Directive. An example is the water tax collected by Water Boards in the Netherlands.</p> <p>These funds were until recently mainly used for the implementation of grey DRR measures yet could be in principle accessed for the implementation of NBS for DRR and water security.</p>
Conditional Financing	Disaster Risk Financing Pillar of DRR	A country with an otherwise robust disaster risk management program can still be highly exposed to budgetary shocks caused by major disasters. Disaster risk financing and insurance helps ensure that governments, businesses, and people are financially protected in the event of a disaster. Knowing the options in a country gives information

¹⁴ In EU terms these are Structural Funds, Life and other funds administered by the EU. For developing countries this refers to Official Development Assistance (ODA) from donors or administered by multilateral development banks (MDBs).

¹⁵ More information about the EU Green Deal available https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

PILLAR	ELEMENT	RELATIONSHIP TO THE FINANCING DRR MEASURES
		<p>on the possible funds that become available after a disaster, as well as on the incentives of different actors to prevent such risks and therefore their insurance risk premiums.</p> <p>There is great potential in the combination of climate services with insurance services, to develop new products like parametric insurance products that help in closing the protection gap but may also create incentives for risk mitigation in private agents (e.g. Flood Index-Based insurances that make use of models as well as remote sensing data to reduce time and cost of processing of claims).</p>
Conservation and Biodiversity Finance		<p>Depending on the scale and design of Nbs for water security, these projects may also be considered as ecosystem and habitat conservation projects. For this reason is also important to make an inventory of existing conservation and biodiversity funding and financing mechanisms.</p>

The resulting complete menu of options is presented in **Figure 10**, the financing instruments with the highest potential are presented:

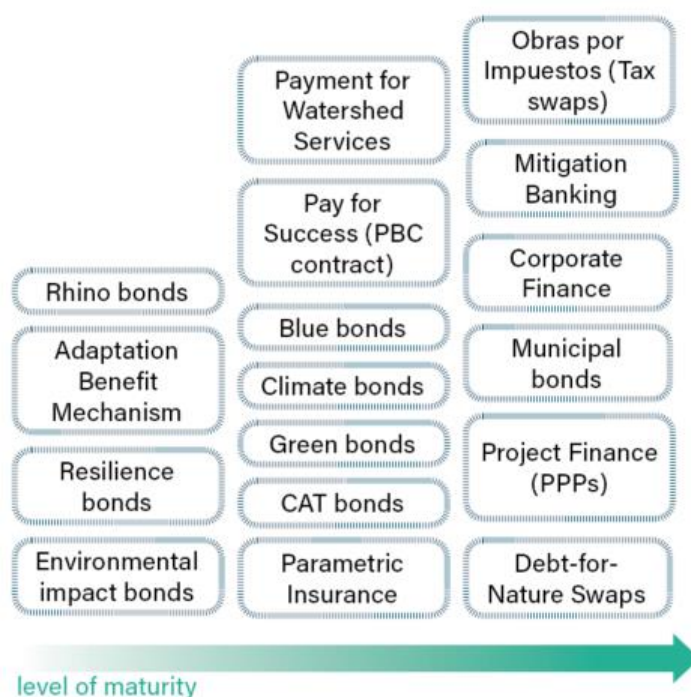


Figure 10. Innovative Financing Instruments for Adaptation and/or Ecosystem-based Disaster Risk Reduction (Adapted from Altamirano 2018 and Environmental Defense Fund 2017).

3.3.4 Business models

Although there may be an increasing amount of capital available for the financing of NbS and DRR measures (e.g. green bonds) which could be issued by the public or the private sector, the key question remains how to generate revenues from these projects such as to pay back for these investments. Here is where business models play a role.

A business model describes the rationale of how an organization creates, delivers, and captures value (economic, social, cultural, or other forms of value) (Osterwalder & Pigneur, 2010)¹⁶.

The process of business model construction is part of the business strategy. The essence is that it defines the manner a business enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit. A business model reflects management's hypothesis about what customers want, how they want it, and how an enterprise can organize to best meet those needs, get paid for doing so, and make a profit.

As in risk reduction and climate adaptation the project sponsor or initiator is rarely private, the above definition needs to be translated into the perspective of a public institution, which will often be the project proponents of project sponsors of climate adaptation or risk reduction strategies and policies. Translated to the supply of public services, we can formulate the concept of business models as:

The process of a policy model construction is part of a public strategy. The essence is that it defines the manner an institution through its project delivers value to citizens (citizens have paid taxes so there are not necessarily new tariffs to raise) or insured clients (insurers point of view) by making the best use of public money. A public strategy should reflect what citizens want, how they want it, and how a public body can organize to best meet those needs, reach a financial sustainable balance, but also care for social justice and rank priorities among all the allotted fields (economic development, health, education etc.).

To develop bankable climate adaptation, water security and NbS projects new business and policy models need to be developed that enable value capturing and internalization of the positive externalities of these projects and their conversion into revenue streams that payback for the investments made.

The introduction and success of new business models in the context of water security will often require the introduction and/or coherent enforcement of existing and new regulations as well as

¹⁶ Osterwalder, A. & Pigneur, Y., 2010. Business ModelGeneration: A Handbook for Visionaries, Game Changers, and Challengers 1st ed., Wiley.

the introduction of economic incentives that drive private agents to value environmental externalities. An example is the introduction of carbon pricing that has triggered the emergence of a new wave of business models, such as the one of carbon project developers (e.g. South Pole Group).

A methodology often used for Business Models is the Business Model Canvas. The original BMC is not the entire fit for public goods or common resources types of problems, so alternative methodologies have been developed. One of them is the **Public-Private Canvas from the Inclusive Business Hub**. Within the NAIAD project, a NAS business model canvas has been developed which is presented in **Deliverable 7.2**.

3.4 Comparative institutional analysis and modes of governance

3.4.1 Transaction and governance structures

A transaction is an event. It occurs when a good or service is transferred across a technologically separable interface (Williamson, 1981). In simple terms, the transaction is the physical delivery of a good or service. Transactions usually occur in a market, where “transaction it is necessary to discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on” (Coase, 1990, p. 114). Therefore, a transaction not only includes what takes to materially producing a good or service (capital, labour, resources, technology, time). It also includes the set of ex-ante negotiations between parties for defining the conditions of the transaction, as well as the ex-post measures to enforce the integrity of the transaction itself. The integrity of transactions can be jeopardized either by the poor competences or skills of one actor promising delivery service and ultimately by actors’ incentives for capturing value at expenses of the counterpart goodwill (opportunism). Transaction costs economics (TCE) aims at defining the best way to organize the transaction (or defining the governance mode), to both introduce economic efficiencies (avoiding losses from producing a service requiring knowledge) and increase the reliability of between parts trading (reduce losses from governing the terms of negotiations and agreement enforcements).

TCE as developed by Williamson (1981), matches transactions with governance structures: if the transaction has specific characteristics (asset specificity, frequency and uncertainty), then the most efficient governance structure (or mode of governance) for the organisation of such transaction is a market contract, a hierarchy (public or a private firm), or a hybrid (Groenewegen & De Jong, 2008). Ultimately, a governance structure defines the extent to which producing a good or service should be delivered making use of in-house personnel, acquiring the good or service from others

or something in between. The latter are called hybrid governance structures and include for example Public-Private-Partnership contracts.

The firm, as a hierarchical organisation based on administrative warrants, is the most efficient governance mode to produce services/goods with high transaction costs and low production costs. On the other hand, buying in the market is the most efficient transaction governance mode when the economic exchange implies low transaction costs and high production costs. Finally, hybrids or alliances are the best form of organisations when producing services/goods with high production and transaction costs. These hybrids or alliances include contractual agreements where two organisations pool some decision and property rights while keeping distinct ownership of assets. Therefore, it combines some characteristics of a hierarchical organisation with some degree of autonomy typical of market organisation.

3.4.2 The institutional environment

Meanwhile, the institutional environment refers to the man-made constraints that structure political, economic, and social interactions. It delineates the rules of the game within which governance structures operate, by prescribing the rules of conduct within which human actions take place. The institutional environment consists of basic formal and informal rules in society and the so-called social capital. The most important component of social capital is trust. Formal rules include laws and rules of society and the way these are enforced and monitored. Informal rules instead consist of common codes of behaviour, sanctions, customs, traditions, norms, values and beliefs; deeply rooted in society.

The **institutional environment** mainly defines (or can be thought of as) enablers and constraints on the environment for the operation of governance structures. In turn, governance structures regulate individual transactions between economic actors.

In different policy areas, the institutional environment is also referred to as the "enabling environment". Which elements of the institutional environment are more or less important to define this enabling environment will depend on the sectoral focus? In the following section, the main elements of the enabling environment for public-private cooperation and Integrated Water Resources Management are introduced to illustrate further the elements included in this concept.

In **Figure 11** the way the institutional environment impacts the choice and the effectiveness of alternative governance structures and types of contractual arrangements is portrayed. The most common contracting practices used by public procurement authorities in a specific country, region or city reflect and are influenced or constrained by the preferred procurement strategy of the government agency in charge. In the same way, the agency procurement strategy and the typology of contracts that are possible are influenced by the national political discussion and the

public administration tradition of the country. The institutional environment includes all these different layers and through the incentives and disincentives, it creates at a systemic level, results in an enabling environment or barriers for successful implementation and effectiveness of alternative contractual mechanisms.

*"In the same manner, the **performance indicators** -at the technical or functional level that are considered in the contracts or other evaluation mechanisms between the authority and the contractor are expected to contribute to a specified service level agreed between road authorities and the corresponding transport or public works ministries in charge. At last the realization of such agreements set the basis for the fulfilment and safeguarding of **public values**, for which the overall national government and not only the transport-related authorities are held responsible."* (Altamirano 2010, p.23).

Accordingly, while the transaction or NbS project itself may be suited to be implemented through an integrated, performance-based contract like a PPP; this may not be the most effective option in a country where the trust of civil society in the private sector is low or the government authorities in charge have no previous experience with designing and enforcing these types of arrangements.

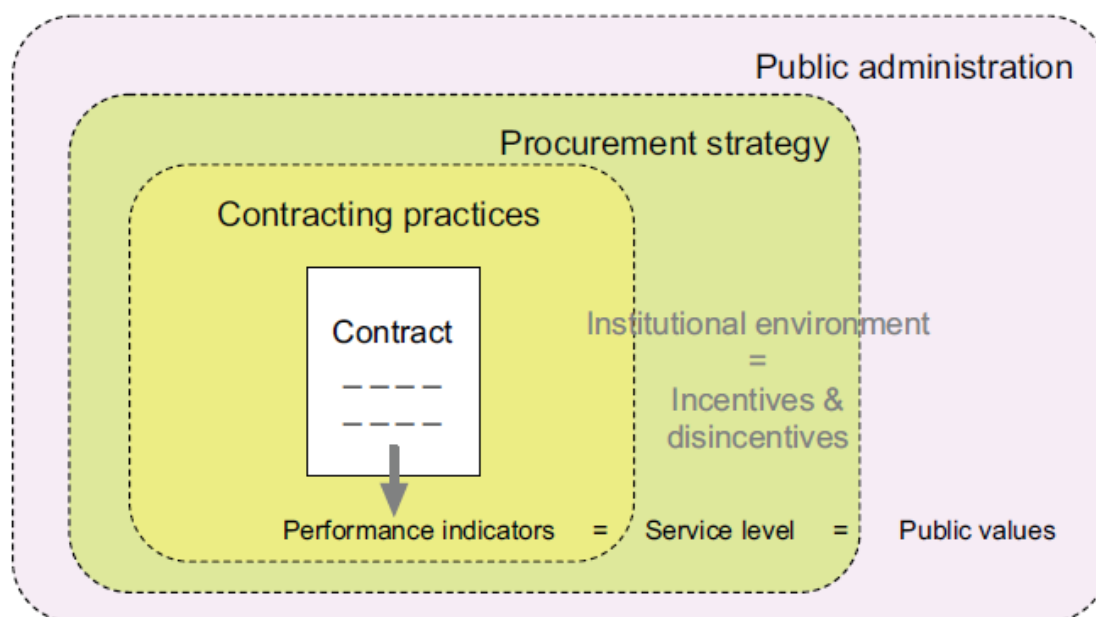


Figure 11. Governance structure and its dependence on the institutional environment (Source Figure 2.3 Altamirano 2010, p.23)

3.4.3 The four type of economic goods

In economics, a good is anything (good, thing or service) that can be consumed or increases utility and therefore can be sold in a market. It can be thought of as only a physical object that is visible (e.g. in macroeconomics and accounting), or it can be both a tangible object and an intangible service (e.g. in microeconomics) (Menger 1950, Gould and Ferguson 1980).

Further, it is also common in economic to divide goods into private, club, common and public goods. The classification responds to considerations of market failures and externalities. The two attributes that set the foundation of this classification are:

- Rivalrousness: whether there is competition involved in obtaining a given good or in other words, whether this good is finite or infinite, or whether “the marginal cost of providing a good to an additional consumer is zero or not” (Pindyck and Rubinfeld 2001, p. 621).
- Excludability: Whether it is possible to exclude anyone from the consumption of a given good and how costly it is to do so.

According to Richard Musgrave who made this categorization based on consumption and excludability characteristics (Musgrave 1958), the market can only function in situations where the [exclusion principles](#)¹⁷ applies. That is for example the case for private goods where “the benefits derived therefrom flow to the particular consumer who pays for them. Thus, benefits are internalized, and consumption is rival” (Musgrave 1989). However, if consumption is nonrival and/or if exclusion cannot be applied, the market fails to function efficiently. The latter are called [market failures](#).

We adopt however a later classification enriched by the work of Elinor Ostrom and other economists that is used in present economics and public choice textbooks. This categorizes goods based on two criteria: competition and exclusion from consumption.

Examples of these four different types of goods and the main challenges involved in their sustainable provision is presented in **Table 10**.

As previously explained in the process of identifying alternative revenue streams to improve the cash profile of water security projects and increase diversification in funding sources it is important to make a distinction between a) the asset enabling the delivery of service and the service or

¹⁷ **Exclusion principle:** *Where A's consumption is made contingent on A's paying the price, while B, who does not pay, is excluded. Exchange cannot occur without property rights, and property rights require exclusion. Given such exclusion, the market can function as an auction system. The consumer must bid for the product, thereby revealing preferences to the producer, and the producer under the pressure of competition, is guided by such signals to produce what consumers want* (Musgrave 1950, 55-6).

services this asset provides to different groups; b) the ownership of an asset and the rights to operate it.

Table 10. Characterisation and definition of economic goods (Source: Hess and Ostrom 2003)

	EXCLUSION EASY	EXCLUSION DIFFICULT
COMPETITION Rival/ Finite	Private goods (finite good produced for profit) Food, clothing, cars	Common goods (finite natural or human-produced good with free access) or Common pool resource (subtractable natural or human-made resource with free access, which, as a result, are likely to be overused) Good that “cannot readily be fenced” (Hardin 1968, 1245) Water, fish, pasture, irrigation system, animal populations)
COMPETITION Non-rival/ Infinite (marginal cost of production to a consumer is zero)	Club goods (infinite goods, which can be excluded from consumption, if using special techniques and technologies, or “goods available for consumption to the whole membership unit of which the reference individual is a member”) Cable television	Public goods (goods, from which all members of a group benefit if any one member receives the benefit) Clean air, national defence, lighthouse, beautification projects, police protection

While the economic nature of the asset itself – for example, an ecosystem- may be a common good and it would make sense to keep this asset under public ownership, the services it provides could be considered a private or toll good and it could be decided that temporally the rights to operate this asset could be given to a private party or community through concession rights. For example, let’s take a forest. The forest is a common resource itself and it may be under public ownership, yet the service it provides to the operators of hydropower dams by reducing erosion and lengthening the useful life of the dam could be considered a private economic good.

The economic nature of the good or service to be provided by the ecosystems has in this way an impact on the type of revenue sources that can be generated. While investments in public goods and their maintenance are normally paid back through taxes or transfers (e.g. subsidies from the national government or international donors), investments required for the generation of private and club goods could be paid back by tariffs paid by beneficiaries, users or polluters.

Although the characterization of types of goods is a good start to define the mode of governance and possible sources of revenues, it is important to consider that this characterization is based mainly on the physical characteristics of the goods or services. Therefore, this simple characterization serves only as a first hypothesis that needs to be confirmed for the given institutional context where the project will take place.

Table 11. Challenges in the provision of different types of economic goods.

TYPE OF GOOD	EXAMPLES AND MAIN CHALLENGES
Private goods	<p>Examples of private goods include food, clothes, and flowers. There are usually limited quantities of these goods, and owners or sellers can prevent other individuals from enjoying their benefits. Because of their relative scarcity, many private goods are exchanged for payment.</p>
Common goods/ common pool resources	<p>Because of these traits, common goods are easily over-consumed, leading to a phenomenon called "tragedy of the commons" In this situation, people withdraw resources to secure short-term gains without regard for the long-term consequences. A classic example of a common good is the fish stock in international waters. No one is excluded from fishing, but as people withdraw fish without limits being imposed, the stocks for later fishermen are depleted.</p> <p>The main challenge in the management of common goods is their size or other physical characteristics, which makes it costly but not impossible to exclude individuals from consuming them. Unlike pure public goods, common goods can be overused and polluted unless use limits are enforced. The common good consists of the stock variable (a core resource that regenerates the fringe variable and thus should be protected) and the flow variable (a limited quantity of extractable fringe units of a core resource that can be consumed) (Bychkova, 2011).</p>
Club goods	<p>This type of good often requires a "membership" payment to enjoy the benefits of the goods. Non-payers can be prevented from access to goods. Cable television is a classic example. It requires a monthly fee but is non-rival after the payment.</p> <p>Four unique aspects of these goods that make them different from public goods are (Cornes and Sandler 1986):</p> <ul style="list-style-type: none"> unlike public good, which can be involuntary, clubs must be voluntary; members choose to belong because they anticipate a benefit from membership. The right of existence is always available for the case of club good. Clubs share partially rival public goods, like recreation facilities, tennis clubs, and swimming pools. The main feature of clubs in the presence of an exclusion mechanism, where users' rates of utilization can be monitored, and non-members and non-payers can be barred. Clubs are also characterized by dual decisions – membership decisions (who can participate) and provision choice (how much of the shared good must be produced). In the case of pure public goods, only the provision decision should be made; membership is the entire population
Public goods	<p>Individuals cannot be effectively excluded from using them and use by one individual does not reduce the good's availability to others. Examples of public goods include the air we breathe, public parks, and streetlights. Public goods may give rise to the "free-rider problem" A free rider is a person who receives the benefit of a good without paying for it. This may lead to the under-provision of certain goods or services.</p>

The possibility to exclude some actors from receiving a service is highly dependent on the public values of a country and their legal tradition. For example, roads are accepted as club goods in Southern Europe but seen as public goods in most Nordic countries.

At the same time in the long term, the economic nature of the good could be changed by the introduction of new technologies. The adoption of new technologies like blockchain and other remote sensing-based techniques may lower significantly the costs of monitoring and charging for the use of resources and help to eliminate free riders.

3.5 Governance modes for NbS for water security

Based on a wide inventory and analysis of implementation arrangements around the world realized by the authors, cross-national lessons have been drawn about the most effective arrangements to deliver different types NbS investments. Based also on this analysis we identified four main types of governance modes or governance structures for their implementation and sustainable management.

These four are:

- a. public procurement contracts,
- b. privately driven water stewardship investments,
- c. collective investment schemes, and
- d. environmental and/or ecosystem markets.

3.5.1 Public procurement contracts

Public procurement refers to the process by which public authorities, such as government departments or local authorities, purchase work, goods or services from companies. A public agency who has been delegated the task to deliver several services by a given ministry has the choice of organising the delivery of these services either by making use of their in-house personnel or by delegating the provision of these services or specific activities involved in that delivery to private agents. This decision is the so-called **make-or-buy decision**.

The type of contract this agency uses to delegate the provision of services and tasks can be very traditional and prescriptive or innovative, performance-based and integrated. More details about public procurement and the different types of project delivery and finance options public agencies can choose from are presented in greater detail in **section 3.9**.

3.5.2 Privately driven water stewardship investments

Water stewardship is defined by the Alliance for Water Stewardship (AWS) as *"the use of water that is socially and culturally equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that includes both site- and catchment-based actions"*. Accordingly, *"good water stewards understand their own water use, catchment context and shared risk in terms of water governance, water balance, water quality and important water related areas. With this understanding, water stewards engage in meaningful individual and collective actions that benefit people and nature (UNIDO)." Although good water stewards can refer*

to all public, private or community agents, the term water stewardship refers often to the role of companies and private sector operating in a watershed.

In a stewardship arrangement, the **project sponsor** or entity commissioning the activities and tasks required for the implementation of the NbS to third parties is a private entity. Project sponsors are often private companies whose primary and secondary production processes are highly dependent on water and for which water scarcity may represent either a direct business risk by challenging business continuity or an indirect risk via regulatory and/or reputational risks. Some of the industrial companies most dependent on the water are tanneries, pulp and paper industries, textile, breweries and soft drinks companies and dairy companies. Other industries that also use water but to a less extent are canning industries and roller and flour mills.

In the last decade, there has been an important shift and increase in awareness and climate change is driving an increase in frequency and intensity of extreme events. In this context and particularly regarding droughts, companies have started to understand that watershed and nature are their true license to operate. This is also causing a slow but significant shift in how companies conceive their investments in the watershed. While in the past these were done out of a Corporate Social Responsibility perspective, aiming at improving their image and gain goodwill from neighbouring communities, in the last decade more and more companies are making water stewardship investments part of their risk management strategy and starting to conceive these investments as part of their core activities. More and more companies are willing to invest in risk mitigation measures for water risks that go “beyond the fence”, watershed conservation investments that go way beyond their farm or plant boundaries. Unfortunately, the operational challenge they face is the nearly prohibitive transaction costs involved in making such collective investments at watershed or system level. Transaction costs are so high because there are seldom in place effective **governance structures** (e.g. like River Basin Committees) that organize all water users in a watershed, secure enforcement of water usage and pollution regulations and have an effective monitoring and operational water management systems that eliminate the free-rider problem.

The free-rider problem is a type of market failure that occurs when those who benefit from resources, public goods, or services of a collective nature do not pay for them or under-pay. Free riders are a problem because while not paying for the good (either directly through fees or tolls or indirectly through taxes), they may continue to access or use it. The result is that the good may be under-produced, overused or degraded, which in turns results in lower levels of service in the future and erodes the willingness to pay off the stakeholders initially paying for the service. Some pioneering companies, like Danone, are going even further and reconsidering their traditional business models to embrace a new regenerative agriculture model that aim to internalize all environmental externalities and create a win-win between productivity, ecosystem functioning and biodiversity wellbeing.

There are few cases where the transaction costs or the free-rider problem are not that important disincentives for private investments in water stewardship. An example could be a private company that owns a very large area of land which makes them experience a high percentage of the impacts of floods, droughts or water quality risks. In such a case, a single private company may be able to influence more directly the outcome (i.e. resilience dividends) of their investments in watershed conservation and NbS, as well as to capture a significant portion of the benefits. All in all, they would be more able to assess with certainty the ROI of their investment and experience the investment as less risky than relatively smaller companies in the same watershed, making them ultimately more prone to invest. Under such a scenario watershed conservation becomes just another corporate investment decision as to the decision to expand a plant or install a more efficient irrigation system.

3.5.3 Investment fund or collective investment schemes

In the financial world, an investment or **mutual fund**¹⁸ (one of the largest asset managers in the world) is a product that invests in assets, such as bonds, equities or cash. The assets owned by the fund are called a portfolio, and they are managed by a fund manager. The money of one investor is pooled together with that of other investors and spread over the whole range of assets within the fund. The investment of each investor in a fund is divided into shares, and the number of shares holds by that investor represent their proportionate ownership of the fund's overall assets, and the return those assets may generate. The prices of these shares will fluctuate daily because the underlying value of the assets will rise and fall – and since the total value of the fund is divided by the number of shares issued, the individual stake of that investor will rise and fall to reflect this.

An investment fund is therefore a way of investing money alongside other investors to benefit from the inherent advantages of working as part of a group, instead of as an individual. These advantages include an ability to:

- hire professional investment managers, which may potentially be able to offer better returns and more adequate risk management;
- benefit from economies of scale, i.e., lower transaction costs;
- increase the asset diversification to reduce some unsystematic risk.

Now in the context of NbS and watershed conservation investments, a collective investment scheme or investment fund implies the creation of an entity that pool resources from different

¹⁸ Black Rock website, accessed October 20, 2020, <https://www.blackrock.com/ch/individual/en/education/understanding-investments/collective-investment-schemes>

beneficiaries and invest them in a variety of NbS and hybrid measures (i.e. investment portfolio) to improve the condition of existing ecosystems and the systemic resilience – regarding water risks- faced by all the contributors to the fund. Water funds are a typical example of collective investment schemes.

Water Funds, as defined by the Latin America Water Funds partnerships¹⁹ are:

- organizations that design and promote financial and governance mechanisms, engaging public, private, and civil society stakeholders to contribute to water security through solutions grounded on nature-based infrastructure and sustainable management of watersheds.
- organizations that contribute to the better governance of water resources; once key stakeholders for good water management have been identified in a watershed area, the Water Fund approaches them and generates the necessary dialogue conditions, sometimes functioning as the bridge between the different sectors.

Water funds have also the function to offer scientific information for the identification and prioritization of the challenges to be solved, so that decision making is based on science and incorporate the different visions and possible solutions to contribute in the best way to ensure the water security of cities.

These collective investment schemes emerged as a local response to the challenge of water security from a vision mainly focused on the conservation aspects of watersheds. The

The pioneering experience of the Water Funds began in the high Andean wetlands, with the creation of the Quito water fund called FONAG. Since then similar water funds have been created in other cities such as Rio de Janeiro and Espirito Santo, in Brazil; Bogota, in Colombia and Paute and Tunguragua. The creation of the Latin American Water Funds Partnership in 2011 provided seed capital and technical assistance fundamental for the systematization of the methodology, its refinement and the expansion that we can see in the region today.

3.5.4 Ecosystem markets²⁰

In environmental markets, an ecosystem service itself is marketed and sold as a commodity to a beneficiary (usually an institution rather than individual) in the context of a dedicated market, usually subject to oversight by a regulatory body. Carbon credits and offsets are the most

¹⁹ Website of the Latin America Water Funds partnership, accessed October 20, 2020 <https://www.fondosdeagua.org/en/the-water-funds/>

²⁰ More references: <https://www.oem.usda.gov/water-quality>

prominent example of such markets and the one with great potential but limited implementation in agroforestry systems, such as shade coffee.

They provide incentives to preserve ecosystems and the services they provide. These markets are an innovative policy approach to increasing funding for environmental conservation and are often viewed as a complement to traditional conservation programmes. Current active and pilot markets exist for carbon, water quality, water quantity, wetlands, and habitat and biodiversity.

In **Table 12** an overview of types of environmental markets is presented. These definitions are based on the USA Department of Agriculture Environmental Markets units.

Table 12. Different types of environmental markets

MARKET TYPE	DEFINITION ²¹
Water Quality Markets	Water quality credit trading can provide a cost-effective means to improve water quality and increase opportunities for conservation on private lands.
Water Quantity Markets	Water quantity markets, including groundwater offsets and in-stream buybacks, operate when water rights are appropriated for non-consumptive use, or when water rights are shifted between users to reallocate resources within a watershed.
Carbon Markets	Increasing atmospheric concentrations of greenhouse gases (GHGs) such as carbon dioxide, methane, and nitrous oxide cause changes in temperature and climate. Environmental markets for carbon and GHG can provide funding for conservation practices that decrease carbon dioxide or other GHG emissions.
Wetlands Markets	Environmental markets for wetlands create incentives for landowners to improve ecosystem services on their lands. These markets are often driven by regulatory programs, for example in the USA by Section 404 of the Clean Water Act.
Habitat and Biodiversity Markets	Environmental markets for habitats create incentives for landowners to improve ecosystem services on their lands. These markets are often incentivized by regulatory programs such as the Endangered Species Act in the USA, though they may also be voluntary.

In environmental markets, supply and demand for water and other ecosystem services are defined by direct negotiations, using as a reference a market price regulated by public policy. These environmental markets usually emerge as a policy intervention aiming to off-set polluting activities, or voluntary payment for ecosystem services. Two well-known examples of environmental markets are the worldwide carbon market as well as the wetlands mitigation market in the United States (see **Textbox 4**). A more recent example of environmental markets are stormwater markets.

²¹ The definitions shown here are based on the Environmental Markets United States Department of Agriculture, website available at <https://www.oem.usda.gov/>

For an in-depth analysis and guidance in the design of environmental markets, we recommend reading **Environmental Markets: A New Asset Class**²², the publication of the CFA Institute Research Foundation (2014) as well as other resources in the website of **The Environmental Trading Network**²³ and **The Ecosystem Market Place**²⁴ website, a Forest Trends Initiative.

Textbox 4. Conservation and Mitigation Banking in the USA (Source: New Forest 2014)

The United States has been a pioneer in the development of what is called mitigation and conservation banking, which are regulatory environmental markets for ecosystem services, particularly related to water and biodiversity.

Regulated markets for the conservation of threatened species and the mitigation of wetland impacts, under the Endangered Species Act and the Clean Water Act, represent a growing biodiversity-based asset class with turnover above US\$ 1 billion per year reported. Although these markets are regional and somewhat fragmented, they do create a variety of attractive investment opportunities.

Under section 404 of the Clean Water Act and Sections 7 and 10 of the Endangered Species Act, anyone who destroys regulated wetlands, streams or endangered species habitats must compensate for the destruction by restoring other areas on the same site; paying in-lieu fees to a conservation organization or buying credits from third parties who have already restored sites elsewhere in the same region. The introduction of new regulations in the last decade has created a regulatory preference for the latter, which is commonly known as mitigation banking. Significant economies of scale and ecological benefits can be achieved when large areas of habitat are restored in advance of impacts.

Wetland and mitigation banking is regulated at the federal level by the Army Corps of Engineers. Meanwhile endangered species habitat banking- also called conservation banking- is regulated by the US Fish and Wildlife Service and the National Fisheries Service. Wetland mitigation banking exists in the USA since the early 1990's and conservation banking first started in California in 1997.

In 2010 there were nearly 1000 wetland and stream mitigation banks selling credits. Conservation banking is a more concentrated market with only about 100 active banks. In total, the mitigation banking industry in the USA transacts more than US\$1.5 billion per annum.

It is important to clarify that mitigation credits are not a commodity good. They represent the environmental value of the restoration implemented for a specific ecosystem in a specific watershed. Since these methodologies to calculate and the type of ecosystem restored vary, these credits are not fungible. They also vary widely in price depending on the economics of the service area in which they are produced and on the approach of regional regulators. To illustrate this difference, a wetland credit could be sold for instance for \$3,000 in Arkansas and US\$400,00 in California.

²² <https://www.cfainstitute.org/-/media/documents/book/ef-publication/2014/ef-v2014-n1-1-1-pdf.ashx>

²³ <http://www.envtn.org/>

²⁴ <https://www.ecosystemmarketplace.com/>

Most like real estate markets, mitigation banking is highly local. Most mitigation bankers are rural landowners seeking additional revenue from their property or small entrepreneurs with backgrounds as land use attorneys, developers or environmental consultants.

Table 13 presents the prevailing governance mode according to the type of economic good, as well as alternative governance modes that fit the sources of funding generated by different types of economic goods or services.

Table 13. Relationship between type of economic good, source of funding and governance mode

TYPE OF GOOD	MOST COMMON SOURCES OF FUNDING	GOVERNANCE MODES
	Taxes or transfers	Public procurement
Common Pool resources	Taxes or transfers	Collective investments vehicles Environmental markets Privately driven water stewardship investments Network of formal and informal arrangements. This could include Public-Private collaboration (contractual and constructive), but also informal (non-binding) arrangements based on community customs and trust.
Toll goods	Tariffs	Public procurement Collective investment schemes
Private goods	Tariffs	Environmental markets

3.5.4.1 Payment for Ecosystem Services Schemes versus environmental and ecosystem markets

Payments for ecosystem service (PES) schemes became a very important conservation policy in the last decade and their application grew in both developed and developing countries around the world. PES schemes are being applied on different scales, ranging from micro-watersheds to entire watersheds that may cut across the state, provincial or national boundaries.

As explained in the Ecosystems Market Place website:

“Environmental markets, ecosystem markets, and Payments for Ecosystem Services (PES) are all terms that are used to refer to the entire suite of economic tools used to reward the conservation of ecosystem services. Confusingly, each of these terms also refers to a more specific subset of these tools.

The term environmental markets is used loosely to refer to all markets that have been set up to drive environmental improvements of some kind. Markets for renewable energy, sulphur dioxide emissions reductions, and organic food might all be termed environmental markets. Ecosystem markets are a

*slightly narrower term that usually refers only to those markets that trade permits or credits related to ecosystem services. The trouble comes when the moniker 'environmental market' or 'ecosystem market' is used to describe conservation payments that aren't part of a "market."*²⁵

PES are considered an economic instrument, a 'market-based instrument' or a 'market for ecosystem services'. They are however not to be confused with environmental markets. They are a new type of subsidy or transfer, but unlike traditional subsidies, which are financed by taxpayers at large, payments can be financed directly and voluntarily by the beneficiaries (users) of the ecosystem services PES help maintain.

According to the Ecosystem Market place, the various economic tools that fall under the term PES are six. These are shown:

Table 14. Economic Instruments that fall under Payment for Ecosystem Services Schemes

NAME OF ECONOMIC TOOL	DESCRIPTION
Direct Public Payments	Direct public payments are payments the government makes directly to providers of ecosystem services. This form of payment for ecosystem services is the most common, with governments around the world paying rural landowners to steward their land in ways that will generate ecosystem services. The Conservation Reserve Program in the United States, for instance, pays out over US\$1.5 billion to farmers each year in exchange for their protection of endangered wildlife habitat, open space, and/or wetlands China has a similar program in place to fund erosion control while Mexico and South Africa target their payments toward stewards of watershed services.
Direct Private Payments	Direct private payments function much like the public payments described above, except that non-profit organization or for-profit companies take the place of the government as the buyer of the ecosystem service in question
Tax Incentives	Tax incentives are a form of indirect government compensation for landowners protecting ecosystem services. In exchange for committing resources to steward ecosystem services, individuals receive tax breaks from the government. Tax incentives are used, for instance, to encourage landowners in the United States to put their land under conservation easements.
Cap-and-Trade Markets	A cap-and-trade program is one in which a government or regulatory body first sets a limit or "cap" on the amount of environmental degradation or pollution permitted in a given area and then allows firms or individuals to meet the cap.
Voluntary Markets	Voluntary markets are markets in which buyers and sellers engage in transactions voluntarily (i.e. not because they are forced to trade by regulation or to meet a mandatory cap). Generally, businesses and/or individual consumers engage in voluntary markets for reasons of philanthropy, risk management, and/or in preparation for participation in a regulatory market.
Certification Programs	When consumers buy certified products, they are paying not just for the product itself, but also for how it was produced and brought to market. Since such production and

²⁵ <https://www.ecosystemmarketplace.com/payments-ecosystem-services/>

	<p>transport are often expensive means of production and transport, price premiums associated with certified products can be considerable. When consumers choose to pay the price, premiums associated with products that have been labelled as ecologically friendly, they are choosing, in a sense, to pay for the protection of ecosystem services. Certification programs designed to reward producers who protect ecosystem services have been developed for a variety of products, including wood, paper, coffee and food, among others.</p>
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As it can be seen in **Table 14** PES is not a mode of governance of their own, but an economic instrument and in some cases a funding mechanism. Depending on the choices made in their design they could take the shape of different **governance modes** and combinations thereof, depending on who pays (user or taxpayer, public or private) and whether these payments are linked to performance specified in units of service and quality or service being delivered to these users. If PES is designed as an economic instrument to raise funds, the funds by PES could be implemented through collective investment schemes, public procurement contracts or privately driven stewardship investments. In the other two cases, voluntary markets and cap-and-trade markets coincide with the environmental/ecosystem market mode of governance.

For example, if payments come from taxpayers or from an increase in tariffs paid by households collected by a water utility (e.g. like the PES system in Peru called MERESE) following a direct payment scheme, and these taxes are earmarked for watershed conservation, the governance mode that emerges could be considered a collective investment scheme. Through this process, water or environmental fund is created and then administered by the water utility or public authority collecting these taxes or tariffs. This authority could then use these funds on a rolling base and set in motion the implementation of various NbS projects or clusters of projects through public procurement contracts.

Meanwhile, if the contributors to the funds are companies in a watershed doing voluntary donations to the fund, the collective investment vehicle will have a private nature, could be managed by a private fund manager delegated to do so by all the members of the fund and may not need to follow public procurement regulations.

Finally, if the payments of private companies or users would be linked to a specified level of service and its delivery, for example, a reduction in their risk to have no access to water in a dry year

As with environmental markets, PES develop mainly around three groups of environmental services:

- Water quality and quantity, often including soil conservation measures to control erosion and sediment loads in rivers and reservoirs and to reduce the risk of landslides and flooding;

- Carbon sequestration (and in some cases protection of carbon storage) to respond to demand from the voluntary and regulatory greenhouse gas emissions markets;
- Biodiversity conservation, by sponsoring the conservation of areas of important biodiversity (in buffer zones of protected areas, biological corridors or even in remnant patches of native vegetation in productive farms) and protecting agricultural biodiversity.

3.5.5 Typology of economic instruments²⁶

A good mix of economic instruments, including Market-Based Instruments (MBI) and fiscal mechanisms, is key to achieve both financial and environmental sustainability. Economic instruments are fiscal and economic incentives and disincentives to incorporate environmental costs and benefits into household and business budgets. Some of the more common instruments are water abstraction taxes, water prices, sewerage and effluent charges, water pollution charges, subsidies, tradable permits and liabilities for damage to waters.

As shown in **Figure 12** these instruments can serve different functions. It is important to bear all these functions in mind. In the FFWS we refer to them in two main ways. First, a part of the enabling environment, considering them in the in-depth institutional analysis modules. Secondly, as types of revenue-generating or funding mechanisms.

While in the short term from a purely financial perspective the use of an instrument like a tariff or fee may prove effective, the same instrument may prove counterproductive from an environmental security perspective. Therefore, it is important to consider in the choice for a particular MBI instrument not only their contribution to the cash flow of the project but also the signal they give to stakeholders and the incentive it creates for one or another type of behaviour to evolve. In other words, a balance needs to be found between financial and environmental sustainability and between the financial and the incentive function of economic instruments.

²⁶ This section is based on the Global Water Partnership webpage describing the Enabling Environment, available: <https://www.gwp.org/en/learn/iwrm-toolbox/The-Enabling-Environment/>

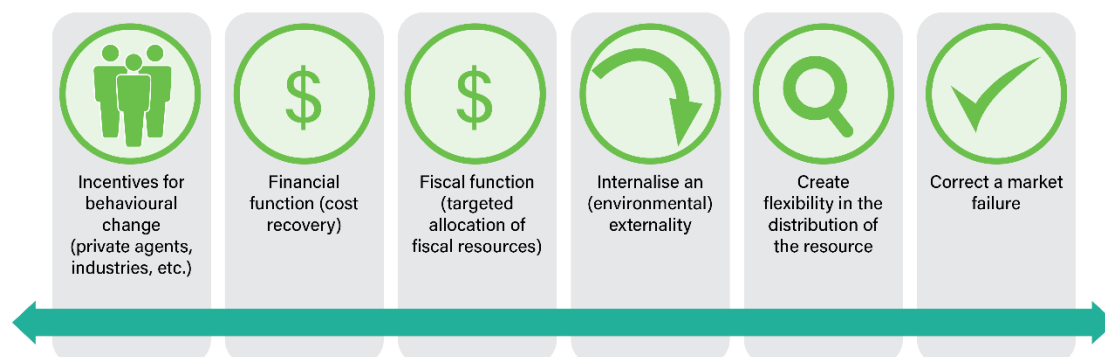


Figure 12. Typology of economic instruments for water security (Translated from presentation Diego Rodriguez, World Bank Group titled « Instrumentos económicos en agua: para que y que queremos lograr? », October 1st, 2020 Preparatory sessions for Peru Water Governance Recommendations OECD)

3.6 The enabling environment for investments in NbS for water security

The enabling environment for the generation of investments in NbS required for their implementation at the system scale consists of a combination of multiple enabling conditions.

Enablers for the sustainable use of water resources, for the uptake of NbS as multifunctional and innovative solutions, effective Public-Private collaboration and private investments in watershed conservation. The key elements of each of these dimensions of the enabling environment for investments in NbS are presented in the following sections.

3.6.1 Enabling environment for the sustainable use of water resources²⁷

As defined by the Global Water Partnership, a proper enabling environment establishes the rights and assets of all stakeholders (individuals as well as public and private sector organisations and companies, women as well as men, the poor as well as the better off), while ensuring for environmental quality.

It consists of “rules of the game” that are laid out to achieve a sustainable balance between the social, economic and environmental needs for water. These rules can be defined by the use of (1) Policies; (2) Legislative frameworks; and (3) Financing and investment structures.

²⁷ This section is based on the Global Water Partnership webpage describing the Enabling Environment, available: <https://www.gwp.org/en/learn/iwrm-toolbox/The-Enabling-Environment/>

In the context of water governance, the enabling environment involves policies, legal frameworks and investment and financing structures:

- Policies – setting goals for water use, protection and conservation. Policy development allows setting national objectives for the management of water resources and water service delivery with concerns for the overall development goals. Water policies are by nature tied to multi-sectoral approaches.
- Legal frameworks – the rules to follow to achieve policies and goals. The required water laws cover ownership of water, permits to use (or pollute) it, the transferability of those permits, and customary entitlements. They underpin regulatory norms e.g. conservation, protection, priorities, and conflict management.

Investment and financing structures – allocating financial resources to meet water needs. Water projects tend to be indivisible and capital-intensive, and many countries have major backlogs in developing water infrastructure. Countries need smart national and international financing approaches and appropriate incentives to achieve development goals. Financial resources need also be allocated to public sector financing for both the management of water resource and the provision of water services. This requires comparatively small budgets, with larger benefits because proper resource management minimizes the risk of misallocations and associated risks for economic growth.

3.6.2 Enabling environment for the uptake of NbS

The most important barriers for the adoption of NbS identified by various authors are:

- Lack of awareness and/or understanding of this innovative approach to the management of water and climate risks
- Existing cultural traditions, attitudes and norms that do not internalize the value of water and ecosystems
- Limited availability of evidence that makes the economic, commercial and financial investment case for green versus traditional grey infrastructure
- Policy and regulatory environments that influence the attractiveness and feasibility of using NbS approaches that require working across different temporal and spatial scales than traditional infrastructure
- Weak governance of water and environmental resources
- Limited access to finance for first time implementation and/or for implementation at the system scale

- Expertise and capacity gaps in both the public and private sectors, whereunder capacity to develop NbS strategies at system scale, design, implement and manage the entire lifecycle of NBS
- Lack of trustworthy suppliers
- Knowledge

In line with these identified barriers, Kapos et al (2019) in their paper titled “The role of the natural environment in adaptation” that served as a background paper on NBS for the Global Commission on Adaptation, recommended the following actions as ways to develop an enabling environment for the uptake of NbS and their implementation at scale:

- Knowledge and awareness should be built through increased collaboration and exchange of experience across sectors, facilitated by governments, donors, civil society organisations and private sector actors
- Climate impact and vulnerability assessments should as a matter of course include analysis of likely impacts on ecosystems and the implications for people’s vulnerability
- Planning, decision-making and action on adaptation should take a systems perspective. NbS for adaptation are best conceptualized and implemented at a landscape or wider scales to take account of the interactions within and between ecosystems and the distribution of potential beneficiaries and impacts
- Changes in procurement, financing conditions, industry standards and other policies, these should be improved to ensure that when a need for adaptation is identified, NbS are always included among the potential solutions evaluated and a consistent suite of benefits is assessed for all options under consideration
- Development of innovative financing arrangements and business models: Financial institutions need to develop new funding streams and models (including de-risking strategies) that can support long-term investment in NbS for adaptation, including by private sector actors
- Capacity development: capacity should be developed by incorporating concepts of ecosystem dependency, climate risk, and NbS for adaptation into curricula and training programs for engineers, economists, environmental impact assessors, and development professionals
- Monitoring, evaluation and sharing of lessons learned across countries and sectors: Governments, finance institutions, development and civil society organisations, corporate actors and research bodies need to promote the wider implementation of NbS for adaptation, emphasising monitoring and evaluation, and disseminating and sharing experience across sectors.
- Civil society pressure can encourage necessary changes in policy and practice because NbS for adaptation are critical to the public good.

3.6.3 Enabling environment for Public-Private Partnerships

As explained by Hine, Queiroz and Chelliah (2009) the enabling environment required for PPPs to be implemented effectively and with maximum value for the public sector; is composed of four principal components. These are called enablers and are closely interrelated. These are:

- Public investor commitment, that ensures sufficient public funding and/or fiscal support
- Favourable investor climate, to ensure private funding
- Capable public and private sectors, to ensure an effective partnership and the protection of the public interest
- Effective risk management, to ensure the maximum benefits from a PPP arrangement.

An enabling environment is important for both, the public and private sides of the PPP equation. The private party investing requires a favourable investment climate, public commitment, risk management and enough public sector capacity to ensure reasonable security and predictability of his investment. Meanwhile, the public sector requires the same elements of the enabling environment to maximize private sector participation and/or investments at the lowest cost and largest social benefit (Hine, Queiroz and Chelliah 2009).

A useful tool to assess a country enabling environment for PPP contracts is the Infrascopes index developed by the Economics Intelligence Unit²⁸. An Infrascopes index is a benchmarking tool that evaluates the capacity of countries to implement sustainable and efficient public-private partnerships (PPPs) in key infrastructure sectors, principally transport, electricity, water and solid waste management. It aims to help policymakers identify the challenges to private-sector participation in infrastructure that, if overcome, could unlock the power of PPPs and support the broader development agenda.

3.6.4 Enabling environment for private sector investments in watershed conservation and NbS for water security

As climate change impacts are being more and more felt by private companies operating in a watershed, their willingness to pay is increasing. More and more companies are willing to invest in beyond the fence measures to reduce their water risks. However weak governance of water and natural resources is a major barrier for these investments to take place and translate into prohibitive transaction costs.

²⁸ The Infrascopes index for different regions of the world can be assessed here: <https://infrascopes.eiu.com/>

Based on a review of successful cases of private sectors investments in LAC, including cases in Brazil, Colombia, Ecuador and Peru, Altamirano (2018) states that good governance and the investment case for private investments in watershed conservation are two sides of the same coins. Good governance of water resources and the environment results in higher levels of trust and social capital, which translate into a reduction of transaction costs, increase in revenues streams, and lower risk perception of private investors. All these factors improve considerably the cash flow profile of NbS and watershed conservation projects and could help to close the financial viability gap and turn them into bankable projects.

The key ingredients of an enabling environment for private investments in watershed conservation identified by Altamirano (2018) are:

- Transparency in the collection of tariffs or payment for ecosystem services and accountability at all levels
- Systems that make a monitor that the funds collected are used for the intended goals
- Clear scientific base to guide the prioritization of investments and the design of investment projects
- Rigorous hydrologic monitoring to communicate to payers about the impact of investments but also to enable learning and continuous improvement in the outcomes that can be achieved with the same financial resources
- Climate change vulnerability models at system scale translated into impacts for specific value chains and sectors, so that both public and private actors can calculate the resilience dividends of ecosystems

Additional to these recommendations and as embodied in the principles of the FFWS approach the authors recommend that efforts are invested in:

Firstly, the creation of governance structures (e.g. River Basin Committees) at system or watershed level that reduce considerably the transaction costs of companies willing to engage in collective action and invest beyond the fence

Secondly, the development of long-term blended finance strategies for the creation of a working green infrastructure market, timing the development of demand and supply for NbS.

Thirdly, developing a level playing field for green and hybrid infrastructure strategies, by on the one hand making changes in public investment planning and procurement processes to enable nexus investments and on the other investing in project preparation of NbS projects (e.g. through specialized project preparation facilities).

3.7 The five-case model to develop a full business case ²⁹

As previously mentioned, the Five Case Model is the approach for developing business cases recommended by HM Treasury, the Welsh Government and the UK Office of Government Commerce. It has been widely used across central government departments and public sector organisations over the last 10 years and is recommended as a good practice in infrastructure spending by the World Bank and other multilateral development banks.

“The need and logic for a consistent decision-making model is simple: if every manager, department, team or organisation arrive at decisions based on their own perception of what is best, then the likelihood of the right decision being made is lower. By having an agreed, standardised approach followed by all, then better, more uniform results are likely. This also has a supplementary benefit – once embedded, it reduces the time (and cost) it takes to develop and approve programmes and projects; all developers know what is expected and required as their schemes progresses through the planning process and the reviewers and approvers can assimilate the proposal before them more rapidly.” (Five-case model website, accessed October 20, 2020³⁰)

The Five Case Model provides exactly this discipline and structure to arrive at the best possible decision. It is important to clarify that is not meant as a substitute for judgement and experience, as this expert judgement will be still required at various moments within the entire decision-making process.

The model can be applied to various situations yet is often used for major capital investments that will result in something being built or procured: a new hospital or school, a major IT development, a new road or similar civil engineering scheme.

Nevertheless, it can be applied equally well to a much wider range of situations where an important decision has to be made: disinvestment in service x or service y, the comparison of benefits to emerge from policy/strategy a or policy/strategy b, or a major change initiative requiring re-engineering or reforming (e.g. an acquisition or merger). None of these may need a significant investment of capital, but these decisions are equally crucial for the success of the organisation’s goals and require therefore the structure of thought and discipline that the Five Case Model brings.

²⁹ All graphs presented in this section are based on the Five Case Model, as portrayed in their website <http://fivecasemodel.co.uk/the-five-case-model/>, accessed October 20, 2020

³⁰ <http://fivecasemodel.co.uk/overview/>

As it has been explained in Chapter 2, each case aims to answer several questions. These are presented in **Figure 13**, where an illustration of the questions per case that need to be answered for a typical capital procurement process which may result in a supply of a solution by a third party. There may be examples of business cases where procurement is not required.

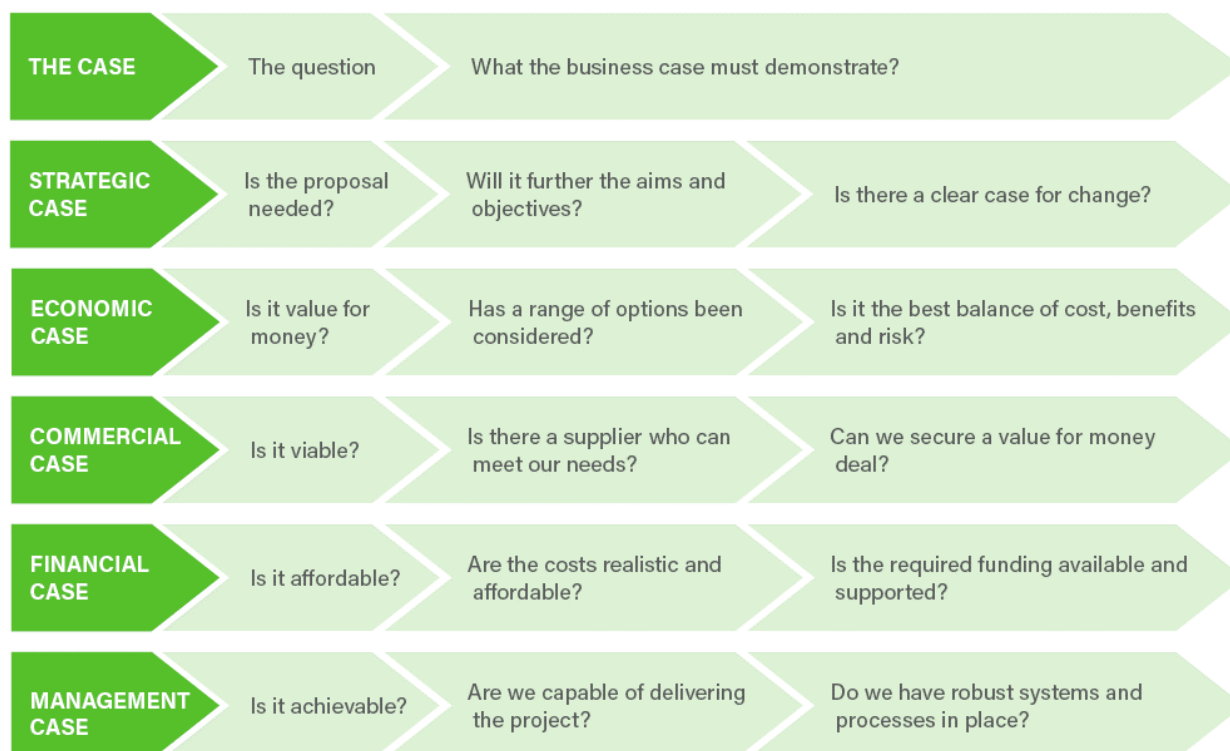


Figure 13. Questions per case for a typical capital procurement

The Five Case Model works well with the traditional three-phase business case life cycle depicted. Many public sector organisations use this approach but use different names and acronyms. In **Figure 14** the business case life cycle for a typical capital procurement is presented.

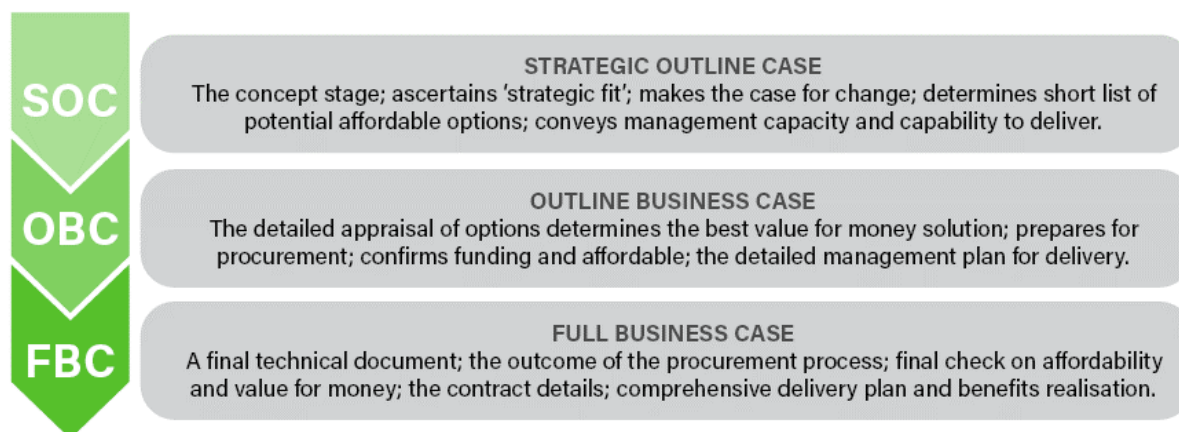


Figure 14. The business case life cycle for a typical capital procurement

The FFWS methodology presented in this handbook supports NbS proponents in the development of the Strategic Outline Case (SOC) and partly the Outline Business Case (OBC). To complete fully the OBC and develop the Full Business Case (FBC) is expected to require a variety of more in-depth feasibility studies and more advanced stages of design for each of the projects considered.

Given the starting point of many NbS initiatives – many not yet at the level of **solution scope** – and the limited knowledge there is still worldwide in detailing their design and assessing with certainty their expected performance over, their life cycle costs and their risk and cash profile we expect that by advancing the SOC and OBC the greater impact is achieved in terms of increasing NbS capacity to attract the interest of public and private investors. Once this is achieved, these investors and/or project sponsors can deploy additional financial resources and expertise to take the NbS programme or project towards the FBC stage.

The SOC, OBC and FBC are three separate documents, each one requiring separate approval and support before moving on to the next stage in the overall project life cycle. And each phase requires the five cases to be addressed, with varying levels of detail. This may appear to be burdensome, time-consuming and potentially costly. However, if applied correctly, it has a real benefit; it can reduce unnecessary costs and management time by eliminating at the early SOC stage any scheme that is a low priority, does not deliver the key organisational goals and strategies and therefore has no corporate support. By addressing the specific questions in each of the five cases, these schemes would self-destruct during very early stages of consideration by the business case development team.

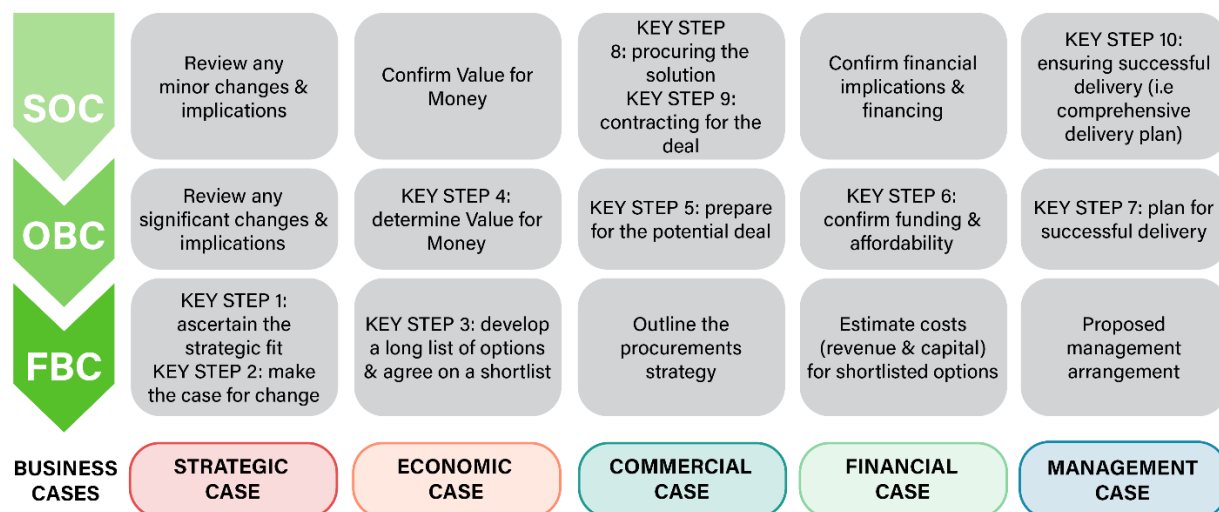


Figure 15. The five case model building blocks

At each of the three stages (SOC, OBC and FBC) the business case needs to consider each of the five cases. The emphasis is different though for each case at the respective stages. We have summarised the purpose of each case in our building blocks diagram below. We have also highlighted the ten key steps; these reflect the core purpose of the document at the various stages of the business case lifecycle.

3.8 Assessing project bankability

Water security strategies are often implemented as investment programmes made of several large investment projects or clusters of projects. Projects are time-bounded agreements within or between organisations for pooling resources towards the accomplishment of an objective. The actual engagement of actors in a project depends on multiple factors. From an economic perspective, it ultimately depends on actors' expectations of creating and capturing value from the time-bounded agreement. Furthermore, projects usually imply front-end investments that usually exceed the financial capacities of project owners. Therefore, it is normally necessary for project developers, investing equity, to request capital from financiers. The typical **project finance** structure has a debt to equity ratio of between 60:40 and 80:20, with some projects having more (or less) aggressive financial structures as explained below. Debt generally requires lower returns than equity in the form of interest.

Investors assess multiple projects to find the best opportunity for getting an economic return from supplying capital. There are different types of investors. The Taskforce on Financing Water

Infrastructure of the World Water Council developed a typology of water infrastructure investors which includes institutional investors, corporate investors, development finance, philanthropy and impact investors.

Impact investment describes capital allocated with the explicit intention to generate social and environmental impact alongside a financial return. This allocation can be made by institutional investors, corporations, development finance organisations, philanthropists or any entity. However, in all cases, investors are aware that compromising their resources in projects managed and executed by others imply a fundamental risk. Their investment might not yield the expected returns, and they even might simply lose their invested capital. That is why investors aim to identify the most solid project proposals for trusting their funds or pricing the perceived risk of payment failure by increasing the interest rate charged. In this context, project delivery is an investment problem.

Project owners need to have a grounded expectation that pooling resources produce the objectives they pursue. In the case of public organisations, the expectations are given by the compliance of rules and mandates and the achievement of given policy and developmental goals. Meanwhile, private organisations are particularly sensitive to financial risk. In simple terms, their decisions are driven by avoiding the risk of losing money. There are widely use assessment criteria that allow understanding of why an economic actor decide to supply financing to one project versus another.

Two of them are the **net present value** and the **internal rate of return (IRR)**. These indicators assume that economic actors base their decisions today, with the expectation of profiting in the future. Therefore, they consider that investing cash in a project has an **opportunity cost** of depositing that money in a bank that pays interests for the amount they have in saving (in more general terms, placing the same amount of money in financial markets).

Table 15. Key investability and bankability criteria

INDICATORS	DEFINITION	STAKEHOLDER
Net Present Value (NPV)	Provides the value (e.g. Euros) of the difference between the present value of one or more inbound cash flows and one or more outbound cash flows. Following pure financial considerations, economic actors will prefer the project that yields higher NPV.	Project sponsors Investors
Internal Rate of Return (IRR)	The IRR is the rate of return at which "the present value of a series of future cash flows equals the present value of all associated costs" (Bragg, 2006, p. 815). Hence, only investments with a higher IRR than the entity's cost of capital would be accepted.	Project developers / Investors
Return on Investment	Return on investment (ROI) is a ratio between net profit (over a period) and cost of investment (resulting from an investment of some resources at a point in time). A high ROI	Project developers/ investors

INDICATORS	DEFINITION	STAKEHOLDER
	<p>means the investment's gains compare favourably to its cost. As a performance measure, ROI is used to evaluate the efficiency of an investment or to compare the efficiencies of several different investments.[1] In economic terms, it is one way of relating profits to capital invested.</p> <p>Investors will not supply financing to a project if the ROI does not match their expectations.</p>	
Debt Coverage Service Ratio	<p>For calculating the DSCR, the following formula is often applied: (free cash flow on a yearly basis – adverse financial impact of climate event)/ debt service. Investors might trust projects with named ratios oscillating between 1.3 and 1.5, e.g. in waterway projects. If it is beneath 1, the project is at danger (high risk). If the reduction is 15% or more, but the DSCR remains above 1, the project is qualified as medium risk.</p>	Financiers
Return on Equity (RoE)	<p>Return on equity (ROE) is a measure of financial performance calculated by dividing net income by shareholders' equity. Because shareholders' equity is equal to a company's assets minus its debt, ROE is considered the return on net assets. ROE is considered a measure of how effectively management is using a company's assets to create profits.</p>	Project developer/ Investor
Debt-to equity (or gearing) ratio	<p>The debt-to-equity or gearing ratio is a financial metric that measures the amount of leverage used by a company. The debt-to-equity (D/E) ratio is calculated by dividing a company's (or Special Purpose Vehicle in the context of a PPP or project finance) total liabilities by its shareholder equity. These numbers are available on the balance sheet of a company's or SPV financial statements.</p> <p>It is a measure of the degree to which a company or project is financing its operations through debt versus wholly-owned funds. More specifically, it reflects the ability of shareholder equity to cover all outstanding debts in the event of a business downturn.</p>	Equity investors/ shareholders

Therefore, economic actors operate upon present value or the current worth of cash to be received in the future with one or more payments, which has been discounted at a market rate of interest.

Now, investment choices differ from project sponsors providing equity and investors providing debt. Often an infrastructure project that opts for project finance has a debt to equity ratio of between 60:40 and 80:20, meaning that is financed 40 to 20% by equity and 60 to 80% by acquiring debt. In a typical project undertaken by a private organisation, financial risk is measured by return on equity (RoE). RoE is the amount of net income returned as a percentage of shareholders' equity and is determined as the **internal rate of return (IRR)** of all relevant injections/redemptions to sponsors equity and deposits (like dividends or interest) to equity providers. Private companies will not engage in a project as sponsors providing equity if they conclude that their RoE does not meet their expectations.

Investors measure risk in terms of **return on investment (RoI)** in projects. A related indicator for measuring financial risk for financiers is the **debt coverage service ratio (DCSR)**.

As it is noted, the measures for assessing financial risk and assessing investment depends on the predictability of cash flows. **Figure 16** shows in a simplified way, the normal pattern of revenues and costs in a project and how project risk turns into financial risk, which means, how an event with a certain probability that affects the accomplishment of the mission of the project turns into a loss of money for investors and project sponsors. A typical infrastructure project is structured upon construction costs (also known as Capital expenses-CAPEX), operation costs (OPEX) and operating revenues. Events jeopardizing the mission of the project might negatively impact construction cost, operation revenues or operational costs.

For debt investors, the DCSR depends on the free cash flow in a certain year. As such, DCSR is vulnerable to sudden spikes in operational cost (the solid red area) and sudden losses (a gap in the green area). The reason is that the project is not able to operate at full capacity and recovery costs have to be paid. The lower operational revenues in that certain year limit the free cash flow. This may cause immediate problems for a project. Usually, investors estimate in advance if that is the case. They estimate free cash flow yearly and the yearly debt coverage, considering the possible financial impact of a project event.

The Return on Equity (RoE) depends on all costs, revenues and the gearing of a project. This is a measure that can be used to consider whether a risk should be mitigated or not.

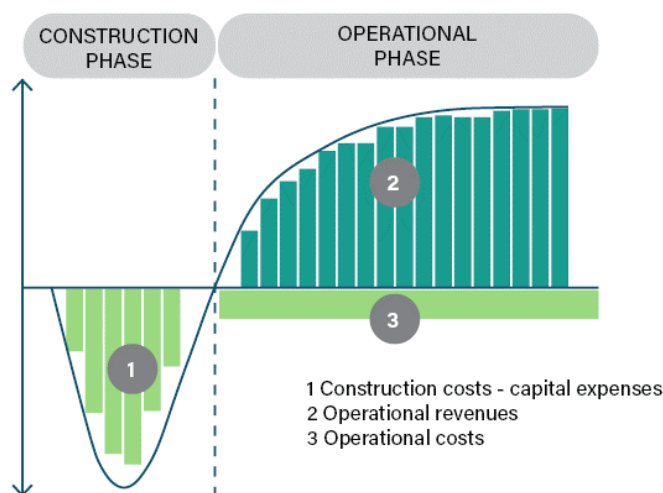


Figure 16. The typical cash flow of an infrastructure project

Other key factors that influence the bankability and investability assessment of project developers (investors) and project financiers are:

- Project preparation and financial management of the public project sponsor. The five cases model aims precisely at guiding a sound investment case that takes into account financial constraints and possible liabilities from the beginning. The FFWS aims precisely at supporting the process of project preparation.
- Risk management and risk sharing protocols that ensure that risk is allocated to the party who is in the most appropriate position to deal with it. For example, a private investor would not be best positioned to mitigate risks that arise from macro-economic problems, i.e. any fluctuations in exchange rates and resulting from inflation etc.
- Track record and risk-bearing capacity of the project developer is key for the financiers to

Project sponsors must identify risks and define the adequate response along with four alternatives: accept, avoid, transfer, reduce/mitigate.

- Accept/retain: While you have identified the risk, you take no immediate action. You acknowledge there is a risk and you will deal with it in case it manifests itself in the future. It is suitable for low impact – low probability risk
- Avoid: Prevent a risk from happening, decide based on how much time or budget this reaction entails. It assumes that your organisation has the capabilities to avoid the risk. Otherwise, you must transfer and carefully define the selecting procedure. It is suitable for high impact – high probability risk.
- Transfer: Pay someone else to bear with the risk for you; this can be both in terms of insurance or through the procurement of certain activities (outsourcing). It assumes that other organisations are in a better position to assume the risk. Otherwise, you might need to avoid or mitigate in house. It is suitable for high impact – high probability risk.
- Mitigating: If you cannot avoid the risk, you can take some action that will reduce the damage to your strategy. If you have capabilities, you better reduce/mitigate in house. Otherwise, you must consider transferring. It is suitable for low impact – low probability risk.

Mitigating/avoiding/transferring a risk implies investing additional resources. From an equity providers' point of view, risk should not be addressed by additional investment when the resulting RoE is lower than the one resulting from accepting the given risk.

3.9 Procurement strategy

Public procurement refers to the process by which public authorities, such as government departments or local authorities, purchase work, goods or services from companies. As public procurement accounts for a substantial portion of the taxpayers' money, governments are

expected to carry it out efficiently and with high standards of conduct to ensure high quality of service delivery and safeguard the public interest (OECD)³¹.

To create a level playing field for businesses across Europe, EU law sets out minimum harmonised public procurement rules³². These are the so-called EU directives on public procurement which apply to the tendering of projects and services worth more than a given amount. The core principles of these directives are transparency, equal treatment, open competition, and sound procedural management. They are designed to achieve a procurement market that is competitive, open, and well-regulated. This is essential for putting public funds to good use.

These rules govern the way public authorities and certain public utility operators purchase goods, works and services. They are transposed into national legislation and apply to tenders whose monetary value exceeds a certain amount. For tenders of lower value, national rules apply. Nevertheless, these national rules also have to respect the general principles of EU law.

Most water-related services are provided through public procurement where private participation in the delivery may involve the use of Public-Private Partnerships (PPPs). The successful implementation requires that both -the public and the private partners- benefit from the PPP arrangement. To successfully conclude a PPP project is a challenge.

The most difficult task is to arrive at a balanced and acceptable sharing of responsibilities, risks and rewards together with the private sector. Government expectations of the savings to be achieved through innovative contracting arrangements have resulted in many cases of biased optimism on both sides (Altamirano 2010).

The problem is that in many cases, the outcome of excessive optimism is renegotiation (Estache et al. 2000). As a result of unrealistic and aggressive bids, many projects face renegotiation (Queiroz 2007).

An effective design of the contract before the project start is crucial since often there is little more for a public agency to do than ensure that all involved parties comply with their contractual commitments (Estache et al. 2000).

In designing a procurement strategy for a project or cluster of projects one needs again to demonstrate that the chosen project delivery method will be effective in achieving Value for Money (VfM). Serious consideration needs to be given to contract and procurement process

³¹ OECD website, accessed October 20, 2020 <https://www.oecd.org/governance/public-procurement/>

³² European Commission website on public procurement, accessed October 20, 2020 https://ec.europa.eu/growth/single-market/public-procurement_en

design to make sure the right incentives are created for the private agent to deliver effectively Value for Money.

Value for money (VfM) is not about buying goods or services at the lowest price. It is about achieving the optimum combination of whole life costs (**total costs of ownership (TCO)**) and quality. Traditionally VfM was interpreted as getting the right quality, in the right quantity, at the right time, from the right supplier at the right price. A more recent interpretation is - obtaining a better quality of goods or services in more suitable quantities, just in time when needed, from better suppliers at prices that continue to improve.

Value for Money could be also often described in terms of the 'three Es' – economy, efficiency and effectiveness:

- economy – minimising the cost of resources for an activity ('doing things at a low price')
- efficiency – performing tasks with reasonable effort ('doing things the right way')
- effectiveness – the extent to which objectives are met ('doing the right things')

To help achieve VfM, goods and services should be acquired through a competitive process unless there are convincing reasons not to do so. The level and type of competition should match the complexity of the procurement and the estimated value of the project to be tendered. Each institution will have its own published thresholds above which, stated procedures must be followed. Barriers to the participation of suppliers should be removed as much as possible. As mentioned before within the EU directives on public procurement apply.

The VfM assessment takes detailed examination risks and uncertainties and through a process of risk allocation and risk-sharing comes to a final design of the contract that creates the incentives for the economy, efficiency and effectiveness goals to be achieved. The risk allocation in combination with the **payment mechanism** will ultimately make the project more or less attractive for private **project developer** and project financiers.

The transfer of risk and responsibility to a private agent goes naturally hand in hand with a delegation of control, the transfer of additional decision rights in determining how the project or task will be completed. As a result of these two characteristics, transfer of risk and decision rights, the potential of PPPs also brings several challenges with it as the complexity of regulating and managing such contracts only increases.

Based on this analysis ones then define (i) whether a specific risk or task should be shared, managed by the public side or managed by the private agent (ii) whether a specific risk or task should be included or excluded from the scope of procurement.

The authority or private institution doing the procurement may choose to tender it as a fully integrated contract (e.g. involving the private sector from design or even planning up to long term Operation and Maintenance) or choose for more traditional separate contracts for each activity and/or lifecycle phase. The main options and sub-options for the procurement of different investment projects and associated services are shown in **Figure 17**.

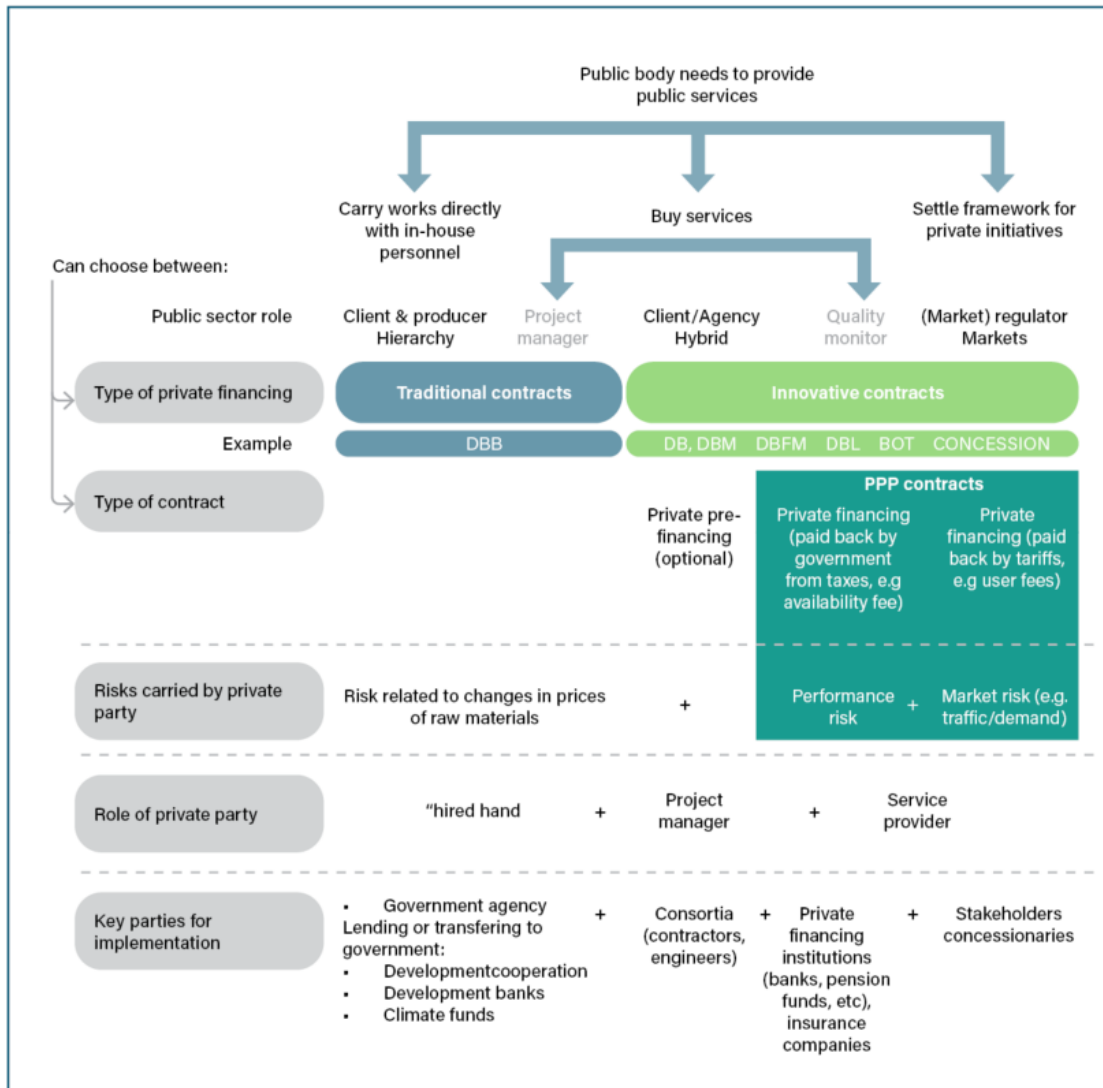


Figure 17. Options and sub-options in public procurement (Source Altamirano 2021; page 79).

A project delivery method is a term used to explain all the contractual relations, roles and responsibilities of parties involved in (capital) project delivery (Ghavamifa and Touran 2008). It

refers to the organisational framework of a project that defines the control mechanisms and the relationships between actors and their incentives (Lahdenpera 2008). Different project delivery systems simply provide different ways of organizing the procurement process. Each system adds new characters to the traditional participants, including the client, the designer and the builder, and the characters' roles expand depending on the system used (Loforte Ribeiro 2001).

There are also different formats for financing an infrastructure project. The continuum of approaches applied to infrastructure project finance by public and private owners, quasi-public agencies, developers, constructors, financiers, bankers, investment bankers, and fund managers includes complex combinations of public and private sector debt and equity, sovereign obligations, commitments, statutes, and regulations and other incentives along with private sector guarantees.

Despite the variety in formats available, there seem to be a limited number of procurement strategies adopted by public authorities;

- 1) separately outsourcing of pure Operations and Management (O&M),
- 2) Design-Bid-Build (DBB), segmented and publicly financed,
- 3) Design-Build (DB) segmented and publicly financed,
- 4) Design-Build-Operate (DBO) publicly financed and
- 5) Design-Build-Finance-Operate (DBFO) which makes use of private financing.

Innovative contracting and procurement practices adopted in the last two decades in the infrastructure world are characterized by five trends (Altamirano 2010):

- Combined or integrated contracts versus segmented contracts
- A shift from technical specifications to functional requirements or even impact indicators,
- Indirect financing of projects (via **project finance**) versus direct financing from public budgets
- Long term contracts instead of short-term contracts for single activities
- Introduction of alternative awarding criteria besides price

These contracting options apply not only to new capital projects but also to the maintenance of existing facilities. These five trends acquire a somewhat different shape and advance at a different pace depending on the market segment they are applied to; capital projects, routine maintenance or periodic maintenance.

NbS and watershed conservation projects that involve enhancing the condition of existing ecosystems may be considered comparable to contracts for periodic maintenance or even routine maintenance of infrastructure assets.

The entity – public or private- contracting or delegating the implementation of a water security project or the provision of specific water and/or ecosystem services (denominated the “principal” in agency theory terms) can incentivize the implementing party (denominated the “agent”) through several ways that vary in power. An overview of the different options that need to be taken when designing a project delivery and finance mechanism is shown in **Figure 18**.

The strongest way to create an incentive is through the contract scope, where is defined which tasks and risks are transferred to the third party. The second strongest is through the payment mechanisms – which could be based on effort and inputs or results, performance or even outcomes- and related monitoring systems that are put in place to enforce bonuses or deductions in payments based on the agreed Key Performance Indicators.

Then in the case of public procurement for which EU directives apply that require open procedures, another important way of incentivizing the agent to act favouring the interest of the principal is through the selection and awarding criteria and tendering processes.

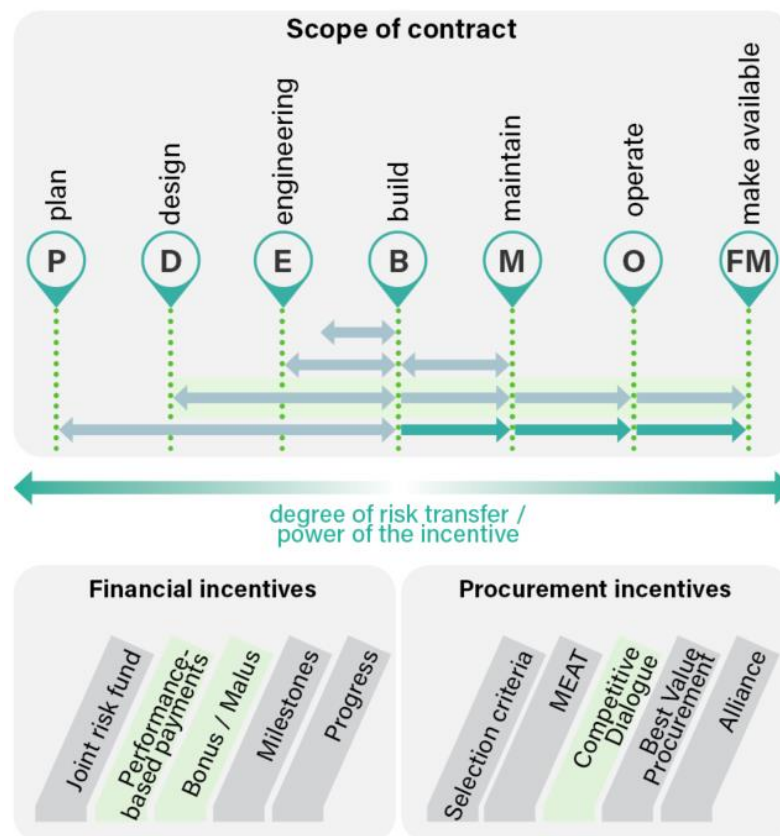


Figure 18. Project delivery options and contractual incentives (Adapted from Altamirano and Boendermaker 2014, decision support framework for contract choice for flood protection projects).

4 THE INVESTMENT CASE OF NBS VERSUS TRADITIONAL GREY INFRASTRUCTURE

This section presents the additional financing challenges faced by NbS projects given their innovative nature and considering the requirements of public procurement authorities as well as the expectations of private investors.

In this section, the specificities of NbS and green infrastructure from a project finance and asset management perspective are presented. The divide between how NbS are assessed by their proponents (e.g. ecologists, biologists and/or eco-engineers) versus by the project finance and infrastructure community at large is explained.

This section therefore could either serve infrastructure project developers wanting to understand NbS and green infrastructure assets, as well as by NbS proponents aiming to understand the infrastructure asset management lens.

4.1 The divide: NbS versus grey infrastructure communities³³

Multiple factors slow down the rate of adoption of NbS for water security. Some of the more often cited are uncertain performance, higher (real and perceived) risk and an unattractive cash profile of NbS projects. However, the most fundamental challenge is that most public and private investment planning processes are geared towards grey infrastructure “projects” as investment units and do not fit the characteristics of natural infrastructure investments.

This section presents how natural infrastructure is seen through the lens of the proponents of this approach versus the lens used by investors. As shown in Error! Reference source not found., the

³³ This section is based on Altamirano, M. A. (2019). Hybrid (green-grey) water security strategies: a blended finance approach for implementation at scale. Background paper Session 3. Roundtable on Financing Water, Regional Meeting Asia Manila, OECD.

way hybrid infrastructure strategies are seen by eco-engineers and proponents in general versus financiers and project developers create an important divide in language and interests. The criteria they both apply to judge the potential of green and hybrid versus grey-only infrastructure strategies are fundamentally different. It is important to clarify that whether the project developer could be public or private, does not make a significant change in this divide; the only difference could be the capacity of the public project developer to carry more risks and financial losses than the private one. Our objective with the FFWS is to enable NbS proponents to engage in strategic planning and investment planning processes and work more effectively together with project developers, project sponsors and financiers.

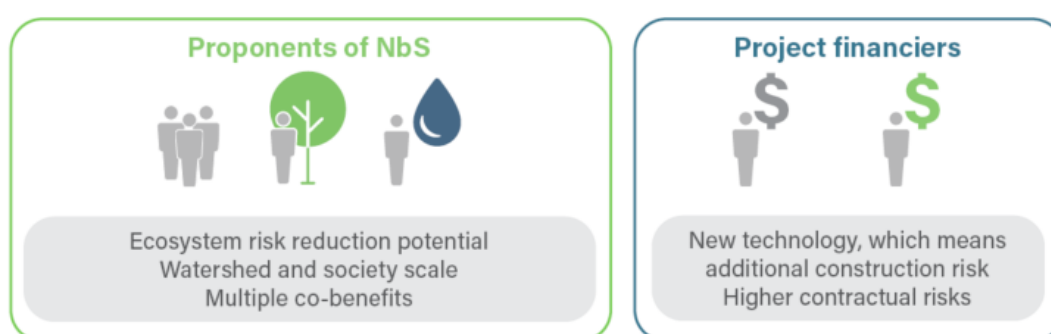


Figure 19. NbS seen through the lenses of proponents versus project developers and financiers (Altamirano 2018)

While NbS proponents advocate for the attractiveness of ecosystems as buffers that protect us against extreme events, financiers and project developers see NbS techniques as an innovation and therefore as a significant source of additional risk. In the project finance world, the riskiest phase of a project is the construction phase and the most important guarantee that this risk will be well managed is the track record of the implementing party with similar techniques. Therefore, the default policy in project finance is to opt for proven technology. A new technology could be a significant source of delays during “construction” and poor operational performance over time, threatening the viability of the projected cash flows. In addition, the lack of standardization across NbS and green infrastructure projects poses an additional investment barrier. Even if historic performance data were readily available, it would be difficult to compare across projects (as each is “unique” to a certain extent). A related challenge for project developers is that most lack a proven track record in delivering this type of asset.

NbS proponents build their argument of superior cost-effectiveness focusing mainly on changes in natural capital stocks and evaluating costs and benefits at the watershed scale and from a societal perspective. As earlier pointed out by OECD (2018) a strong economic case for investment does not always translate into a compelling financial case. Meanwhile in project finance, the main criteria to evaluate alternative investments are the project **internal rate of return (IRR)** and **net**

present value (NPV). Both are calculated by considering the cashflows – positive or negative - that can be captured by the project under the given contractual boundaries, in terms of area under their management, tasks and risks they have assumed. A financing institution will also decide whether to grant a loan to the project developer based on the same cash balance, assessing their debt servicing capacity³⁴.

NbS proponents build their investment case on their capacity to fulfil multiple functions and to generate multiple co-benefits. This feature increases their cost-effectiveness and could ideally lead to multiple sources of funding. However, in practice many of these co-benefits do not translate into revenue streams. At the same time, multiple functions require projects to be contracted by multiple principals, public and/or private project sponsors. And since it is expected that there will be trade-offs between these functions this feature of NbS could easily translate into significant contractual risks, during construction and operation of these projects.

Finally, an additional advantage often highlighted by NbS proponent is that their implementation requires bottom-up planning and could be community-driven. Again, this advantage is seen as a disadvantage by the infrastructure investment community; as implementation arrangements that rely on volunteers and communities do easily translate into additional personnel required for coordination, oversight and contract management. In the context of public agencies that need to do more with less personnel, this NbS feature creates an important barrier for their wider adoption.

Summarizing, for the implementation of NbS at system scale a middle ground between these two groups need to be found. Changes are needed in both sides: within public and private investment cycles and procedures, as well as in the way NbS projects are prepared and structured. NbS proponents need to invest more effort and creativity in the design of appropriate implementation arrangements that improve their overall investment case, their strategic, economic, commercial, financial and management cases.

How do we create a bridge between the two perspectives? How do we make the case for the changes needed in our investment planning systems? The first step – as explained in **Chapter 2** - is to strengthen their strategic case in a wider economic development context, by developing a sound Theory of Change. Positioning ecosystems as critical infrastructures and integrating them into our master planning process as allies in the challenge of dealing with an uncertain future and enablers of a paradigm shift may be a promising venue.

³⁴ The measurement used by the financial sector for debt servicing capacity is the so-called Debt Service Coverage Ratio (DCSR), for its definition see the Glossary.

Once we have managed to position NbS as critical building block of a new economic development paradigm, how do we integrate ecosystems into our strategic planning processes and make sure NbS elements of our water security strategies do not get implemented at slower pace than our grey infrastructure ones?

This is precisely the challenge that the FFWS project preparation process presented in this handbook intends to solve. As explained before the FFWS propose an approach that engages the (infrastructure) financing community and the NbS water security strategies in the process of designing project delivery and finance arrangements that fit the characteristics of hybrid projects. A process that involves all relevant public, private and community actors key for implementation and enables the translation of strategic water security plans (e.g. Integrated Water Resources Management or Disaster Risk Management plans) into clearly phased hybrid infrastructure clusters that can be absorbed by formal public investment planning processes and then translated into number of financially viable or even bankable deals making use of a blended finance approach. For a description of the process and how to design your own roadmap we advise you to read **Chapter 2**.

In the following sections we present more in depth the NbS features that differ from grey infrastructure assets.

4.2 NbS as asset class

Investors often speak in terms of asset classes. An **asset class** is a group of investments that exhibit similar characteristics and behave similarly in the marketplace (e.g., equities, fixed incomes, and cash equivalence). Accordingly, to leverage greater investments in NbS the challenge is crucial to develop NbS investments into a new accepted and attractive asset class for investors. The OECD has recently discussed how infrastructure in general could be conceptualized as an asset class, whereby important asset characteristics for investors are **risk/reward ratio** and the project cash flow profile (OECD, 2018). As concluded in this discussion, framing public (grey) infrastructure as a new asset class is already a massive challenge. Infrastructure assets are very heterogeneous, a sizeable pipeline of bankable projects is missing and there is insufficient historic data to assess asset performance.

Considering the challenges faced already by traditional infrastructure investments to become a recognized and attractive asset class for institutional investors, the creation of a NbS projects as new asset class becomes an even more complex endeavour.

The functionalities that many NbS provide are heterogenous even within the same landscape (watershed or coastline), which translates in different levels of risk for projects covering specific sections. In addition, and as explained before, there are important differences between the predictability of returns of NbS versus traditional grey infrastructure. The most tangible one is that functionality depends on cyclical and long-term ecological processes, that may be less directly controllable than traditional grey infrastructure solutions for water security.

4.3 Bankability implications of building with nature

An essential difference between traditional grey infrastructure and NbS are the way these are built and the processes on which they depend to provide specified levels of service. *“NbS follow a design process that takes into account natural processes and ecosystem services, both used and optimized to fulfil multiple functions. As a result, solutions are cost-effective, environmentally sustainable (e.g. low energy use and material requirements) and often also require less periodic maintenance efforts and/or rehabilitation investments than traditional grey infrastructure. This is because ecosystems are able to adapt to changing circumstances and therefore make for a more robust design in the long term”* (Altamirano 2017). In addition, NbS contribute to the visual quality of landscapes and the natural capital of a region or country

Examples of NbS are the creation or restoration of mangrove forests, shallow foreshores, sand dunes and reefs. These will not only reduce the wave load on coastal defence systems, but will also contribute to carbon fixation, slow the pace of erosion processes and improve water quality. Ecosystems as mangroves naturally adapt to sea level rise, as they have the capacity to trap sediment. Other examples include green roofs, permeable vegetated surfaces, urban forests and urban wetlands (Byrne & Yang, 2009; Douglas, 2011; Foster, Lowe & Winkelman, 2011).

There are different ambition levels in design moving increasingly from man-made to a natural approach, and thus starting from an ecological optimization of land use, going through the design of artificial ecosystems and the creation optimal conditions for ecosystem development, and up to the reinforcement of existing ecosystems.

The reliance of NbS and their functionality on cyclical and long-term ecological processes, instead of highly engineered standard construction processes has several practical consequences in their cost-effectiveness but also on their bankability. An overview of these practical consequence is presented in **Table 16**.

Table 16. Overview of building with nature impact on cost-effectiveness and bankability of NbS projects versus traditional grey infrastructure

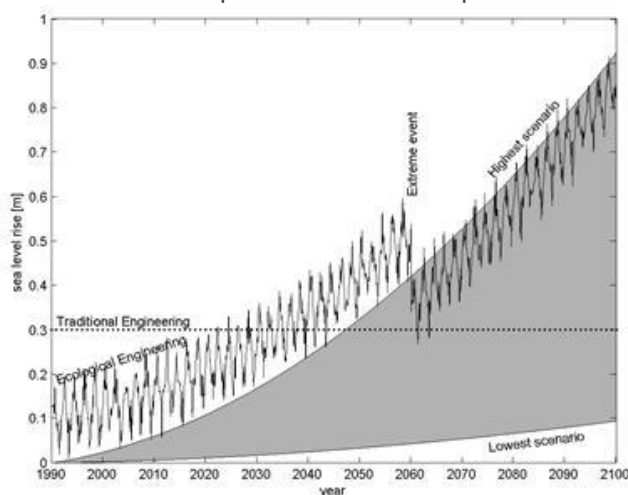
NBS CHARACTERISTIC	IMPACT ON LIFECYCLE PHASE, CASH-FLOW AND RISK PROFILE	RISK/REWARD RATIO	COST-EFFECTIVENESS
Cyclical performance	Operation & Maintenance (O&M) phase (+) Performance risk → (+) probability deductions in payments from project sponsors → (+) risk perception of project financiers → (+) cost of capital	Higher	Costs: (+) financial costs Benefits: complex to assess and compare with traditional grey
Adaptive capacity	(+) Useful life → (-) Total Costs of Ownership (TCO)	Lower (dependent on contract term)	Higher yet differences in useful life makes comparison challenging
Longer time to reach functionality	Construction (+) Construction time → (+) risk perception project financiers Cash-flow profile (-) Capital Expenses (CAPEX) → (-) CAPEX/OPEX ratio → more difficult to use Project Finance (+) time to receive availability or users' fees → (+) cost of capital	Higher	Complex to compare with traditional grey Lower: if there is urgency to reach full functionality
Natural resource subject to depletion – and area required for implementation	(+) Environmental, Social and Governance (ESG) risks during construction, O&M (+) Coordination and enforcement costs Possibly (+) Land acquisition costs	Higher	Higher in the long term, provided sustainable management of the resource is achieved
Capacity to fulfil multiple functions	Design, Build, Operation & Maintenance phases: Trade-offs between functions need to be managed → (+) transaction costs, (+) contractual risks	Higher	Higher yet additional complexity in comparing with traditional mono-functional infrastructure
Impact on systemic resilience (water and climate risks) and biodiversity	Not captured by traditional procurement and project delivery models Possible: (+) Access to concessional funds - climate and biodiversity related → (-) Cost of capital	Lower	Higher yet complex to compare making use of traditional infrastructure SCBA for infrastructures

As shown in **Table 16** the impact of NbS reliance on natural processes has mostly advantages in terms of their cost-effectiveness from a societal perspective, yet the complete difference in space and time scales at which these building or construction processes operate makes a fair comparison between NbS and grey infrastructure projects very complex. Meanwhile, most of these characteristics translate into a higher risk/reward ratio for project financiers and therefore considerably lower levels of bankability.

Against this context and as shown in the last row of **Table 16**, concessional sources of finance that value the resilient dividends of NbS at systemic level (e.g. climate or biodiversity finance) could be a game changer and create a strong incentive for project developers and financiers to invest in NbS.

4.3.1 Cyclical performance and adaptive capacity

Figure 20 shows the differences in functionality over time between traditional engineering and ecological engineering. In this graph the performance of traditionally engineered seawalls versus mangroves in terms of coastal protection and capacity to adapt to sea level rise is shown over a period of 110 years. In the case of mangrove systems “increasing inundation leads to higher rates of sediment deposition, which helps tidal wetlands deep up with sea-level rise (...) These types of



feedbacks likely explain the persistence of wetland within the intertidal zone over thousands of years in the stratigraphy record and observation of accretion rates” (Kirwan & Temmerman, 2009, p. 1801). Besides coastal protection, mangrove systems offer several additional ecosystem services. They provide supporting and providing services which are used by activities such as aquaculture, agriculture and forestry.

Figure 20.Traditional engineering (dotted line) versus ecological engineering (thick line). (Borsje et al., 2011)

These dynamics however are not totally or directly controllable. This translates into a higher risk perception for private project developers, provided these projects continue to be contracted making use of traditional project finance (i.e. Public-Private-Partnership contracts) schemes, where payments are linked to ability to guarantee a certain specified level of performance (preferably without fluctuations) and most performance risks are assigned to the implementing consortium.

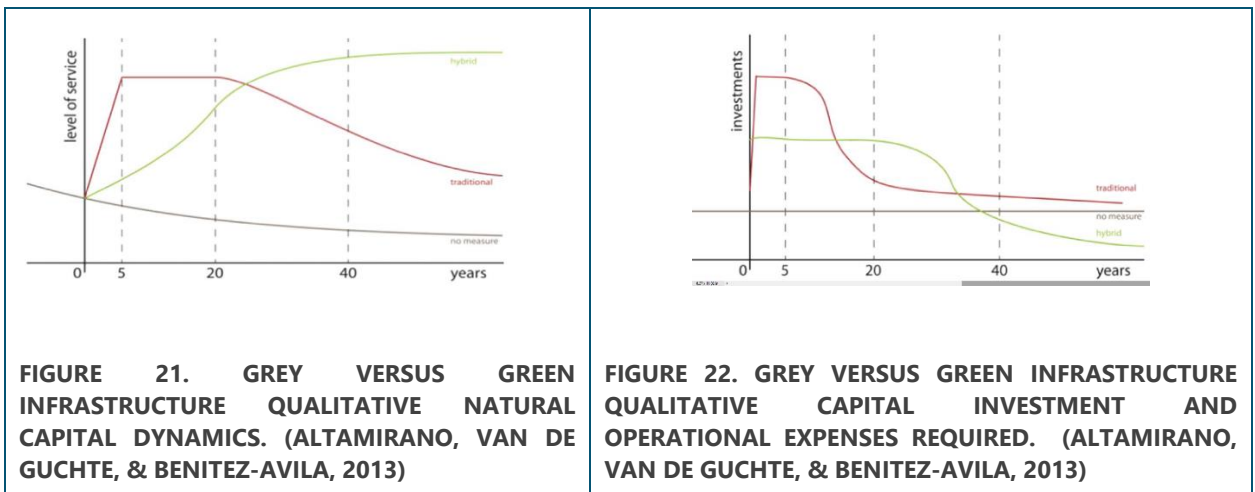
Traditional public procurement and project finance schemes create also strong incentives for the use of proven technologies to limit construction risk to a minimum, assuming construction is the riskiest lifecycle phase of a capital project. Most traditional project developers have little previous experience with building with nature processes, which makes NbS equivalent to a new technology. This does not only result in a higher perceived and real risk from the project developer point of view, but also affect project developers in their capacity to access finance at favourable conditions. In project finance, given the reliance on the project performance; besides the project cashflow and

risk profiles, the project financier place significant importance in the previous experience of the consortium or private party implementing the project.

4.3.2 Longer time to reach functionality

Most NbS projects take a longer time to reach functionality than traditional infrastructure. As stated by Altamirano, van de Guchte and Benítez-Ávila (2013) and shown in **Figure 21** and **Figure 22** the time required by hybrid coastal protection systems (i.e. mangrove forests in combination with groynes) versus traditional seawalls is longer and this combined with their adaptive capacity translates into lower CAPEX over the entire useful life of the asset, spread over a much longer period of time. A longer construction phase as well as the resulting CAPEX/OPEX ratio makes NbS projects less attractive from a project finance perspective.

This dependence on ecosystem dynamics – provided that these ecosystems are not under other type of external pressure- also may translate into much lower Operation and Maintenance (O&M) efforts and costs (Denjean et al., 2017).



4.3.3 Natural resource subject to depletion – and area required for implementation

An additional complexity in the design, construction and O&M phases of NbS is the fact that their functionality and performance over time depend on natural resources that are susceptible to depletion and to multiple environmental pressures difficult to manage. For example, mangrove forests could be seen as infrastructures that provide coastal protection, while at the same time

they are a source of timber and therefore a resource that can be depleted by communities driven by their need to generate income in the short term.

The same characteristic makes the revenue generation potential of NbS difficult to guarantee. Their sustainable financing as well as their performance over time, are both highly dependent on collective contractual (formal or informal) agreements that guarantee the commitment of the communities and economic actors surrounding them to manage responsibly these natural resources. This introduces significant ESG risks and

This characteristic combined with the fact that most NbS projects require for their effective implementation of much larger areas of land or the proper management of these areas, result in a significant increase of ESG risks, coordination and enforcement costs and possible much larger land acquisition costs.

At the same time, these characteristics also could translate into public infrastructure projects that are much more value by local communities and face less resistance than traditional ones. It all depends on the complex dynamics between local socio-economic conditions, the enabling environment and the quality of the planning process. The more local actors are involved in the decision-making process and the less dependent they are for their subsistence on the depletion of these natural resources, the higher the chance these characteristics have a positive instead of a negative effect on project bankability and cost-effectiveness.

4.3.4 The market value of Nature

Finally, a crucial and still unresolved challenge for the bankability of NbS projects is the market value of nature. While it is more and more globally acknowledged that climate change cannot be tackled without ramping investments to protect and restore nature, according to recent studies NbS attract only 3% of global climate funding. As stated by the Rt Hon Lord Goldsmith, UK Minister for Pacific and the Environment in his statement on Building a Clean and Resilient Recovery from COVID-19 in Support of Climate Action and the Sustainable Development Goals, published July 8th, 2020, the main reason is that there is not yet a market for nature: *"A growing market for the clean technology revolution is emerging. But that is not so for nature. Consider the Amazon and other great rainforests. The whole world depends on them. Yet their value barely registers, worth much more dead than alive. Financial incentives that destroy forests outstrip those in favour of their protection by over 40 to one."*

4.4 Typology of green infrastructure measures for water security

In order to assess the investment case of NbS programmes or projects and design a fit for purpose arrangement for them, it is important to first gain understanding on the different types of NbS projects and their biophysical and technical characteristics that enable the provision of multiple functions but also require very distinct natural processes. In **NAIAD Deliverable 4.2** we defined a list of typologies of green infrastructure measures according to their functionalities and cost generating activities. **Table 17** gives an overview of these different types of NbS for the mitigation of floods, droughts and water quality risks.

Table 17. Typical green infrastructure, function and cost generating activities (Source: NAIAD D4.2)

GREEN INFRASTRUCTURE MEASURE	MAIN FUNCTION	SECONDARY FUNCTION	COST GENERATING ACTIVITIES
Re/afforestation	(ground) water supply regulation, water purification, erosion control, biological control, water temperature control, flood control.	Food production, raw materials, medicinal resources, carbon sequestration, pollination, species habitat, maintenance of genetic diversity, recreation, tourism, aesthetic value, spiritual experience, air purification	Cost of seeds and plant, soil preparation, planting type, labour and machinery, regulation requirements, land acquisition. Ungulate removal, weed control, training and education. Land acquisition.
Riverbank protection	Erosion control	Species habitat	Bioengineering, boulders placement, planting vegetation, design Maintenance
Wetland restoration	Water supply regulation, water purification, biological control, water temperature control, flood control	Food production, raw materials, medicinal resources, carbon sequestration, pollination, species habitat, maintenance of genetic diversity, erosion control, recreation, tourism, aesthetic value, spiritual experience.	Mowing, grazing, clearing trees, increasing open water by removing aquatic vegetation, extending area of mosaic habitats, improving hydrological conditions, shrub clearance, long-term management/monitoring to ensure recovery.
Wetland construction	Water supply regulation, water purification, biological control, water temperature control, flood control. Biological wastewater treatment 'technologies', nutrient pollution control (reduce eutrophication risk) of wastewater, reduce flow velocity, remove nutrients and sediments, mitigate surface run-off.	Food production, raw materials, medicinal resources, carbon sequestration, pollination, species habitat, maintenance of genetic diversity, erosion control, recreation, tourism, aesthetic value, spiritual experience.	Site assessment and design, excavation and layout, materials, inlet and outlet structures, pipes, pumps, and vegetation. Substrates Land acquisition O&M can include activities such as the regular checking and repairing of pumps, inlet and outlet structure for water level, hydraulic loading, pollution loads of influent and effluent, odour control, removing sediment, harvesting the vegetation (optional), plant protection (e.g. pest or disease vector control) and checking filter bed for clogging.

GREEN INFRASTRUCTURE MEASURE	MAIN FUNCTION	SECONDARY FUNCTION	COST GENERATING ACTIVITIES
Green spaces (e.g. parks)	Water supply regulation, water purification, water temperature control (shading), urban stormwater runoff, bioretention, infiltration. Protect aquatic environments from impacts of surrounding land use [9]	Food production, erosion control, habitat for species, recreation, aesthetic value.	Planting vegetation, building materials, labour costs, planning, design, Land acquisition
Water harvesting (hybrid)	Water supply regulation, moderation of extreme events.	Erosion control, aesthetic/cultural value, urban heat prevention, air quality, cooling effect, spatial quality/recreation, co2 capturing.	Site assessment and design, construction, labour, wide variety of techniques, land acquisition. Placing pipes, underground system, retention crates. excavation of soil, depleting sand, planting vegetation, drilling for infiltration, placing pumps.
Riparian buffers	Temperature control, moderation of extreme events, water purification, biological control	Food production, raw materials, medicinal resources, carbon sequestration, pollination, habitats, genetic diversity, recreation, tourism, aesthetic/spiritual value biodiversity, cultural ES, recreation, tourism, nature preservation	Land acquisition, planting of buffer zones, substrate.
Green roofs	Moderation of extreme events.	Food production, temperature control, pollination, habitats for species, aesthetic value.	Watering, weeding, pruning, application of organic fertilizer and occasional removal of invasive or undesirable plants and replanting as needed. Drains and gutters must be inspected and cleared more frequently than on a roof without a garden, due to the build-up of plant debris
Mangrove restoration	Moderation of extreme events	Food production, raw materials, medicinal resources, temperature control, erosion control, pollination, biological control, habitat, genetic diversity, recreation, tourism, aesthetic/cultural value, spiritual value	Land purchase (if any), seeds and seedling growing costs, transportation and labour costs, Problem and system analysis, design of restoration plan, the process of recreation of abiotic conditions (e.g. construction of groynes) Setting up a monitoring system
Coastal/salt marches	Moderation of extreme events	Food production, raw materials, medicinal resources, temperature control, erosion control, pollination, biological control, habitat, genetic diversity, recreation, tourism,	land purchase (if any), seeds and seedling growing (saltwater tolerant grasses, shrubs and other vegetation) costs, transportation and labour costs Extensive planning and monitoring regarding; restoration of the tidal

GREEN INFRASTRUCTURE MEASURE	MAIN FUNCTION	SECONDARY FUNCTION	COST GENERATING ACTIVITIES
		aesthetic/cultural value, spiritual value [2] CO2 sequestration [2]	hydrology, the proper mix of freshwater with saltwater, nutrients, and sediments to tolerable concentrations of toxic materials. problem and system analysis, design of restoration plan, the process of recreation of abiotic conditions (e.g. construction of groynes, setting up Monitoring system)
Restoring oyster reefs	Moderation of extreme events	Food production, erosion control, biological control, habitat, genetic diversity, recreation, tourism, aesthetic/cultural value, spiritual value, Nitrogen removal.	Problem and system analysis, design of restoration plan, the process of recreation of abiotic conditions (e.g. construction of groynes) Setting up a monitoring system

4.5 Defining a hierarchy of services relying on green infrastructure

The development of the commercial and financial case for NbS is supported by the FFWS by assuming that revenue streams can be generated in the form of payments by users or taxpayers for given levels of service. It is also assumed that the provision of these services relies on the implementation of several complementary measures (i.e. clusters of projects) that together provide a number of (natural) functions (e.g. water purification), and these functions in combination with infrastructure networks in place (e.g. water distribution networks for irrigation) result in a certain level of service provided to different users (e.g. farmers).

To make this assessment the FFWS relies on the so-called ecosystem service cascade, developed by Haines-Young and Potschin (2009, p. 15). The ecosystem service cascade as portrayed in **Figure 25** links ecological structures and processes and elements of human well-being on the other. A measure such as restoring a wetland is an intervention that aims at modifying an existing biophysical structure or process.

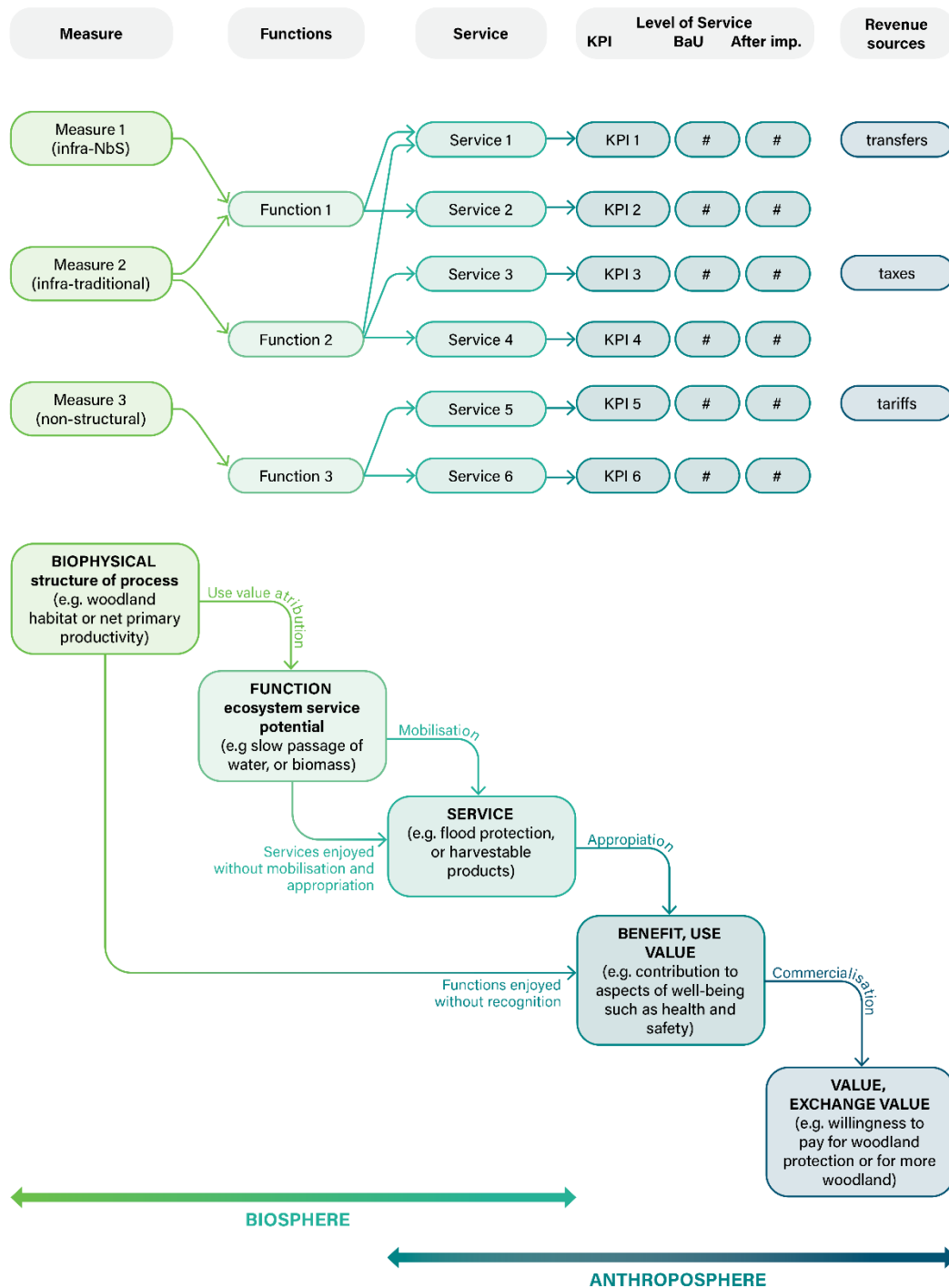


Figure 23. Ecosystem service cascade. (Adapted from Haines-Young & Potschin, 2009)

By doing so, the implementation of an NbS alters the functionality of existing ecological structures and by doing so enables the provision of valuable services to individuals, groups or communities. This service has a positive impact on well-being and therefore prone to be valued in terms of willingness to pay.

The FFWS aims at facilitating the definition of a governance and funding structure that enables the monetization of ecosystem services and willingness to pay if the service is delivered. This willingness can only be materialized as a future commitment through formal (and enforceable) agreements. These formal agreements require specifications on what is expected to get in the transaction (economic exchange) in terms of a quantified level of service. A credible promise in terms of levels of services enables investors to take the risk of financing the NbS investments needed today to generate those services in the future.

The findings of a workshop organized by Deltares with experts on wetlands, willow forests, mangroves and engineering asset management from Deltares but also from Wetlands International, IHE-Delft and water managers from Bangladesh September 2019 confirmed the FFWS hypothesis that there may be important trade-offs between multiple NbS functions as well as complex interactions between hazards that could affect the functionality of NbS over their entire lifecycle (Lazurko and Altamirano 2019). While the workshop was designed to investigate functions and hazards individually, participants identified situations in which managing an NbS to maximize one function may require trade-offs with another (e.g. wetlands managed for maximizing water purification may not necessarily maximize biodiversity benefits) and that hazard events that combine multiple stressors may introduce greater risks to long-term NbS functionality (e.g. willows in a floodplain may be more vulnerable to severe drought when combined with bed erosion) (Altamirano, Lazurko and Arellano 2019).

These findings underlined the need to develop tools that balance the interconnectedness of natural systems with frameworks that are relevant to engineers and financiers. They also confirmed the need to define jointly a clear hierarchy of functions the NbS is supposed to fulfil, to ensure the right decisions are made during design, implementation and operation and maintenance; which is a key element of the Financing Framework for Water Security approach (Altamirano and Lazurko, 2019).

5 THE FFWS IN ACTION: DEVELOPING THE INVESTMENT CASE OF NBS STRATEGIES FOR WATER SECURITY IN EUROPE AND WORLDWIDE

5.1 Introduction

Between 2016 and 2020 the FFWS guidelines for project preparation have been continuously improved and successfully implemented in seven countries at different scales. Within Europe as part of the H2020 NAIAD project they have been implemented in close collaboration with local demonstration partners to develop a long-term strategy for the implementation of NbS at scale beyond the NAIAD project. The three demonstration cases directly coached by the Deltares team were: a) Micro Urban Wetlands (MUW) for flood management in the **city of Rotterdam, the Netherlands** ; b) large scale groundwater-related ecosystem services in **Medina del Campo, Spain**, for drought risk management and c) wetlands restoration for flood risk management in the **Lower Danube in Romania**. The team supported the nine NAIAD Demos in assessing the maturity of their five investment cases and drafting the way forward beyond the project through a short training and collaborative modelling workshop towards the end of the project.

Worldwide these guidelines have been applied in Asia in Indonesia (Semarang, urban resilience strategy) and the Philippines (Jalaur River Basin, IWRM strategy and Manila, Masterplan for the Sustainable Development of Manila Bay), and in Latin America and the Caribbean in Mexico (Oaxaca, urban resilience strategy) and Guayaquil, Ecuador (green infrastructure flood management strategy).

The FFWS approach and detailed formats and collaborative modelling session scripts as presented in this handbook were used by demo leaders and tested fully by the three demonstration cases mentioned above. The investment case evidence collected and a roadmap towards implementation at scale of NbS solutions for water security resulting from the implementation of these guidelines are both presented in the first section. The result is a proposed implementation arrangement per cluster of projects specified, including the choice of governance mode, funding, financing and procurement strategies.

To finalise the third and last section of this chapter presents the results of the application of the FFWS in the city of Semarang, in Indonesia. The Cascading Semarang case that also makes use of hybrid infrastructure strategies to mitigate urban flooding and subsidence was a project that took place within the Water as Leverage for Resilient Cities Asia program. The Water as Leverage for Resilient Cities Asia program was an initiative of the Dutch government in cooperation with the Asian Infrastructure Investment Bank (AIIB), the Dutch Development Bank FMO, 100ResilientCities,

Partners for Resilience, Architecture Workroom Brussels, International Architecture Biennale Rotterdam and the Global Centre on Adaptation.

This has been one of the most comprehensive application worldwide of the FFWS approach as it took place in the context of an innovative urban resilience strategic planning process, counted with the extensive support of a large consortium of local partners, international pioneering urban design, planning and engineering firms and the continuous feedback of multilateral development banks.

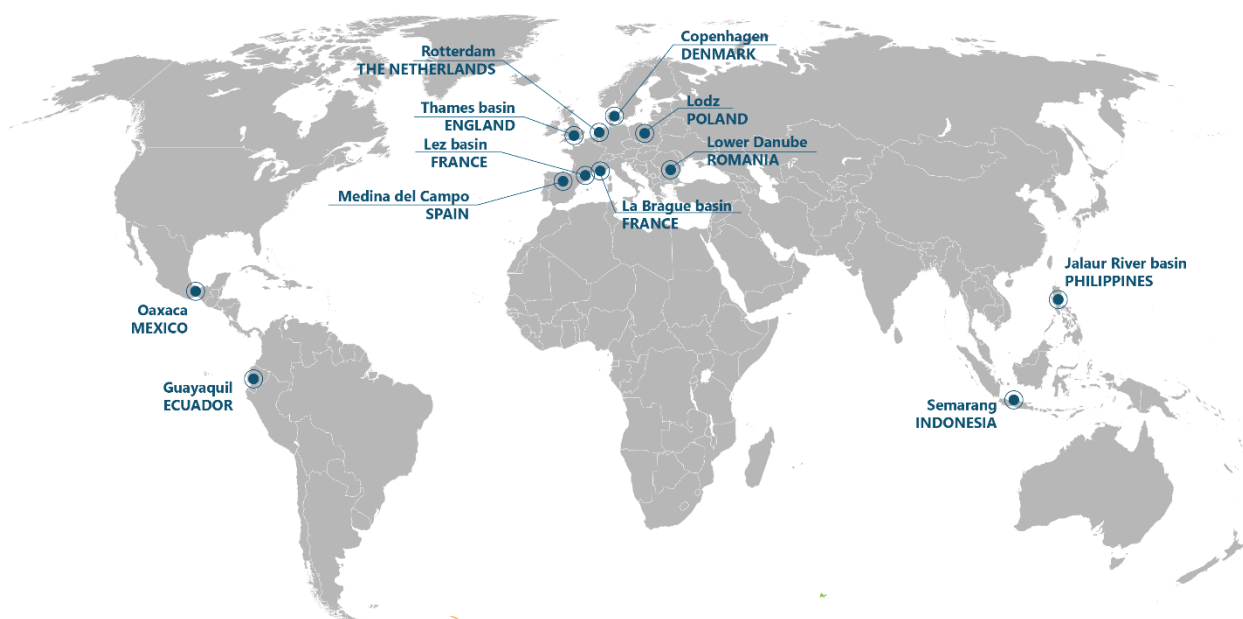


Figure 24. Location of the application of the FFWS in Europe worldwide.

5.2 FFWS applications in Europe

Before starting to introduce each of the three cases supported within NAIAD, it is important to highlight the fact that each of them had a significantly different starting point. The level of engagement of demo leaders with public investment planning processes varied but also the level of specification of NbS strategy being proposed. Unfortunately, most of them – except for the Rotterdam demonstration case- did not have the level of solution scope once we started the facilitation process and this created important limitations in the application of the FFWS project preparation approach.

A team from Deltares took the role of facilitator and coached demo leaders in the process of developing a project preparation roadmap that fit their context specific needs, considering the

results of the self-assessment of the five cases of investment and the particular constellation of stakeholders and enabling institutional conditions. The process involved several analytical steps, including desk research, bilateral interviews, internal demo teams project meetings as well as collaborative business modelling workshops engaging a larger set of stakeholders.

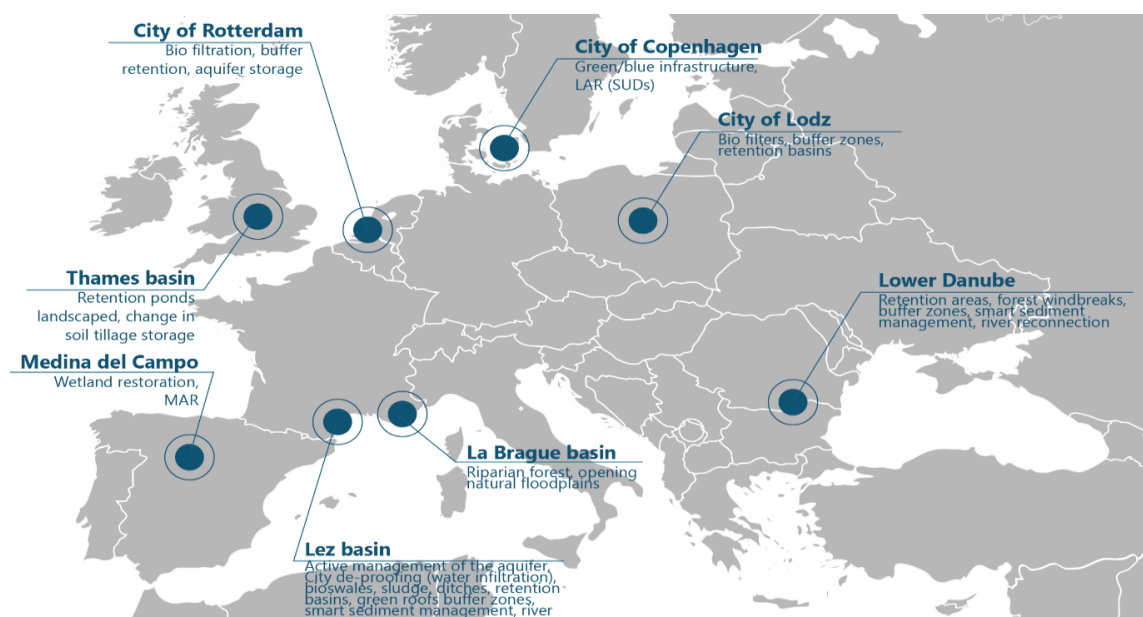


Figure 25. Nature Insurance value: Assessment and Demonstration (NAIAD) demo cases throughout Europe

The presentation of each of the cases follows the following logic. First the project preparation roadmap is presented. After the results of the application of the FFWS methodology presented in **Chapter 2** are presented, starting with the strategic case and assessment of enabling conditions for successful implementation of NbS for water security at system scale. These results are followed by the presentation of the economic case, including an analysis of the pains and gains experienced by different actors in the BAU versus implementation of NbS strategy scenarios. To finalize each case concludes with next steps recommended to shape further the NbS programme into an investable proposition and take it towards implementation at system scale, including the presentation of the commercial, financial and management cases and implementation choices regarding the funding, financing and procurement strategies.

To finalize the FFWS was applied to all nine NAIAD Demos through a collaborative business modelling session organized during the project demo meeting last January 2020 in Copenhagen. This exercise enabled demo leaders to assess the strengths and weaknesses of their NbS strategy in terms of bankability and maturity of the investment case of their programme or project. The results of this assessment as well as some practical recommendations towards upscaling of NbS

in the city of Lodz, the demo cases of La Brague and Thames basins are presented in the second section of this chapter.

In the design of the process and the facilitation strategy priority was given to the most relevant implementation barriers and knowledge gaps identified through the intake assessment realized with each of the demos at the beginning of each case.

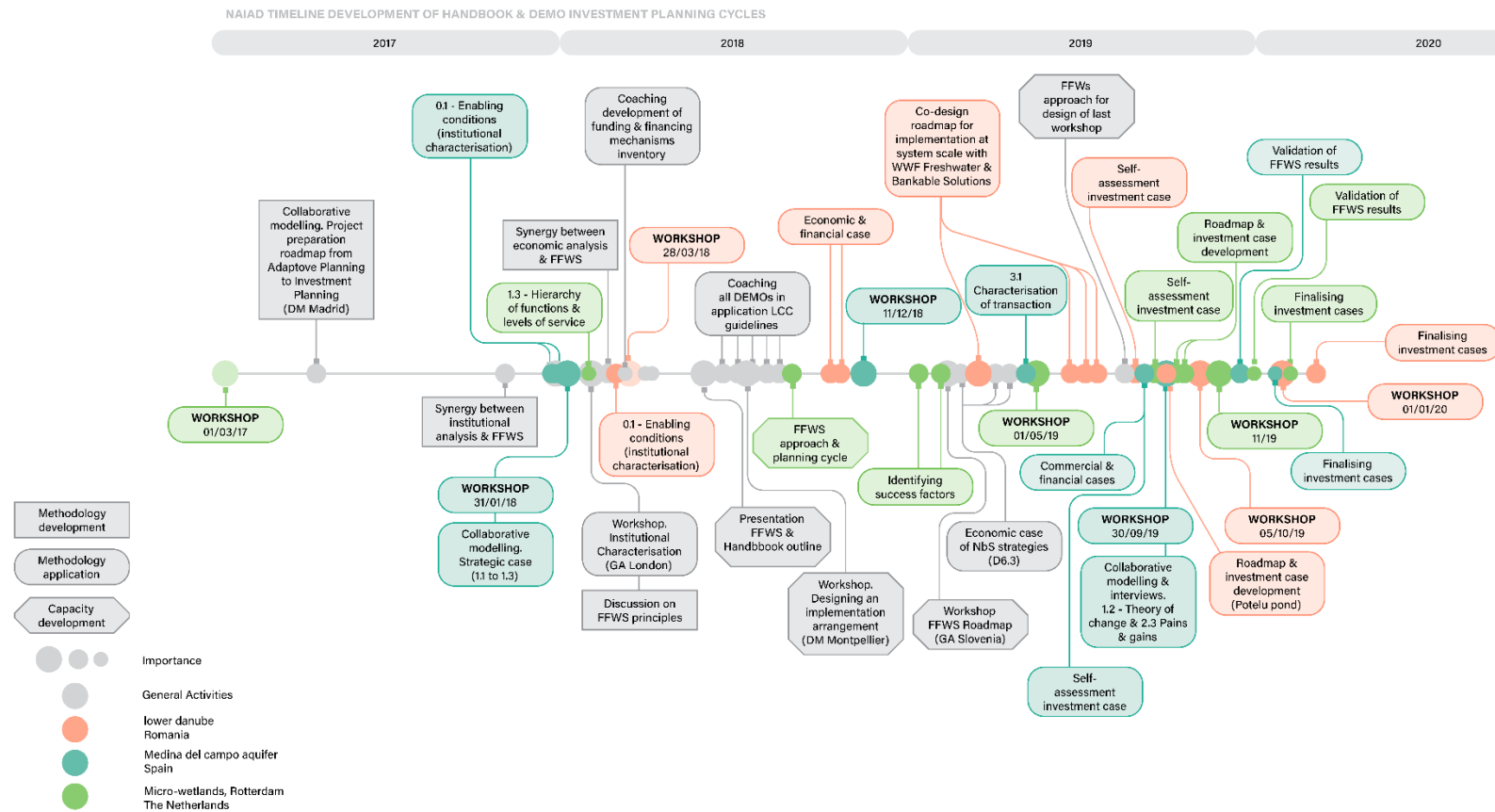


Figure 26. Timeline of the NAIAD project

5.2.1 City of Rotterdam: Urban Micro Wetlands

DEMO CASE: URBAN MICRO WETLANDS, CITY OF ROTTERDAM

RESPONSIBLE: N/A

● high quality of information
 ● space for improving Information quality
 ● no information at all

	YES/NO	INFO. QUALITY	MODULE
1. STRATEGIC CASE			
Solution scope of preferred strategy	YES	●	1.1
Theory of change	YES	●	1.2
Hierarchy of functions and levels of service over time	YES	●	1.3
Levels of services (over time)	YES		1.4
Enabling conditions within institutional setting	YES	●	0.1
Stakes, supporters and opponents	YES	●	0.2
Capacity levels and social capital	YES	●	0.3
Role of the insurance sector	NO	●	0.4
Inventory of funding and financing sources	YES	●	0.5
2. ECONOMIC CASE			
Qualitative Social Cost Benefit Analysis (SCBA)	YES	●	2.1
Quantitative Social Cost Benefit Analysis (SCBA)	YES	●	2.2
Pain and gains (value chains)	YES	●	2.3
3. COMMERCIAL CASE			
Characterisation of the transaction	NO	●	3.1
Make-or-Buy Decision	-	No applicable	3.2
Risk profile	NO	●	3.3
Market sounding	YES	●	3.4
4. FINANCIAL CASE			
Qualitative Lifecycle Costs Analysis (LCCA)	YES	●	4.1
Quantitative Lifecycle Costs Analysis (LCCA)	YES	●	4.2
Revenue streams (qualitative)	NO	●	4.3
Revenue streams (quantitative)	YES	●	4.4
Cash flow profile	YES	●	4.5
Financial Viability Gap	YES	●	4.6

Financing Strategy	YES	●	4.7
5. MANAGEMENT CASE			
Procurement objectives and boundary conditions (Ambitions, concerns and key implementation stakeholders)	NO	●	5.1
Project delivery and finance model per cluster: contract scope, financial and tendering incentives	YES	●	5.2
Implementation strategy per cluster	YES	●	5.3
Implementation arrangement (contractual and financial) per cluster	NO	●	5.4

The Rotterdam demo case is built around the implementation of the Urban Water Buffer (UWB) project in the neighbourhood of Spangen, located in the western part of the city of Rotterdam, the Netherlands. The UWB is one of the many measures that make part of the municipality vision to create multifunctional, visible retention areas on public squares. The FFWS for the Rotterdam case was implemented at a later stage of the planning cycle, compared to the other two demo cases. The Rotterdam demo case differs from the rest in NAIAD in two ways. First, the scale of the NbS is the smallest from all, making its implementation somewhat less complex to accomplish as most benefits could be captured by actors already in charge of related assets in the area. Second, it is the only demo case where the NbS innovative technology was implemented and the results evaluated by project sponsors within the project duration.

As such the application of the FFWS differed from the application of it in the other two demo cases. The choice of mode of governance and funding of the pilot project were already taken once the framework was applied. Therefore, was in first instance used to validate the methodology by comparing the choices made by the local actors and project sponsors with the recommendations generated by the FFWS. After validation, the project preparation process focused on identifying alternative implementation strategies and pathways towards upscaling of the innovation as main building block of Rotterdam municipality initiative to become 100% climate-proof by 2025.



Figure 27. Urban Water Buffer in Spangen, the Netherlands (H2O Waternetwerk)

5.2.1.1 Strategic case: Theory of change and enabling environment

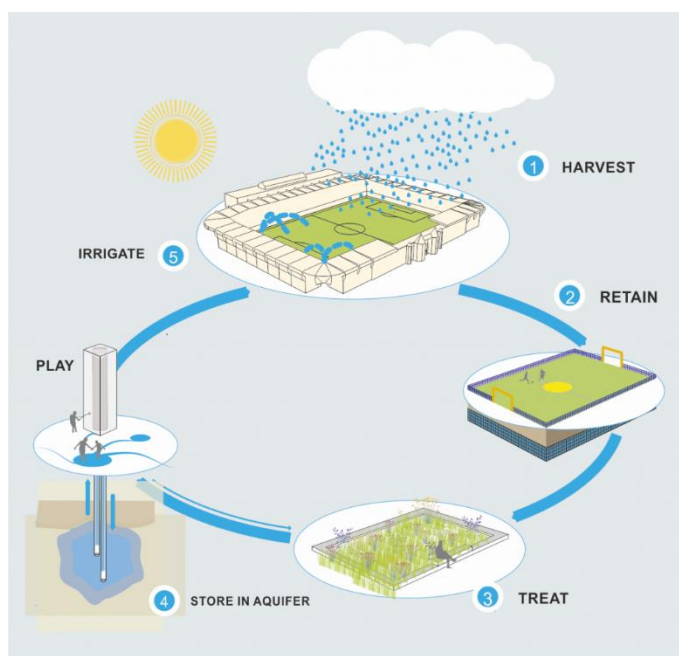
The Spangen neighbourhood faced pluvial flooding during peak rainfall events, while inhabitants had the ambition of improving the spatial quality of the neighbourhood with more green areas. Additionally, the soccer club Sparta wanted to make their water supply more sustainable. One of the solutions chosen was the Urban Water Buffer (UWB).

As shown in **Figure 28** the Urban Water Buffer (UWB) is a system that collects, treats and infiltrates rainwater runoff in the underground through infiltration wells to allow for later re-use of the treated storm water. The UWB is a combination of three elements: a separate sewer system, a grey rainwater collection system and nature-based components to treat and store the water before reuse. The concept operates as a hybrid, that mimics natural processes to provide the desired level of service.

This innovation pilot was made possible by the cooperation between the Municipality of Rotterdam, the Water Authority Delfland, the community organization Natuurlijk Spangen, the water company Evides and a consortium of knowledge institutions and SMES aiming at developing the concept called “TKI-Urban Water Buffer”.

In the Netherlands entrepreneurs and research organisations can join a Top consortium for Knowledge and Innovation (TKI) programme to get involved and share knowledge, risks and investments. Entrepreneurs can contribute with their knowledge and equity investments and

receive research services and support by top knowledge institutes in return.



As portrayed in **Table 18** the strategic case for investments in UWB is strengthened by the strategic importance of water and flood risk management in the Netherlands as well as by its contribution to the SDG and circular economy policy agendas at national and municipal level. The UWB aims to increase water retention capacity during torrential rain events and in this way reduce the risks of pluvial flood while contributing to multiple water management challenges of city, water utility and water board.

Figure 28. Graphical representation of the UWB system

Additionally, the increasing climate variability introduced by Climate Change has made pluvial flooding an additional threat for most Dutch cities. Innovation is required to deal with this new climate risk in a cost-effective manner. The UWB due to its modular design and small scale could be replicated in multiple city areas and become an important building block of a circular economy model Rotterdam aims to implement. In conclusion, the UWB has a very strong **strategic fit** with both national and municipal priorities.

The implementation of the UWB innovation pilot has also been facilitated by the existence of R&D catalytic funds. The implementation challenges introduced by the financial viability gap and risks introduced by the innovative nature of UWB could be solved thanks to the financial support of the TKI innovation fund from the Top Sector Water.

Table 18. Institutional enabling conditions for the NbS in Rotterdam

INSTITUTIONAL LAYER	INCENTIVES FOR INVESTMENT & IMPLEMENTATION	DISINCENTIVES FOR INVESTMENT OR IMPLEMENTATION
Layer 1: Social Embeddedness:	Water and flood risk management are historically top national security issues in the Netherlands Given a very long tradition of land reclamation, water management and more specifically the mitigation of flood risks is a top strategic priority in the Netherlands. If no actions would be taken, half of the country could be submerged. Among the oldest forms of local governments are the so-called water boards ^{34F35} , some of them founded in the 13th century. Strategic importance of SDG and circular economy agendas The Dutch government endorsed the 2030 Agenda for Sustainable Development at the UN summit of September 2015.	The national security status of flooding along an extremely high level of knowledge and technological development in water management may increase the risk aversion of problem owners towards innovations such as UWB.
Layer 2: Institutional Environment	Innovation is a pillar of the Dutch model of economic growth and competitiveness. Accordingly, significant investments are done in supporting R&D and the Netherlands ranks among the best worldwide. Innovation funds available to bring NbS innovation to maturity Through programmes like the Top consortium for Knowledge and Innovation (TKI), the national government provides support to innovative companies through grants, innovation credits and tax benefits.	
Layer 3: Governance	Rotterdam municipality leadership on circular economy Rotterdam is on the way to becoming a waste-free society. To achieve this, the city is moving from a linear economy to a circular economy model. Good water governance and high cost recovery levels	

³⁵ Water boards are regional government bodies charged with managing water barriers, waterways, water levels, water quality and sewage treatment in their respective regions.

INSTITUTIONAL LAYER	INCENTIVES FOR INVESTMENT & IMPLEMENTATION	DISINCENTIVES FOR INVESTMENT OR IMPLEMENTATION
	<p>Clear allocation of responsibilities and roles between different institutions regarding water management, combined with a well-designed taxing system resulting in one of the systems worldwide with the highest levels of cost recovery.</p> <p>Creditworthy project sponsors</p> <p>Enough funding for water management and climate adaptation investments, their operation and maintenance and clear procurement rules enable the creation of a pipeline of opportunities for NbS innovation for urban flood management.</p>	
<p>Layer 4: Individual analysis, Market and prices</p>	<p>Emerging urban NbS market</p> <p>In the EU, the NbS market for urban water management, climate adaptation and circular economy challenges is growing. This is the result of an increasing demand for cost-effective solutions to handle extreme events increases and the slow formation of a complete landscape of NbS providers.</p> <p>A growing future pipeline of deals for urban NbS makes the decision to invest in developing and maturing new technologies of SME's.</p>	

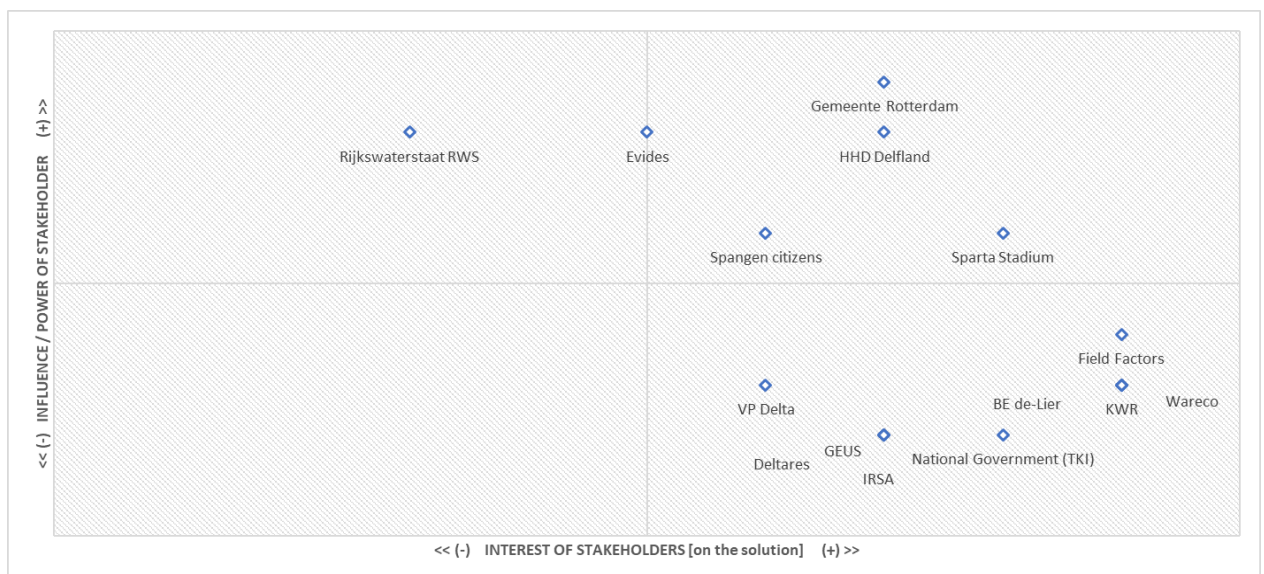
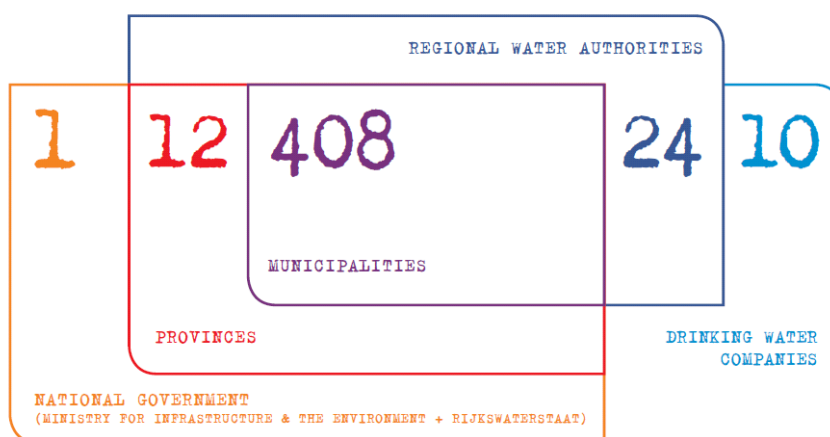


Figure 29. Stakeholder analysis for the implementation of UWB in Rotterdam

As shown in **Table 18** the water governance model of the Netherlands has been a major enabling factor in the successful implementation of the UWB Rotterdam case and one that will also play an important role in the opportunities for upscaling of this NbS at city and even national level.



An important characteristic of the Netherland water governance model is that is very decentralised. Water boards or regional water authorities play a crucial role in this system. There is also an earmarked tax for water management at regional level that is collected directly by water boards that ensures significant funding for the proper operation and maintenance of all water management related infrastructures. Besides and as established in the Administrative Agreement on Water from 2011, there is a very clear allocation of roles and responsibilities. The main players in the Netherlands water management system are the central government, 12 provincial governments, 22 water boards, 408 municipalities and 10 drinking water companies.

Table 19. Responsible authorities per function of the water system in the Netherlands

TASK	ORGANIZATION	FINANCING
Flood protection, water quantity and water quality (main water system)	State (public)	General resources, pollution levy national waters
Groundwater	Province (public)	Regional (water) tax
Flood protection, water quantity and water quality (regional)	Water board (public)	Regional (water) tax
Wastewater treatment	Water authority (public)	Regional (water) tax
Drinking water supply	Water companies (semi-public)	Tariffs
Sewerage	Municipalities (public)	Local (sewerage) tax

First as shown in **Table 19** it is clear which authority is the main responsible to provide each of the main tasks. Secondly, as depicted in in **Table 20** the setting of standards is assigned to only one general democratic body who then supervises how these tasks are implemented by a given implementing agency.

Table 20. Standard setting authorities and implementing agencies in the Netherlands

PRINCIPAL (STANDARD SETTING AUTHORITY)	AGENT (IMPLEMENTING AGENCY)
Flood Risk Management: primary flood defence system → Central government	Rijkswaterstaat Waterboards
Pluvial flooding including flood defence system → Provinces	Water boards
Water quality → Central government	Rijkswaterstaat and waterboards

This clear allocation of responsibilities also translates into an easier to define role per actor in the implementation of the UWB NbS solution. As shown in **Table 19**, each of the different stakeholder involved in making the implementation of UWB demo case possible contributed different resources.

The UWB is part of a comprehensive strategic plan that has as objective to make Rotterdam a 100% climate-proof city by 2025 and is called “Sustainable Rotterdam” or “Rotterdam duurzaam: 010 Duurzaam”³⁶ in Dutch. Rotterdam Climate Change Adaptation Programme also aims to increase the resilience of the city to climate change. This means that by 2025 the municipality aims to implement all necessary measures and investments required to minimize the impact of climate change and climate variability in each of the economic sectors and activities that take place in the city.

In line with this vision, all urban development plans in Rotterdam will consider long-term foreseeable climate change while allowing for contingencies. The ‘waterproof city’ they envision needs to be robust and resilient, combining green and grey infrastructure as optimal as possible. The municipality is giving priority to adaptation measures that enable water collection during heavy downpours (emergency storage) combined with options that delay the discharge of rainwater into drainage systems. Water storage in Rotterdam is integrated in the urban environment wherever possible, collectively also encouraging the installation of green roofs.

³⁶ <https://www.010duurzamestad.nl/>

Table 21. Rotterdam case stakeholders and their contribution to implementation

STAKEHOLDER	LIFECYCLE PHASE AND ROLE	RESOURCES
National Government	Innovation subsidy provider	Money: TKI Programme funds for R&D, from the Ministry of Economic Affairs and Climate.
Rijkswaterstaat RWS (government agency)	Planning	Authority: government agency responsible for water supply and water quality of the main water system
HHD Delfland (Water board)	Planning/	Authority: regional water authority in charge of the maintenance of dykes and dams, the control of water levels and water quality Money: regional water tax
Gemeente Rotterdam	Planning/ Project sponsor	Authority: local authority. His responsibility is solving urban flooding problems Money: local water tax and national subsidies. The Municipality is the funder, and responsible for urban development.
Evides	O&M/Project sponsor and service provider	Money: tariffs charged to water service users. Evides is the water company and operator of the wastewater and water supply system in the city of Rotterdam
VP Delta (Network organization)	Broker	Network: connections with entrepreneurs and research institutes
KWR (Research institute)	Design, O&M and validation/ Project developer TKI consortium	Expertise: project management and act as suppliers/executors
Wareco (consultancy company)	Design, O&M/ Project developer TKI consortium	Expertise: specialized in water, soil and foundations, and act as suppliers/executors
Field Factors (SME)	Design, O&M/ Project developer TKI consortium	Expertise: biofilters/implementation. It is the initiator partner and technology supplier. Is the DEMO leader within NAIAD.
Codema B-E De Lier	Supplier/ Project developer TKI consortium	Expertise: horticulture solutions.
Sparta Stadium	End user	Network: public information, diffusion in the local area.
Spangen citizens	Beneficiary	Network: public information, diffusion in the local area.
GEUS	NAIAD partner working with demo	Expertise: groundwater systems and climate adaptation
IRSA	NAIAD partner working with demo	Expertise: social acceptance of NbS
Deltares	NAIAD partner working with demo	Expertise: strategic planning for adaptation and urban flood risk management, NbS mainstreaming and finance

The municipality of Rotterdam, the regional water authority of Delfland, and the inhabitants of Spangen were working together on spatial improvements in the area, by increasing the amount of green space. The TKI consortium Urban Water Buffer, formed by research and knowledge institutes, consultancy companies, SMEs and public authorities, was looking for opportunities to explore the potential of applying the concept of underground rainwater storage and recovery in urban areas.

At the same time, the Cruyff Foundation was working on the renovation of a playground in the neighbourhood. As the window of opportunity arose, all stakeholders came together to start an integrated project. The final decision was made by the City of Rotterdam was driven by their policy goal to improve water management in the Spangen neighbourhood, combined with their interest to assess the potential of the Urban Water Buffer concept for Rotterdam pluvial flooding and climate adaptation challenges. **Figure 28** presents the stakeholder analysis for Rotterdam.

5.2.1.2 Economic case: Winners and losers

The project has as direct benefits the reduction of damages due to pluvial flooding by increasing by 1,400 m³ the retention capacity of the system. Another direct benefit is the provision of 15,000 m³ of harvested rainwater per year. As a result of this combination of functions, the project resulted in a reduction of the investments originally required to address these multiple challenges. The indirect benefits of the project include higher property values in the neighbourhood, reduced water treatment costs, and reduced damage and mitigation of groundwater salinization risks. Regarding sustainable urbanization, the project indirectly contributes to the improvement of aesthetic quality, social interaction and community engagement. As climate adaptation measure, the project reduces the load to the sewer system, increases infiltration capacity, reduces run-off, reduces drinking water usage, heat island effects and enables the mitigation of both, drought and flood risks at local scale. **Table 22** presents this overview of **pain and gains** experiences by key stakeholders in the Rotterdam demo case.

The required **level of service** for the Urban Water Buffer (UWB) was to provide sufficient retention capacity to process 66 mm rain events every two hours, retaining stormwater from 4 ha disconnected surface. Now, as explained in **NAIAD D6.3 Demo insurance assessment**, the economic case for investments in UWB was framed in terms of considering the UWB as one measure that makes part of a larger hybrid strategy implemented in the entire Spangen neighbourhood.

This hybrid infrastructure strategy included the creation of natural retention options, a separate sewerage system and the Urban Water Buffer in a complementary manner. This hybrid strategy was compared against a grey only strategy (traditional and centralized system) and a green only strategy (combination of different NbS such as green roofs). In the comparison of these different options given the spatial boundaries of the Spangen pilot case, the level of service specified was provide sufficient retention capacity to deal with a T10 rain event, which defines an event where 52,9 mm of water rain within a period of 12 hours.

Meanwhile in the context of the NAIAD project and given that implementation at small scale had already taken place, the demo leaders preferred to work with the FFWS in designing an

implementation arrangement that could enable the implementation of the UWB in multiple urban locations and at city or even country level.

Table 22. Pains and gains of existing value chains due to the implementation of UWB in Rotterdam demo case

SECTOR	TARGET GROUP	WINNER/ LOSER	BAU-2050		SOLUTION-2050	
			PAIN	BENEFITS	PAIN	BENEFITS
Recreation (sports)	Sparta Stadium	Winner	Yes	No	No	Yes
			When heavy rainfall occurs, the stadium fields get flooded within an hour period time			Reduction urban flooding impacts Rainwater reuse to irrigate the fields
Housing	Spangen citizens	Winner	Yes	No	No	Yes
			Flood damages Overflow/clogging of municipal sewage, damage to houses and floors, damage to installations and urban green			Reduction urban flooding impacts of cloudbursts
Commerce	Spangen local businesses	Winner	Yes	No	No	Yes
			Foregone revenues Discontinuation of commercial activity due to flooding problems			Reduction urban flooding impacts of cloudbursts

5.2.1.3 Commercial, Financial and Management cases

The funding and governance structure were organized around the provision of two services: water retention and freshwater supply for irrigation. For the first service, the governance structure is centralized procurement in charge of the municipality of Rotterdam. As a public good, the revenue comes from local taxes collected by the municipality paid by citizens, as well as through funds of the water board Delfland which are also derived from regional water taxes paid by citizens.

The analysis of the second service -supply of water for irrigation- is more complex, given the characteristics of the hybrid solution. The supply of freshwater is enabled by the implementation of the solution, rather than by the exploitation of an existing water reservoir. This water storage exclusively supplies water to the Sparta stadium, and none other users. The scale of the service is rather small, and the supplier is the semi-public water utility Evides. The Sparta Stadium pays a tariff. **Table 23** presents hierarchy of services provided by the NbS and the corresponding governance modes and funding sources possible for the implementation of the NbS in Rotterdam.

Table 23. Service hierarchy, governance mode and funding sources for UWB Rotterdam

MEASURE S	FUNCTION	SERVICE	TYPE OF GOOD	PREVAILING GOVERNANCE MODE FOR TRANSACTION	COMMISSIONER	TARGET GROUP	LEVELS OF SERVICE KPI	BAU	TARGET	REVENUE MECHANISM
Rainwater collection system	Collecting rainwater	Rainwater retention capacity	Public good	Centralized procurement	Rotterdam Municipality	Spangen citizens	Quality of service	NA	1,400 m ³ every 48h	Tax
Separated sewer system	Retaining rainwater									
Treat, store and reuse system	Treating, storing, reusing rainwater	Fresh water supply for irrigation during dry seasons	Private good	Small scale (private) association	Evides (Water Utility)	Sparta Stadium	Quality of service	NA	15,000 m ³ /year	Tariff

The estimated **lifecycle cost** considering capital expenses, routine and periodic maintenance, and direct and indirect support required for the asset to provide these services during the 50-year **useful life** totals EUR €1,715,291. Additionally, an **opportunity cost** between €11,700 - 33,480 was identified. This is generated because the area where 90 m² biofilter occupied by the biofilter cannot be used for other purposes. This calculation assumes a value per each square meter between EUR €130 and EUR €372.

Regarding sources of funding, the most important one is the water tariff of EUR €0.91 per cubic meter paid by Sparta stadium and that could be enough to cover operational costs. Another source of funding will be the regional water taxes collected by Delfland water board.

Accordingly, the implementation arrangement was structured taking as design constraints the procurement practices of three commissioners: Rotterdam municipality, Evides water company and Delfland regional water authority. The resulting allocation of risks and responsibilities was in line with the municipality responsibility to over the rainwater collection system, leaving possible the delegation of the Design and Build phases to third parties. Both phases were bundled in a DB contract and transferred to the TKI consortium Urban Water Buffer. The operation of the retention system as expected retained in-house by the commissioner, the municipality.

The final component was the treatment, storage and reuse system, which represented the more innovative component of the UWB. The design and implementation were procured by the

commissioner and delegated to the KPI consortium. Meanwhile and possibly due to economics of scale and scope, the operation and maintenance of this part of the system was commissioned by the municipality to Evides, the water utility serving the Spangen neighbourhood. Finally, Delfland water board is responsible for flood protection, water quality and water quantity tasks within the regional water system.

Given the innovation pilot status of this project, standard procurement procedures did not apply. The resulting implementation arrangement is presented in **Table 24**. In synthesis, it is expected that for the implementation at system scale of UWB the chosen mode of governance will be predominantly public procurement contracts. Alternative in other institutional contexts where flood protection is not a direct responsibility of the state or in particular situations where a private actor can capture within their spatial or business model boundaries the resilience dividends of UWB, the governance mode could be a private water stewardship investment or one of the projects commissioned by collective investment scheme.

Table 24. Implementation arrangement for the UWB in Rotterdam

MEASURE	COMMISSIONER	MAIN TASKS ASSOCIATED	PUBLIC-IN-HOUSE/PROCURE IN THE MARKET/ASSUMED BY THE MARKET/ASSUMED BY A NETWORK	DEGREES OF PRIVATE MANAGERIAL FREEDOM
Rainwater collection system	Rotterdam Municipality	Designing of rainwater collection system	Public in-house	N/A
	Rotterdam Municipality	Implementation rainwater collection system	Procured	Low
	Rotterdam Municipality	Operation rainwater collection system	Public in-house	N/A
Separated sewer system	Rotterdam Municipality	Designing and implementation retention of water	Procured within the KPI innovation programme (Public-Private-Knowledge consortium)	High
	Rotterdam Municipality	Operation retention of water	Public in-house	NA
Treat, store and reuse system	Rotterdam Municipality	Treatment, storage and reuse designing	Procured within the KPI innovation program (Public-Private-Knowledge consortium)	High
	Rotterdam Municipality	Treatment, storage and reuse implementation	Procured	High
	Rotterdam Municipality	Treatment, storage and reuse operation	Evides (Water Utility)	High

MEASURE	COMMISSIONER	MAIN TASKS ASSOCIATED	PUBLIC-IN-HOUSE/PROCURE IN THE MARKET/ASSUMED BY THE MARKET/ASSUMED BY A NETWORK	DEGREES OF PRIVATE MANAGERIAL FREEDOM
	Rotterdam Municipality	Treatment, storage and reuse maintenance	Evides (Water Utility)	High
Monitoring	HHD Delfland (Regional water authority)	Monitoring	Procured	Low

As the nature of the UWB Rotterdam case was a pilot project, the demo leaders assessed the performance in the Spangen area as proxy for the value delivered by the UWB. A relevant insight from the pilot project regarding the implementation of this initiative at city scale, was in identifying as important value drivers the capacity of UWB to delay the discharge of rainwater into sewerage systems and to supply water beyond its capacity to deal with extreme runoff.






















Accordingly, in an upscaling scenario, regional water authorities could consider the UWB solution as the most promising one when their ambition is to provide a steady supply of water in areas with expected overflow issues and increase water reuse. Consequently, the upscaling scenario requires to identify actors interested in restoring natural water balance and implementing circular solutions for water supply for urban units such as the stadium. In other words, the upscaling strategy would imply the identification of a pipeline of projects considering a wide range of business models for multiple actors in the city. The drivers of these initiatives would range from addressing concerns of water scarcity in the summertime, raise social cohesion by raising spatial quality to support branding strategies of private companies investing in circular solutions. In order to support the upscaling of the hybrid solution, Deltares proposed to use a *blended finance* strategy as a guiding framework for structuring the pipeline of projects.

5.2.2 Medina del Campo aquifer, Spain

DEMO CASE: MEDINA DEL CAMPO AQUIFER, SPAIN

RESPONSIBLE: ICATALYST

 high quality of information
  space for improving Information quality
  no information at all

	YES/NO	INFO. QUALITY	MODULE
1. STRATEGIC CASE			
Solution scope of preferred strategy	YES		1.1
Theory of change	YES		1.2
Hierarchy of functions and levels of service over time	NO		1.3
Levels of services (over time)	NO		1.4
Enabling conditions within institutional setting	YES		0.1
Stakes, supporters and opponents	YES		0.2
Capacity levels and social capital	YES		0.3
Role of the insurance sector	YES		0.4
Inventory of funding and financing sources	NO		0.5
2. ECONOMIC CASE			
Qualitative Social Cost Benefit Analysis (SCBA)	YES		2.1
Quantitative Social Cost Benefit Analysis (SCBA)	YES		2.2
Pain and gains (value chains)	NO		2.3
3. COMMERCIAL CASE			
Characterisation of the transaction	YES		3.1
Make-or-Buy Decision	NO		3.2
Risk profile	NO		3.3
Market sounding	NO		3.4
4. FINANCIAL CASE			
Qualitative Lifecycle Costs Analysis (LCCA)	YES		4.1
Quantitative Lifecycle Costs Analysis (LCCA)	YES		4.2
Revenue streams (qualitative)	YES		4.3
Revenue streams (quantitative)	NO		4.4
Cash flow profile	NO		4.5
Financial Viability Gap	NO		4.6

Financing Strategy	NO		4.7
5. MANAGEMENT CASE			
Procurement objectives and boundary conditions (Ambitions, concerns and key implementation stakeholders)	NO	●	5.1
Project delivery and finance model per cluster: contract scope, financial and tendering incentives	NO	●	5.2
Implementation strategy per cluster	NO	●	5.3
Implementation arrangement (contractual and financial) per cluster	NO	●	5.4

The ecosystem in question is the Medina del Campo aquifer, a groundwater body in Central Spain extending beneath Southern Valladolid and Northern Avila provinces. The area covering 3,700 km² is highly impacted by droughts, groundwater exploitation, and degradation of the surface riverine ecosystems along the Zapardiel river. Climate projections indicate that these conditions will worsen in the future and probably threaten the economic wellbeing of the region, which is highly dependent on agriculture. A collaborative process with water users and related stakeholders has resulted in the identification and planning of 5 measures: aquifer recharge, technological transformation of fields, alternating crops, water abstractions control and other governance measures including the constitution of WUAs (water user associations). While the technological transformation of fields was not considered originally as part of the strategy within the NAIAD project, the analysis undertaken by Deltares, including the results of the first stakeholder engagement workshop found out this to be a critical component for the overall success of the NbS programme. Therefore, it was decided to include this measure as part of the preferred strategy in the design of the project preparation process.

The FFWS for the Medina del Campo case was implemented during the process of building commitment with water users, and during the later stage of strategy building for complying with the [Water Framework Directive](#) targets for groundwater. The assessment of existing data was a collaborative process between the project leader, the Duero River Basin Authority (CDH) and the research institute Deltares. Additionally, the findings from the NAIAD project and the FFWS application could be of use for the further design of the LIFE Integrated Project lead by the CHD. This LIFE-IP RBMP-Duero project aims to implement a river basin management plan in the central-south part of the Duero river basin, including the Medina del Campo region **Textbox 5**. Differently that in the Rotterdam demo case, the most crucial success factor for implementation in the Medina del Campo case is driving a change in behaviour by agricultural water users, that would incentivize them to make significant changes in their agricultural practices. Existing traditional practices have compromised the sustainability of water resources in the long term. Given this key implementation challenge in this application of the FFWS relatively more attention was paid to the non-structural measures or soft components of the NbS strategy than in the other two applications within NAIAD. In line with this focus, we realized an in-depth institutional analysis

following the institutional characterisation methodology presented in NAIAD **Deliverable 5.6 Report on the comparative institutional analysis and methods and guidelines** but also on **Appendix C**.

5.2.2.1 Strategic case: Theory of change and enabling environment

Spain has been exposed to significant simultaneous changes, which have challenged water management efforts nationwide. On the one hand, European regulation requires from member parties the compliance with more demanding environmental goals. On the other hand, the lack of demographic retention in the rural areas and an aged farming sector affect this and other regions in Spain and set an important constraint for the implementation of the proposed measures.

Main drivers for implementation of an NbS strategy are to reduce water consumption by 25%, to restore ground-water-related ecosystem services, to improve water supply quality now affected by arsenic contamination, and to reduce flood and drought risk and other related risks such as landslide. The initiative stems from the strategic goals and responsibilities of the CHD to comply with European regulations and national water planning. The enabling environment is given by the structure of water rights, and the Water Framework Directive. Accordingly, the problem owner is the Duero River Basin Authority (CHD), as the authority in charge of water planning and the enforcement of the Water Framework Directive (FD).

In previous decades, the CHD granted **water rights** over the aquifer in a time when the knowledge on aquifer dynamics was rather scarce. Therefore, there was an overprovision of water rights on the aquifer. The situation as is now is presented **Figure 30**.

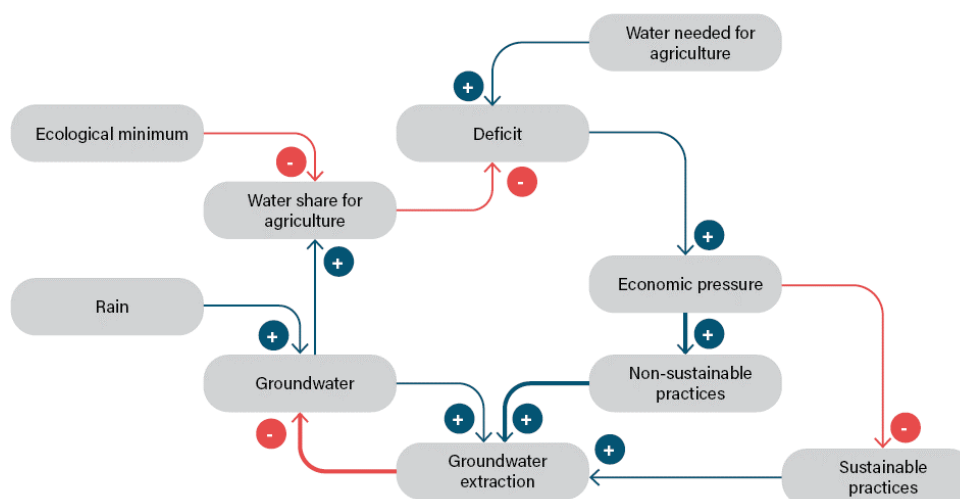


Figure 30. Business as Usual situation in Medina del Campo

The WFD was issued in 2000 imposing obligations to member states aiming at achieving a good status in terms of their quantitative and chemical conditions. In fact, the current deterioration of the aquifer legally enabled by widespread water rights implies objective grounds for formally declaring the status of overexploitation. In such scenario, the CHD would be entitled to enforce the creation of water user associations within 6 months of the declaration. The creation of these associations forces users to bundle their exploitation rights at the head of one organism, which in practice means renouncing to individual water rights. This scenario was considered as highly undesirable by the CHD and the water users, most of which totally or partially depend on irrigated agriculture. It might have implied a fierce conflict, like the one experienced in the Doñana³⁷ aquifer in the south of Spain in 2019.

³⁷ The Doñana aquifer was declared over-exploited in February 2019, following the European Commission procedure against Spain to the European Court of Justice of Luxembourg for not fulfilling its obligation in guaranteeing the good condition of aquifers. A complaint was filed by WWF back in 2010. The declaration of over-exploitation is an administrative act under the WFD. This situation triggered a large social conflict as the CHD restricted exploitation rights of farmers. The Spanish Civil Guard had to intervene.

Textbox 5. LIFE-IP RBMP-DUERO project (More information available on: <https://www.lifeduero.eu/en/>)

The objective of LIFE-IP RBMP-DUERO is to support compliance with the Water Framework Directive (WFD), the Wastewater Treatment (UWWT) Directive, the Groundwater Directive (GWD), the Floods Directive (FD) and the Habitats Directive, by implementing the Duero River Basin Management Plan (RBMP).

The project will cover sub-basins, those of the rivers Trabancos, Zapardiel and Arealillo, where water bodies do not reach good ecological status. The area of action has an extension of approximately 5,000 km² which represents approximately 6% of the Duero basin and involves 154 municipalities. The project aims to show how the use of **natural capital** is a particularly valuable asset to hedge against the effects of climate change, by adopting best science, new approaches and good governance practices.

As a primary aim, the project will design integrated tools that combine innovative approaches, namely:

- **Natural infrastructure** (i.e. natural water retention measures);
- Improved **public participation**, stakeholder engagement and communication;
- **Green economy** (i.e. valuation of watershed environmental services); and
- Better **governance of water resources** to address known problems and challenges, in line with, and if possible, beyond, regulatory requirements.

Two supporting objectives are to help create **synergies between** water policies and other sectorial **policies** (e.g. agriculture), to develop effective and well-coordinated actions and to raise **awareness of environmental problems** by promoting the participation of water users and all relevant stakeholders.

Some of the project expected results that will contribute to the implementation of the Medina demo case are:

- Establishment of a wetland recovery strategy, and the recovery of at least 20 of the 30 wetlands located in the project's area;
- Enhanced aquifer recharge, by improving the connection between surface water flows and groundwater;
- Transformation of at least 5 000 ha from irrigated to rain-fed crops, avoiding the extraction of 15 HM3 from the aquifer;
- Creation of 300 ha of new forested areas, improving the Nature 2000 network and increasing carbon sequestration; and
- Creation of new economic activities related to eco-tourism;

Blended finance strategy: In addition to the IP budget itself the project will facilitate the coordinated use of 8,525,000 EUR complementary funding from European Regional Development Fund (ERDF), H2020 and other public national funds. These complementary actions aim to support the implementation of the UWWT Directive, the Operation Programmes and Rural Development Plans linked to environmental challenges and water governance

Given the results of the physical assessment of the managed aquifer recharge measure showing marginal impact as initially designed (for more details see **NAIAD D2.7 Guidelines for**

approaches to understand the role of Nbs in flood and drought mitigation), the key to success was framing the project as an effort to drive voluntary change in agricultural water use practices.

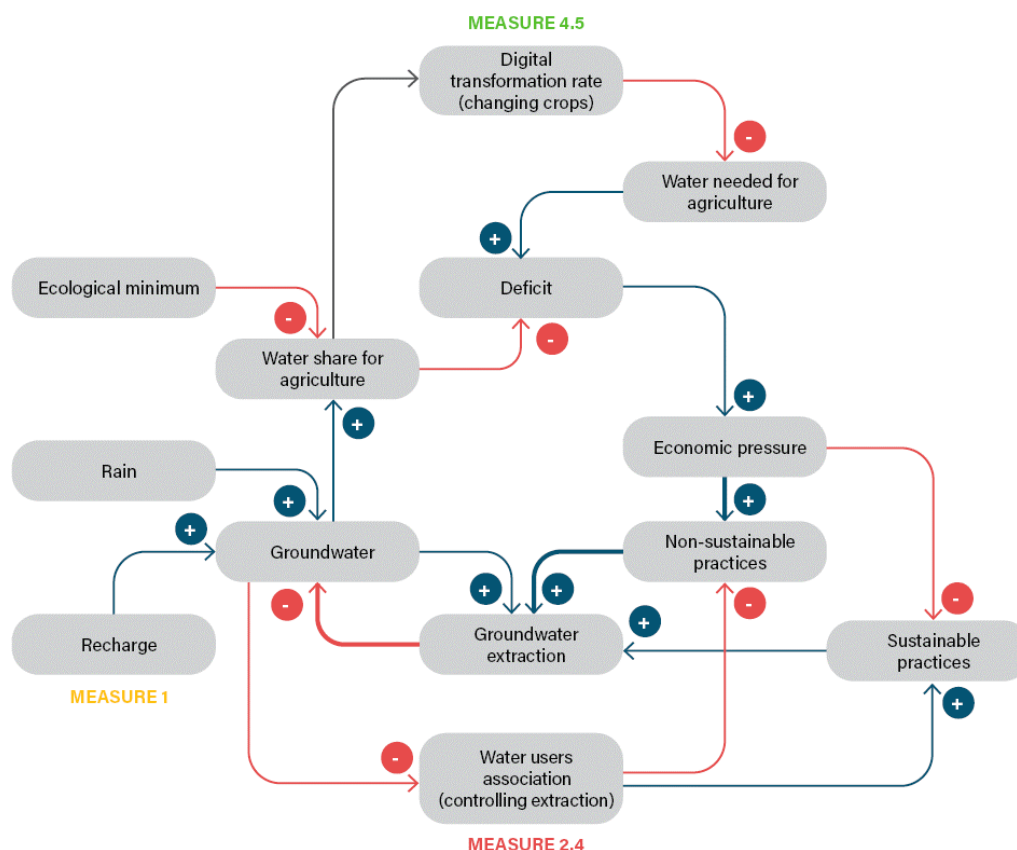


Figure 31. Nbs Strategy to achieve sustainable water use in Medina del Campo, Spain

The achievement of this goal is however complicated by the fact that the CHD is not institutionally responsible for the agricultural policy. Most agricultural policies and regulations affecting water are driven by the Common Agricultural Policy (CAP), which must be adapted by each member state to its specific context. This process involves a wide range of actors and interests, although the main management and enforcement responsibilities fall on the regional government (Junta de Castilla y León).

An additional complicating factor is the fact that agriculture is regarded as an aging sector facing decreasing returns. According to agricultural associations profit margins are very low their subsistence depends increasingly on agricultural subsidies rather than on financially sustainable

business models. There is a policy to counteract the depopulation of rural areas based on credits aiming keep youth living in the area.

In a nutshell, the success of the NbS projects relies on the capacity to engage and incentivize the agricultural sector in a transformation of their practices. Accordingly, a key element of the NbS strategy are investments in agricultural modernization, to enable an increase in sector productivity while reducing water consumption. As presented in **Figure 31**, the NbS strategy proposed to introduce a change in the way water is managed towards a more sustainable water use regime includes:

- 1) aquifer recharge (structural measure)
- 2) Formation of Water Users Association (non-structural, governance measure);
- 3) Control of abstractions; (non-structural measure to increase enforcement)
- 4) Transformation of the fields and
- 5) Introducing alternating crops.

In **Table 25** the institutional setting and enabling environment for the implementation of the NbS strategy in Medina del Campo demo case are summarized, by presenting key formal and informal institutions that create an incentive or disincentive for investments and successful implementation of NbS for water security. **Figure 32** presents the relative importance of different stakeholders regarding the implementation of the preferred NbS strategy in Medina del Campo.

The implementation of sustainable plans and NbS is supported by an increasing sense of urgency experienced by government authorities such as MAPAMA (Ministry of Agriculture and Fishing, Food and Environment), the JCyL (Castilla y León Regional government), and the CHD (El Duero River Basin Authority) thanks to the adoption of binding environmental restrictions at the European level. Important policy drivers for the adoption of NbS for water security are WFD, the Habitats Directive and the Flood directives (2007/06) that stimulate the development of flood management plans and nature restoration strategies. In anticipation to more stringent legal and ownership measures, the CHD has already started the implementation of some governance provisions such as the consolidation of some Water User Associations, and some monitoring tasks to improve water management in the region.

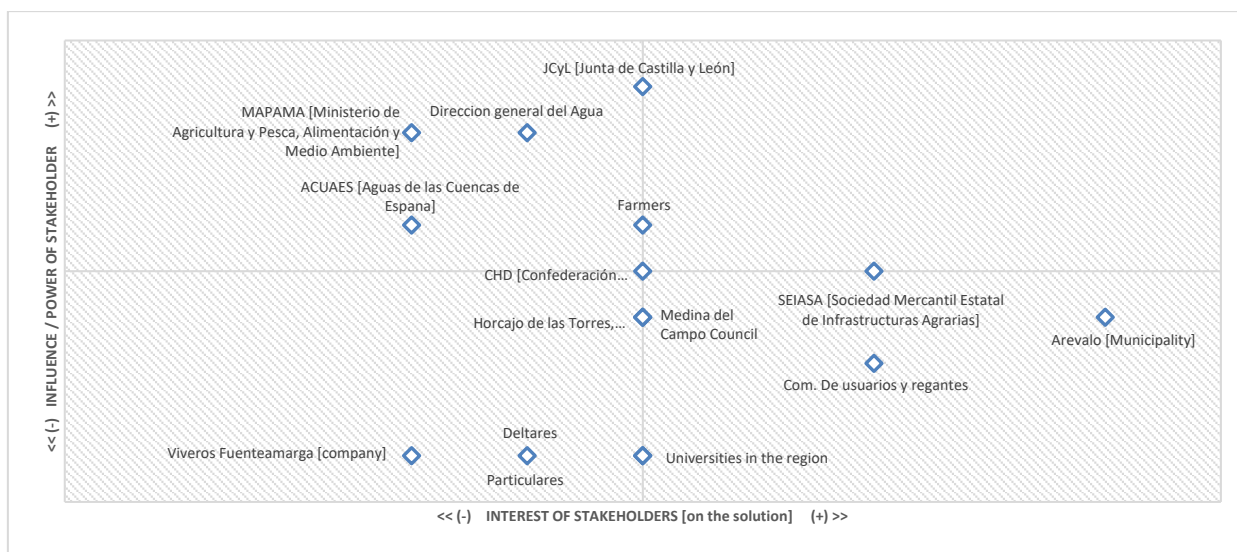


Figure 32. Stakeholder analysis for the implementation of NbS in Medina del Campo

Additional to these policy drivers, some monetary transfers to farmers from CAP are conditional to the implementation of reforestation or other actions that contribute to the protection of biodiversity, water quality and climate change mitigation and adaptation. In alignment with these incentives the new generation of rural development plans also embody a set of principles that increase the attractiveness of NbS to public investment agencies.

With regards to sources of funding, as shown in the IP-LIFE program example there is a growing opportunity for the use **blended finance** strategies, particularly mixing funding from different local, regional and national government institutions with EU transfers. The increasing strategic importance of environmental goals is translating into an increase in public budgets to undertake action, which may be an opportunity for investments in NbS. The remaining challenge is then operational, as it is to be seen whether NbS or hybrid design options will become the preferred final option to be tendered versus grey or highly engineered options. As explained in **Chapter 4**, there are important additional costs and risks involved in procuring NbS versus traditional infrastructure. As budget allocation respond to strategic goals that are seldom translated into measurable outcomes and appropriately evaluated and monitored, the risk remain that public authorities will opt for proven technologies that they perceive as the reliable and cost-effective in the short term.

At the same time, urgent socio-economic challenges open a window of opportunity for rethinking the present economic growth paradigm. In this context NbS programmes could gain much more traction, given their potential to introduce a new win-win dynamic between economic growth and environmental and climate security.

Numerous investment projects often with support from the EC are stimulating a new rural growth model. An example is the Interreg project Rural Growth, whose main objective is to increase the competitiveness of local businesses hand in hand with environmental sustainability by diversifying the economy (e.g. wine related tourism), introducing green technologies, introducing changes in spatial planning and strengthening the rural-urban connection.

Despite these hopeful advances driving investments in NbS for water security, there are still in place important disincentives for their mainstreaming and implementation at scale created by the same socio-economic pressures. These are also presented in **Table 25**.

5.2.2.2 Economic case: Winners and losers

The most important and direct benefit that results from the implementation of the NbS strategy in Medina del Campo is the reduction of drought risk and associated impacts for the agricultural sector. As agriculture is one of the main economic activities in the region, a reduction of this risk impacts directly economic resilience.

As previously explained the NbS strategy aims to reduce in the long-term water stress by conserving aquatic ecosystems, terrestrial ecosystems and wetlands protected under Natura 2000 policy. By balancing environmental and economic goals, the NbS investment programme is expected to contribute to the region goal of retaining youth and may also contribute to more young people becoming active in a new modern agricultural sector. In the medium to long term the program aims to avoid a potential future social conflict that could be triggered if aquifer condition worsens and is declared over-exploited.

As it can be observed in **Table 27** the sector most impacted by the implementation of the measures in the short term is the agriculture sector, particularly the farmers, although it will also affect the whole agroindustry value chain. The paradox is that this is also the sector that will benefit the most in the long term with a more reliable and sustainable water provision model. Other interested groups include the environmentalist organisations, as well as business owners linked to the agriculture sector.

Table 25. Institutional enabling conditions for the NbS in Medina del Campo

INSTITUTIONAL LAYER	INCENTIVES FOR INVESTMENT AND SUCCESSFUL IMPLEMENTATION OF NBS	DISINCENTIVES FOR INVESTMENT OR SUCCESSFUL IMPLEMENTATION OF NBS
<p>Layer 1: Social Embeddedness</p>	<p>Increasing environmental awareness Increasing awareness in different sectors about water and climate risks and the urgency to adapt.</p> <p>Economic and water crisis as window of opportunity for systemic chain Population decline since 2010 is resulting in an aging population. This decline is the result of a longer process of economic decline. Combined with the effects experienced in the agricultural sector due to an increasing frequency of extreme events, the urgency and awareness about the need to shift to a different economic model is increasing.</p>	<p>Traditional agricultural practices The area has an agriculture-based economy. Intensive irrigation agriculture is the most common practice of local farmers, resulting in overexploitation of groundwater resources. An aging population results in a significant resistance to change towards new irrigation practices.</p> <p>Influence of the agricultural sector on local politics The water authority is dependent on political cycles, and the agriculture sector is a well-organized elector.</p> <p>Decreasing returns and social capital Widely shared perception that agriculture is not profitable, and therefore farmers must seize any opportunity to increase their returns. In this context of decreasing returns, individual interests win over collective interests and associativity in the agriculture sector is in risks. Population perception of grey infra as more reliable solution to risks and hazards than NbS.</p>
<p>Layer 2: Institutional Environment</p>	<p>Increasing enforcement and incentives for NbS Implementation There are prospects of a more controlled water exploitation regime. The Spanish regulation and the WFD provide a credible expectation that enforcement of punitive measures will take place if the aquifer does not reach the minimum environmental goals established.</p> <p>Important policy drivers WFD, the Habitats Directive and the Flood directives (2007/06) Conditionality of CAP monetary transfers.</p>	<p>Contradicting incentives created by multiple EU policies Strategic goals of many EU agendas remain abstract and are not yet made operational in terms of performance indicators. It is on implementation at local level that trade-offs become visible. An example is the tension between the incentives created by the Water Framework Directive (WFD) and the EU's Common Agricultural Policy (CAP).</p> <p>Who influences the risk is not who experience it An additional complication is the fact that in many cases the actors whose actions increase water risks, are not the ones that directly or immediately experience the consequences. The management of water risks and related investments are under the responsibility of the CHD, while in practice the</p>



	<p>New generation of rural development plans investment projects Numerous investment projects often with support from the EC are stimulating a new rural growth model.</p>	<p>main deterioration driver is unsustainable abstractions from the agriculture sector.</p>
<p>Layer 3: Governance</p>	<p>Long term integrated plans at system scale An increasing number of integrated plans at system are being developed for the region, and this creates a level playing field for NbS as they contribute to systemic resilience levels. Key strategic plans for Medina del Campo are the River Basin Planning Program which is already articulated with the National Hydrological Plan, the National Risk Management plan and National Irrigation Plan. A particularly catalytic European Program is the European LIFE-IP The Duero River Basin Management Plan (RBMP-DUERO). Groundwater extraction is regulated by water rights, which were granted by a Spanish law back to 1926. Need to generate more Value for Money There is an increasing awareness of the need to articulate diverse investing initiatives to do more with less and opt for multipurpose and multifunctional projects. Public participation in strategic planning is being encouraged.</p>	<p>Water rights are a big part of the problem since former scenarios were more positive in the past; some water rights were granted which cannot be sustained given the current constraints. Land property rights and concessions could be a barrier for the implementation of NbS as these may require changes in the use of private land, as they often require also a higher spatial scale for their implementation. EU procurement directives could create a barrier for the uptake of innovations and make the tendering of NbS projects more complex, risky and costly for public agencies. A key indicator in procurement is Value for Money. It is challenging for local authorities to prove when opting for NbS that VfM will be achieved. Two main reasons are the absence for most NbS types of historic data on performance of NbS versus traditional grey as well as the lack of trustworthy suppliers that could carry project implementation risks.</p>
<p>Layer 4: Individual analysis, Market and prices</p>	<p>Availability of technologies that enable:</p> <ul style="list-style-type: none"> a) increasing agricultural productivity, while reducing water consumption. b) control of water extractions, c) assessing the impact of on the improvement of piezometric levels 	<p>Agricultural sector digital gap due to average age of farmers. Decreasing returns in agricultural sector and affordability of solutions The investments required for the implementation of the measures like modernization of the agricultural sector and aquifer recharge are too high to be recovered through an increase in water tariff. At the same time farmers are reluctant to take loans to make investments in new irrigation systems given the conditions that apply that may bind them to stay in the area.</p>

Table 26. Medina del Campo case stakeholders and their contribution to implementation

STAKEHOLDER	RESOURCES
MAPAMA- Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente Ministry of Agriculture, Fishing and the Environment	Money: general taxes. Authority: policy drafting and implementation, control over public water domain
CHD- Confederación Hidrológica del Duero El Duero River Basin Authority.	Money: Channels European Union grants for the implementation of NbS (e.g. Life project), receives budget allocation from the National Government Authority: water managers, supply and water quality. the executive branch and regulatory organ. Expertise: specialized in water, soil and foundations
MITECO– Dirección General del Agua Ministry for the Ecologic Transition and Demographic Challenge – Water Direction	Authority: Water Authority at the National level, defining the National Hydrological Plan.
Junta de Castilla y León (JCyL) Regional Government	Authority: Regional authority in charge of implementing Common European Agricultural Policy Money: taxes and channels national subsidies for agricultural development
SEIASA -Sociedad Mercantil Estatal de Infraestructuras Agrarias State trading company for agricultural infrastructure	Money: Agency that executes the development of agricultural infrastructure.
Comunidades de usuarios y regantes Water users’ community	Network: They bring together agricultural producers, owning water rights to exploit groundwater.
Particulares Business owners within the agricultural value chain	Network: Social pressure to keep in place current agricultural (BAU scenario)
Farmers	Network and Expertise.
Councils of Arevalo, Horcajo de las Torres, Rágama, El Oso and Medina del Campo	Authority: Regional authorities implementing policies
Research institutes e.g. IGME	Expertise: assessing the technical alternatives for reaching objectives.
Viveros Fuenteamarga (privte company)	Expertise: design and construction of aquifer recharge techniques

Table 27. Pains and gains of existing value chains due to the implementation of NbS in Medina del Campo

SECTOR	TARGET GROUP	WINNER/ LOSER	BAU-2050		SOLUTION-2050	
			PAIN	BENEFITS	PAIN	BENEFITS
Farming	Farmers	Loser short-term	Yes	No	Yes (short term)	Yes (long term)
		Winner long-term		No extra costs or changes to their current exploitation schemes. Unrestricted exploitation in the short term.	Reduction of water consumption and compliance with regulations	Sustainable and reliable provision of water- avoiding abrupt discontinuation due aquifer overexploitation
Environmental	Environmental groups	Winner	Yes	No	No	Yes
			Acquire and ecosystems exploitation and loss			Avoid ecosystems degradation and recovery of the aquifer
Commerce	Local Business Owners	Neutral	Yes	No	Yes (partially)	Yes
			Discontinuation of commercial activity due to restriction of the aquifer water supply		Temporal slow down of production and commercial activity of the area (i.e. change of crops)	Sustainable and reliable provision of water- avoiding abrupt discontinuation due aquifer overexploitation

5.2.2.3 Commercial, Financial and Management cases

Given the future scenarios of water scarcity, the focus service is reducing water consumption. Funding and governance have two main sources. The first one through centralized procurement and using the budget available from the Duero River Basin Authority. Another important source of funding emanates from the European Union level, where the environmental goals reached by the measures are the priority. This budget is also managed in a centralized manner and will be driven by the fulfilment of performance indicators in the aquifer, and effectiveness of the governance goals implementation, e.g. degree of parcels encompassed in a WUAS. Being that the service and benefits constitute a public good, the possibility of putting a tax scheme in effect is considered feasible and desirable. Some income has already been inputted by the water rights and their subsequent responsibilities. **Figure 33** summarises service hierarchy, funding and governance structure.

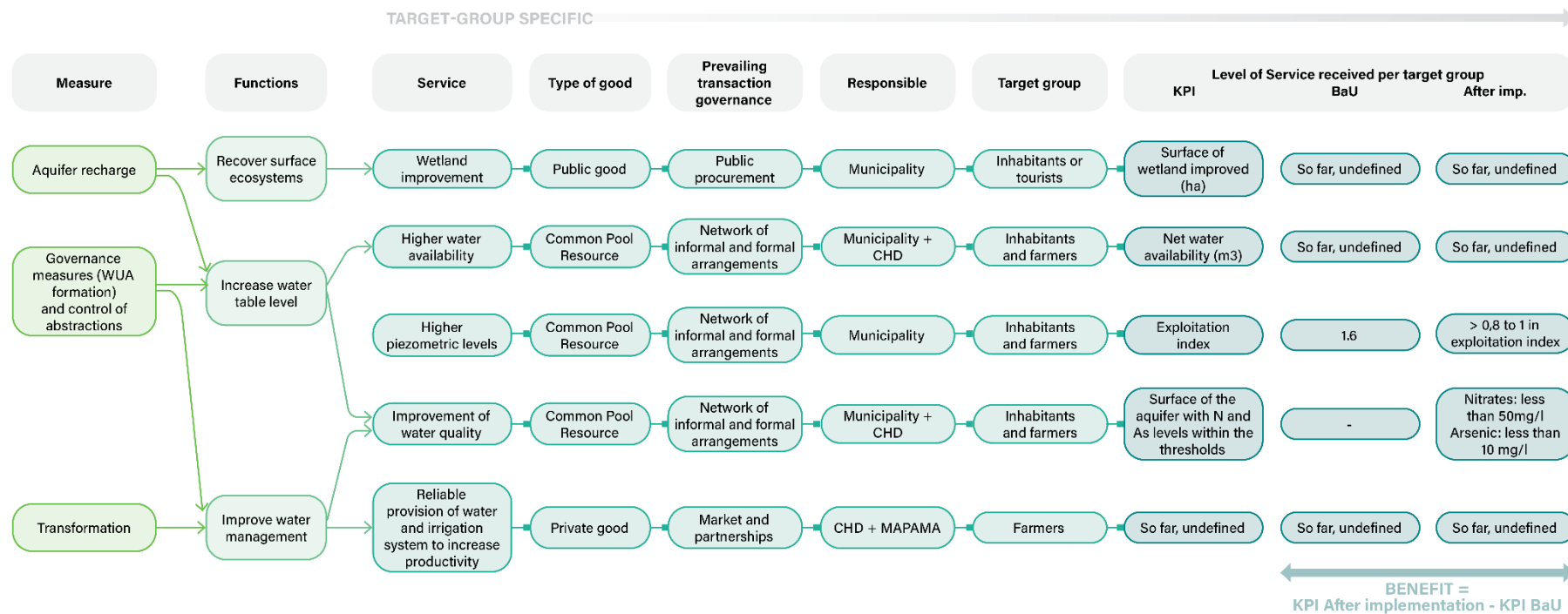


Figure 33. Service hierarchy, funding and governance structure for Medina del Campo

Information about **lifecycle cost** is limited. Operational expenses, avoided damage and opportunity costs, have not been quantified by the demo leaders and there unfortunately no indication of their magnitude to make a qualitative assessment. A rough assessment of the total CAPEX required -drafted based on early drafts of the plan with limited detailing of the **solution scope** - is approximately 2 million euros. This estimate does not include including the investments required for the technical modernization of the fields and educational campaigns to promote and initiate the alternation of the crops.

The implementation arrangement was structured according to the procurement practices of public commissioners: Medina de Campo municipality and the CHD. The delivery and proper operation of the aquifer recharge system is a responsibility of the Municipality, as such they will act as commissioner for this part of the NbS strategy. The **governance modes** that will be used for the implementation of this is part of the NbS strategy is therefore **public procurement contract**. Taking this into account, the CHD and the Municipality can develop further with support from EU innovation partners³⁸ the specifics of the procurement strategy, including the **scope of contract**, financial incentives to consider in the payment mechanism as well as **procurement incentives** built in the awarding procedure. Given the innovative character of the solution, it is expected that the municipality will keep control over design and then delegate the responsibility for building the solution and possibly operate it to the winning private company or consortium.

Finally, both the municipality and the CHD oversee the management of water-related disaster risks such as droughts. **Table 28** gives an overview of possible implementation arrangements for Medina del Campo NbS programme.

³⁸ CHD cooperates with a variety of EU R&D partners in the water, climate and biodiversity space through several platforms and projects. Examples are EIP-WATER taskforce, the EU LIFE Programme and H2020 projects such as NAIAD.

Table 28. Implementation arrangement for NbS strategy in Medina del Campo



















MEASURE	COMMISSIONER	MAIN TASKS ASSOCIATED	PUBLIC-IN-HOUSE/PROCURE IN THE MARKET/ASSUMED BY THE MARKET/ASSUMED BY A NETWORK	DEGREES OF PRIVATE MANAGERIAL FREEDOM
Assessment of water quality [Service: water quality]	CHD	Collection of information and inventory of water capture points	Assumed by a network	N/A
		Geological mapping and survey, Piezometric -flow measurement and Hydro-geochemical studies.	Procured in market	Low
		Study of infrastructures and devices available for artificial recharge.	Public in-house	High
		Tests of recharge devices and complementary construction works.	Assumed by a network	N/A
	CHD	Extraction inventory and checking correspondence between the authorized volumes and collected data	Public in-house	N/A
	CHD	Locate parcels whose crops are suspiciously been irrigated with groundwater extractions	Assumed by a network	N/A
Water recovery and resource efficiency [Service: water availability and quality]	CHD	Creation of a recreational area near the Medina del Campo town	Procured in market	High
Artificial recharge of the groundwater body Medina del Campo [Measure: Aquifer recharge]	CHD	Design: Civil engineering consulting company	Procured in market	Low
		Construction works [CW] removing of waterproofing layer (soil and infiltration works)	Procured in market	High
Compensation payments for environmental services and climate change mitigation and adaptation services [Measure: CUAs + governance measures]	CHD	Agroforestry programme: creation and management of new forested areas in currently cultivated plots	Assumed by a network	N/A
		Assessing NbS impacts on reducing water risk for agriculture (Minimal compensation, Maximum compensation, Assessment of damages)	Procured in market	N/A

5.2.3 Lower Danube: Potelu pond

DEMO CASE: LOWER DANUBE, POTELU POND

RESPONSIBLE:

 high quality of information
  space for improving Information quality
  no information at all

	YES/NO	INFO. QUALITY	MODULE
1. STRATEGIC CASE			
Solution scope of preferred strategy	YES		1.1
Theory of change	NO		1.2
Hierarchy of functions and levels of service over time	YES		1.3
Levels of services (over time)	NO		1.4
Enabling conditions within institutional setting	YES		0.1
Stakes, supporters and opponents	YES		0.2
Capacity levels and social capital	YES		0.3
Role of the insurance sector	YES		0.4
Inventory of funding and financing sources	NO		0.5
2. ECONOMIC CASE			
Qualitative Social Cost Benefit Analysis (SCBA)	YES		2.1
Quantitative Social Cost Benefit Analysis (SCBA)	YES		2.2
Pain and gains (value chains)	YES		2.3
3. COMMERCIAL CASE			
Characterisation of the transaction	YES		3.1
Make-or-Buy Decision	NO		3.2
Risk profile	NO		3.3
Market sounding	YES		3.4
4. FINANCIAL CASE			
Qualitative Lifecycle Costs Analysis (LCCA)	NO		4.1
Quantitative Lifecycle Costs Analysis (LCCA)	NO		4.2
Revenue streams (qualitative)	NO		4.3
Revenue streams (quantitative)	NO		4.4
Cash flow profile	NO		4.5
Financial Viability Gap	NO		4.6

Financing Strategy	YES		4.7
5. MANAGEMENT CASE			
Procurement objectives and boundary conditions (Ambitions, concerns and key implementation stakeholders)	NO	●	5.1
Project delivery and finance model per cluster: contract scope, financial and tendering incentives	NO	●	5.2
Implementation strategy per cluster	NO	●	5.3
Implementation arrangement (contractual and financial) per cluster	NO	●	5.4

In Romania, the floodplain areas having great potential to replenish 5 million m³ of water by 2020 are considered for restoration purposes mainly along the lower Danube river. The Romania demo focused on a section of an extensive floodplain of approximately 8 km between Sarata and Potelu, which is part of the most important areas for restoration along the Bechet to Corabia Danube reach. The pilot area of the project is represented by the Dabuleni - Potelu-Corabia enclosure. The enclosure was dammed between the years 1965-1966 at the 1% insurance with a safety reserve high of 1m. The FFWS was carried out during the modelling process requested by the Romanian authorities as part of their interest in identification of alternative models for floodplain restoration and included a participatory planning process supported by NAIAD partners.



Figure 34. Water security challenges in the Lower Danube

As shown in **Figure 34** the demo case is intended to address multiple water security challenges faced in the whole Lower Danube. These risks are primary floods but also droughts that alternate on yearly basis with different intensity. Romanian authorities estimated restoration and civil works in 800 hectares, that would involve expropriations and revisiting the existing lease agreements with landowners. The DEMO leader aims at articulating this initiative for the future river basin master plan to be updated in 2021. So far, the demo case has advanced in the hydrological modelling providing evidence of the flood risk reduction comparing to a traditional solution, which typically imposes a significative burden to water authorities due to maintenance costs. Hence, the application of the FFWS aimed to strengthen the strategic and economic case by advancing the NbS programme theory of change, identification of enabling conditions and of winners and losers.

5.2.3.1 Strategic case: Theory of change and enabling environment

Potelu pond was drained around 1969 to develop agricultural activities and the former location of the pond was protected by dikes and drainage channels. The increasing relevance of floodplain restauration in the area was triggered by 2006 flood events, with devastating effects in the agricultural communities of Bistret, Potelu, Calarasi and the Calarasi-Rould island. According to the International Commission for the Protection of the Danube River (ICPDR), the flood affected 3.200 households, 36,807 ha farmland, and 62,2 km of county and communal roads, and as a result 11.470 inhabitants had to be evacuated³⁹. The Potelu pond in 2006 was recreated after the controlled breach at Orlea, giving local communities the opportunity to experience the original natural landscape configuration of the area and to grow in awareness of the potential benefits of recovering it. Unfortunately, the Potelu pound was drained again a year later as part of a national level program to reinstate former agricultural activities.

After 14 years from the occurrence of the major event the perception on the drastic consequences is still very fresh especially at the level of local public authorities. The combination of events around the floods of 2006 turned out into an opportunity to raise awareness about the economic benefit of recovering the pond for locals, such the possibility to expand fishing activity.

The 2006 flood disaster still created a reference that encouraged actors to consider DDR issues of the lower Danube hand in hand with the country ambition to improve waterborne transport. Additional to the 2006 floods important developments that have gradually raised national and local awareness about the potential of NbS and strengthen institutional capacity to undertake

³⁹ International Commission for the Protection of the Danube River. 2008. "The Analysis of the Danube Floods 2006." ICPDR.

more coordinated action and strategic planning for water security at system scale are the following:

- The importance given to the Danube in the national context was reinforced by the establishment of the ICPDR in 1998. The creation of this commission also opened the possibilities for sustainable and collective action within a transboundary cooperation platform. An example is the EU Strategy for the Danube River (EUSDR) which was elaborated and initiated by the governments of Austria and Romania and accepted by the European Council in 2011.
- In 1999 the WWF under coordination of UNDP-GEF elaborated the study *Evaluation of Wetlands and Floodplains Areas in the Danube basin as a component of the Pollution Reduction Program*⁴⁰. The study identified areas with a very high and high rehabilitation further analysis with respect to their actual rehabilitation potential four areas were prioritized to facilitate progress (Potelu pond is one of them).
- Disasters as sign of reaching a tipping point. In Romania the most catastrophic floods happened in 2006 and 2010. The historical flash flood of the Danube in April 2006 (15.800m³/s at Bazias) was the largest ever recorded and showed that current flood protection systems cannot cope with such high flows and an alternative flood protection paradigm may be needed. Droughts in the Danube basin have also been recorded with high impact on civilians (water supply shortage), economic activities (damage on agricultural crops and husbandry sector) and biodiversity (loss of biodiversity). Severe droughts have been recorded in 1992/1992, 2003, 2011 (considered the worst drought since the 17th century) and most recently in 2015⁴¹
- In 2000, the governments of Bulgaria, Romania, Ukraine and Moldova signed the Lower Danube Green Corridor Agreement recognizing a need and shared responsibility to protect and manage the Lower Danube in a sustainable way by establishing a green corridor along the 1000 km of the Lower Danube River. The agreement aims to protect and restore wetlands along the river and reconnect the river to its natural flooding areas, reducing the risks of major flooding in areas with human settlements and offering benefits both for local economies e.g. through fisheries, tourism and for the ecosystems along the river.

⁴⁰ Study available at:

<https://www.icpdr.org/flowpaper/viewer/default/files/EVALUATIONWETLANDSFLOODPLAINAREAS.pdf>

⁴¹ <https://www.icpdr.org/main/issues/droughts>

- Flood risk mitigation in general gained more space in the policy agenda once Romania accessed the EU in 2007.
- After the catastrophic floods of 2006 the Romanian government approved the Ecological and Economic Resizing Programme in Romanian Sector of the Danube floodplain. The project was implemented by National Research Institute for Danube Delta Tulcea (INCDDD) and finalized 2008. Among its priorities were: 1) reassessment of settlements defence lines against floods; 2) Polders restoration in order to recover natural functions of wetlands including conservative interest areas (SCI, SAC, SPA, national); and 3) Reassessment of economic activities in agriculture/fish polders into a mixed concept economic and room for water. This project is particularly relevant for the chosen NAIAD demo case in Potelu.
- Gradual development of local expertise for strategic planning and the development of hybrid water security strategies. **Figure 35** shows a series of projects promoting grey and nature-based solutions implemented by National Administration Romanian Waters (NARW) between 2006 and 2014, and key new initiatives planned for the period 2016-2021. Other projects exploring suitability of different models for flood protection have been implemented by Romanian authorities in cooperation with international partners, such as the Evaluation of the restoration potential for Danube and its tributaries in cooperation with WWF, and Room for the River- stakeholder participation in developing flood protection scenarios at Cotul Pisicii, Galati and the Redevelopment of Danube floodplains, scenario for development of floodplains between Ghidici and Zaval; funded by the Partners for Water program of Dutch government.
- Finally, the Danube River Basin District Management Plan and Flood Risk Management Plan for the Danube River Basin District are also contributing to a change in paradigm where natural flood management model could become the new norm. Wetlands and temporary storage basins are part of the solutions foreseen by both documents, targeting to have 2650 ha of wetland restored by 2021.

Unfortunately, important disincentives for the implementation of NbS at national and local level remain in place. An overview of these incentives and disincentives created by institutions in four different layers is presented in **Table 29**. Among these are the perception of grey infrastructure as more reliable than NbS, as well as the somewhat contradicting demands created by multiple local and EU policy agendas.

To remove these barriers is important to coordinate actions between the authorities regulating different sectors and make an analysis of the systemic effect of multiple policy and economic instruments they administer. Navigation on the Danube is for example regulated by the ICPDR which also takes care of the implementation of the WFD and Flood Directives at basin level.

Romanian authorities are also responsible for implementing these two policy frameworks. Meanwhile, the dynamics in the agricultural sector are influenced by the Common Agricultural Policy (CAP) largely based on subsidies.

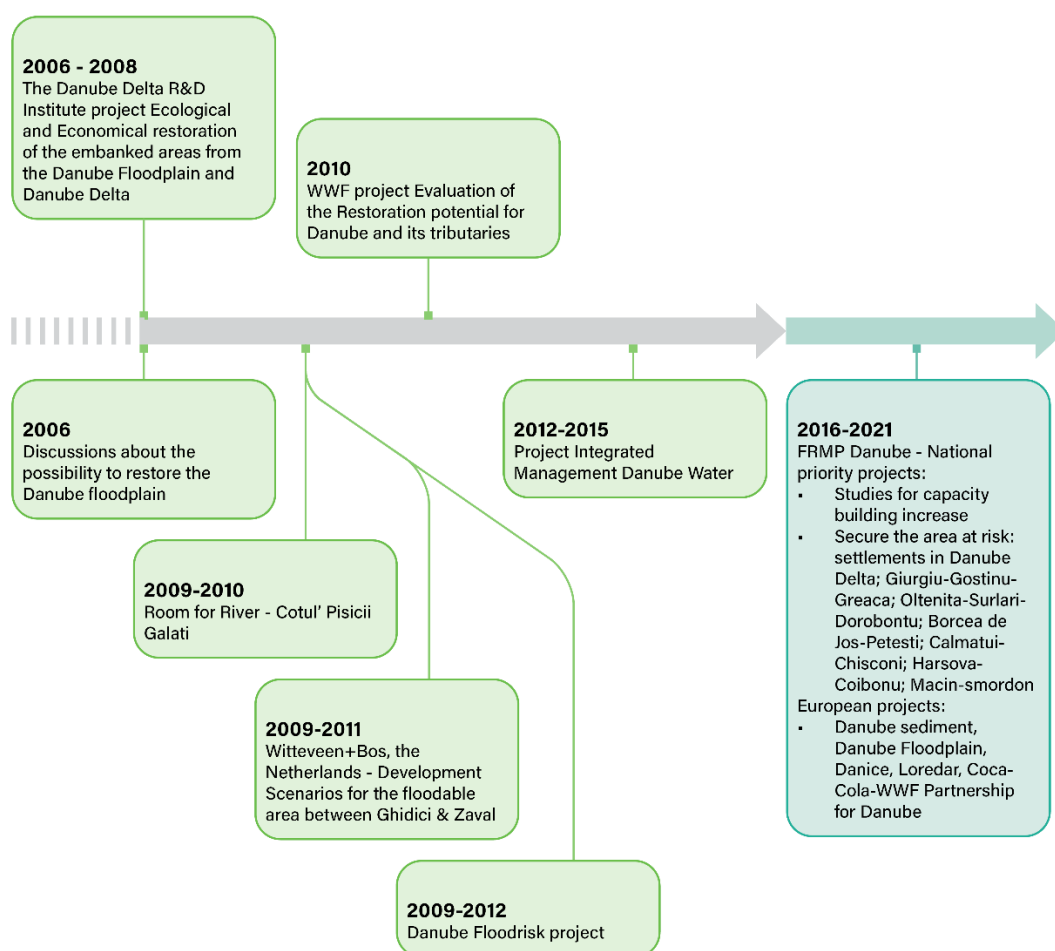


Figure 35. Romania NbS for water security projects implemented between 2006 and 2014 (Source: NARW, translated BDG⁴²)

Given this institutional setting, the need for a change or the so-called strategic case for investments in NbS emerged from the convergence between the local interest of communities for diversification of economic activities (mainly fishing and eco-tourism), and the central government concern for alternative strategies for flood protection. After 14 years from the occurrence of the

⁴² http://www.rowater.ro/pmri_site/3.%20Planul%20de%20Management%20al%20riscului%20la%20inundatii%20-%20Draft/P.M.R.I.%20Dunare/12%20PMRI%20Dunare.pdf

major event the perception on the drastic consequences is still very fresh especially at the level of local communities. Therefore, the strategic case of the Potelu demo case builds on the potential of NbS to combined both the provision of flood protection measures while creating economic opportunities for local community actors.

In the context of large strategic investments plans such as the Ecological and Economic Resizing Programme in Romanian Sector of the Danube floodplain, the Potelu area could be seen as a building block in the creation of a cascade system for relieving pressure on existing flood defence infrastructure. As shown in **Table 29** decreasing public budgets make this hybrid approach to flood protection attractive, as it may translate into lower capital investments required in the short term and maintenance costs in the medium and long term.

In other words, the Potelu demo theory of change could be summarized as follow: by generating the evidence of wetland restoration impact on economic dynamization at local level (including profit and income levels of individual farmers and SMEs) and provision of flood protection services in a cost-effective manner versus a grey infra only scenario, the demo case will have a catalysing effect in driving a paradigm shift. Through the project not only evidence is created but also local expertise at both the public and private sectors. Both combined are expected to reduce the risk perception of private project developers and public project sponsors towards NbS projects and enable procurement of these projects in the future at lower costs, given a reduction in transaction as well as in financial costs (i.e. reduced risk premium).

As a pilot project that makes part of a larger plan and shift to hybrid flood protection strategies, the strategic relevance of the Potelu demo case is on providing evidence of the economic, social, technical and financial feasibility to carry out similar restoration projects in the other areas. The pilot could also provide evidence on the benefits for navigability that could be achieved through nature restoration projects.

To understand the important of the navigability function of the Danube it is important to mention that the River Danube is considered to be the backbone of water transport in Europe. The Danube connects, via Rhine - Main Canal, Western Europe and Rotterdam harbour with the Black Sea, that is with Russia and the East.

Hence, some of the actors interviewed suggested the possibility to connect the Potelu demo case to planned navigability investments that are envisioned in the Trans-European Transport Network policy⁴³. One of them is **Rhine-Danube Corridor** investment program which aims to make this

⁴³ More information on this EU policy can be found at:
https://ec.europa.eu/transport/themes/infrastructure_en

corridor the main East-West link between continental European countries, connecting France, Germany, Austria, Czech Republic, Slovakia, Hungary, Croatia, Romania and Bulgaria all along the Main and the Danube rivers to the Black Sea by improving (high speed) rail and inland waterway connections. This investment program represents 91.9 billion EUR of estimated investment, of which 4.2 billion EUR for inland waterways and 2.6 billion for ports. The completion of the Corridor is expected to generate 2 million job-years between 2015 and 2020 in the maritime sector and additional 725 billion EUR of GDP in the same period (European Commission, Mobility and Transport 2018) ⁴⁴.



Figure 36. Stakeholder analysis for the implementation of NbS in the Lower Danube

⁴⁴ <https://ec.europa.eu/transport/sites/transport/files/2018-eu-that-delivers.pdf>

Table 29. Institutional enabling conditions for the NbS in the Lower Danube

INSTITUTIONAL LAYER	INCENTIVES FOR INVESTMENT AND SUCCESSFUL IMPLEMENTATION	DISINCENTIVES FOR INVESTMENT OR SUCCESSFUL IMPLEMENTATION
<p>Layer 1: Social Embeddedness:</p>	<p>Community collective memory about the payoffs of functioning ecosystems for fishing and tourism activities.</p> <p>Indigenous knowledge of NbS, simple green infrastructure solutions applied by forefathers.</p> <p>Disasters that challenged existing highly engineered flood protection system.</p> <p>Institutional memory of 2006 and 2010 disasters that showed that current flood protection systems could not cope with such high and sudden water flows.</p> <p>Wide societal consensus on the need to invest on Disaster Risk Management and measures to decrease the vulnerability of communities, advance towards a more diversified economy and protect their cultural heritage.</p>	<p>Low risk perception combined with lack of insurance culture at local level challenge the feasibility of innovative business models that can capture the resilience dividends of NbS.</p> <p>Strong attachment to traditional agricultural practices (vegetal crops) and perception that NbS could be a constraint to these practices.</p> <p>Population decline and aging.</p> <p>Grey infrastructure perceived as less risky versus NbS. Long historic tradition and experience of Romanian infrastructure authorities and institute with grey infrastructure for flood protection.</p>
<p>Layer 2: Institutional Environment:</p>	<p>Accession to Europe resulting in an increase of importance in the national policy area of issues such as flood risk management, adaptation to climate change and protection of natural capital. This also opened cooperation with other countries applying a natural flood management paradigm, such as the Netherlands.</p> <p>The WFD as key policy driver for investments and coordinated action at system scale. It requires to investments in the Danube River Basin to achieve ecological status goals by 2021. The National Flood Risk Management Plan identifies 3 major integrated projects for the Lower Danube basin based on the analysis of localities/groups of localities at risk in case of the 1% potential flood scenario. The combination of water security, adaptation and natural capital goals on the EU agenda is translating into a consolidated approach for Danube basin. A clear example the requirement to consider NbS options also in navigability related investment projects.</p>	<p>Contradicting demands created by multiple local and EU policy agendas</p> <p>Sometimes divergent objectives and implementation priorities between sector policies: water management, agriculture (e.g. subsidies as incentives for land holding regardless the productivity), transport and environment sectors.</p> <p>Complex to navigate land tenure system. The land ownership in the area is a mix of private and public entities. To add complexity, government land has been leased to big and small farming companies. There are still cadastre issues, and lack of clarity regarding ownership and responsibility for assets after implementation.</p>

<p>Layer 3: Governance:</p>	<p>International Commission for the Protection of the Danube River (ICPDR) enable collective action and strategic planning at system scale in a transboundary cooperation platform.</p> <p>Increasing national expertise on strategic planning for water security considering hybrid options.</p> <p>Increasing recognition of potential of NbS to be a win-win strategy for economy and environment in new generation of strategic investment plan, and also a cost-effective measure in a context of decreasing public budgets.</p> <p>Various subsidies for NbS and green infrastructure for protection of biodiversity as well as for improvement of fishing, and aquaculture sectors.</p>	<p>Limited NbS technical expertise at local level to undertake project preparation and design of implementation arrangements for NbS projects that ensure long term service provision. Most grey infrastructure projects were often administered by national authorities.</p> <p>Bureaucratic procedures that increase risk perception</p> <p>A complex institutional setting and not clearly specified interactions at central, regional and local level, as well as unaligned policy targets and standards increase implementation risks for NbS projects at system scale. This translate into a higher risk perception of NbS versus traditional grey infra projects for private project developers</p> <p>Significant transaction costs of NbS projects combined with decreasing budgets for national agencies such as NARW may result in the choice of grey over NbS options.</p>
<p>Layer 4: Individual analysis, Market and prices.</p>	<p>NbS co-benefits as driver for community demand</p> <p>Current market dynamics and prices suggest that aquaculture would yield higher rentability to small and large farmers than traditional agriculture, incentivizing a change in land use practices.</p> <p>Additionally, NbS co-benefits could make possible the introduction of new economic activities that create more local employment and welfare opportunities, such as fishing and ecotourism.</p>	<p>Important knowledge gaps regarding the level of service in terms protection capacity that can be guaranteed by NBS, OPEX as well as the magnitude of co-benefits in the long term.</p> <p>Individual welfare versus collective environmental interests could stop community actors from changing land use. Promoting a change may put in risk their right to receive agricultural subsidies.</p>

Table 30. Lower Danube case stakeholders and their contribution to implementation

STAKEHOLDER	RESOURCES
<p>Ministry of Environment, Waters & Forests (MEWF)</p>	<p>Authority</p> <p>National authority in the environment, water and the forestry sectors</p> <p>Head of Inter-ministries Committee for Climate Change, coordinates the National Agency for Protected Areas</p> <p>Head of the Water Inter-ministerial Council and of the Floods Secretariat</p> <p>Network: of Environmental Protection Agencies at local level</p> <p>Coordinates with NARW</p> <p>Money: state budget as well as EU Structural funds that can be transferred to NARW for implementation</p>
<p>Ministry of Agriculture and Rural Development</p>	<p>Authority</p> <p>Central public authority in charge with elaboration and implementation of strategies and national programs in the field of agriculture, food industry, rural development and land management. MARD is the management authority for direct payments and financing investments in agriculture and rural development as well as fishing and aquaculture.</p> <p>Network: of directorates for agriculture and rural development at county level, part of</p>

STAKEHOLDER	RESOURCES
	different inter-ministerial working groups including cross border Money: state budget and CAP, streaming Romania's allocations from the European Agricultural Guarantee Fund (EAGF), the European Agricultural Fund for Rural Development (EAFRD) and the European Fisheries and Maritime Affairs
National Administration Romanian Waters (NARW) -Agency	Authority: National Administration (network of 11 RBAs, Stanca Costesti and the National Institute for Hydrology and Water Management) coordinated by MEWF. Money: own revenues from water usage charges or tariffs (e.g. use by hydropower companies), state budget allocations, EU funds either via national operational programmes or participation in other EU initiatives (e.g. H2020, Interreg, Danube Transnational Programme)
County Council Olt	Authority: In charge of defining development plans for the county Money: influence in the allocation of the resources to different territorial units (villages, communes, cities within the council).
Local councils (Ianca, Gura Padinni, Orlea, Grojdibodu communes) and County Council Olt	Authority: In charge of defining land use within local legal boundaries (e.g. imposed by leases) Network: Capacity to mobilize population towards the solution
River Basin Administration Olt & Jiu (Romanian Waters)	Authority: Responsible at basin level to keep stakeholders informed and involved, major stakeholder at basin level, delegated by NARW Money: re-distribution of funding coming from NARW
Galati Lower Danube Administration	Money: Funded from state and own collected taxes Expertise: Maintain the navigation channel and the monitoring system of the water depths and the sediments Network: Network with partners along Danube course, key actor at national and local level
Environmental Protection Agency Dolj & Olt	Money: Funded from state budget, could support green investments at local level
Dolj & Olt county Agricultural Offices	Authority: Represent the Ministry of Agriculture at local level, in charge of monitoring and integration of agricultural data Network: Connection with the farmers in the county
Land reclamation agency under the Ministry of Agriculture ANIF –Dolj & Olt offices	Expertise: County network of the main pumping stations, main irrigation channels and the drainage system
OUI (Farmers organized as Water Users)	Network: Funded from EU funds & subsidies, loans and own budget
The Agency for the State Domains -Agenția Domeniilor Statului (A.D.S.)	Money: Important stakeholder as they own agricultural assets and land in all counties
Land Improvement Agency (local office Olt-Dunare)	Money: Funded from state budget, could support investments in land development at local level
National Agency for Fisheries ANPA (Olt office) part of the Ministry of Environment	Money: Funded from state budget, could support investments in fishing at local level
Prefecture Dolj	Authority: verifies the legislative and the other documents issued by the county settlements. Key actor in case of emergency situations

STAKEHOLDER	RESOURCES
Businesses active in the area (farming, tourism, etc.)	Money: resources to invest in the development of new ecological business models and exploitation rights in leased public area Expertise: in sustainable business models

Whereas there is an emerging consensus about the need to restore the Lower Danube habitat, there are also important concerns regarding land tenure in the Potelu area. The area the pond used to take is used for agriculture and cover approximately 15.000 ha of land. Of this land 30 to 40% is under use of small farmers and 60% under the use of the company Agronova. The land used by Agronova, approximately 7,000 ha was leased to them by The Agency for the State Domains (ADS). Local councils own approximately 200 to 300 ha in the area, registered as pasture.

The implementation of the pond restoration project requires the revision of current land tenure, including land ownership and concession rights granted in the past. This process of renegotiating rights is expected to be one of the most complex aspects and source of ESG risks for the project, a recurrent situation in most NbS rural projects. At the same time, a successful process would set a precedent for carrying similar negotiations in other places. One of them is the Bistret demo case, a demo case of the Interreg Danube Transnational Programme project supported by WWF. This demo was also supported in developing a project preparation roadmap by the Deltares team. The results of this application are not reported in this edition of the handbook. The Bistret pond area also has multiple landowners. For example, public agencies from the Ministry of Agriculture such as NARW and ANIF have rights over the area occupied by weirs and dikes, while others like ANPA from the Ministry of Environment have administration rights concerning watershed management and fishing activities.

5.2.3.2 *Economic case: Winners and losers*

When framing the Potelu demo case as part of the larger restoration plans of for the Lower Danube floodplain lead by NARW, the economic benefits envisioned are for the entire region; both upstream and downstream communities will be positively impacted in the long term. In the analysis of pains and gains it is important to take into account that the communities living in the Potelu area are not directly exposed to significant flood risk as they live in areas with relatively higher elevation than the rest. For them the most relevant gains are the co-benefits created by the restored pond, in terms of traditional fishing and eco-tourism activities.

The preferred solution being developed is also expected to include additional components to create a positive impact on groundwater levels (e.g. installing an underground membrane) and alleviate the problem of water scarcity faced by communities up north. The design also considered a connection of the Potelu pond with the Danube which is expected accelerate the process of restoring sediments balance in the river.

The implementation of the Potelu demo case depends significantly on the drive of local communities in four settlements. These are Ianca, Potelu, Grojdibodu and Gura Padinii. The inhabitants of these communities could make available the land required which is now either owned by private owners or local authorities.

Table 31. Pains and gains of existing value chains due to the implementation of NbS in the Lower Danube

SECTOR	TARGET GROUP	WINNER/ LOSER	BAU-2050		SOLUTION-2050	
			PAIN	BENEFITS	PAIN	BENEFITS
Housing	Communities upstream and downstream	Winner	Yes	No	No	Yes
			Overflow in the case of extreme conditions such as the one occurred in 2006			Flood risk reduction
Local community	Potelu community	Winner	Yes	No	No	Yes
			Limited access to economic dividends of the area			Diversification of local economy: fishing, aquaculture and eco-tourism, Increase in water transport due to improved sediments balance
Agriculture	Landowners in the area	Winner/ losers	Yes	Yes	Yes	Yes
			Decreasing productivity return due to soil degradation.	Exploitation of land for agriculture	Impacting the current model of production based on exploiting a drained wetland.	Eventually a more innovative and sustainable business model
Biodiversity	Local communities and Natura 2000 sites	Winner	Reduced biodiversity due to adverse conditions	-	-	New species fauna, flora, sustainability of the ecosystem

Other key actors for implementation are the National Agency for Land Improvement (ANIF) and the larger private agroindustry company Agronova. The former is key to make the connection to the Danube possible, as this can only be done via the existing network of drainage channels. These

channels are considered public property and administrated by ANIF. The latter is a company producing alfalfa, fruits and cereals and using the largest extension of agricultural land, who holds exploitation rights of public land under a lease contract. The negotiation with Agronova is pending and may benefit for a further specification of expected pains and gains of different actors and policy goals, to design and account for possible compensation measures.

As shown in **Table 31** in the overview of pains and gains of different stakeholders along the agricultural value chain in the Potelure area, the implementation of the NbS project would impose a pain on them in the short term by triggering a reassessment of the land concession rights they hold. However, depending on the final design, the phasing of the works to recover the pond and Agronova own capacity to adapt to these changing conditions, NbS implementation could in the medium and long term also source of gains for them. In the context of international environmental standards being adopted by multinational companies and the disclosure of climate and environmental risks becoming a requirement from capital providers, the incentives for companies to engage actively in water stewardship are becoming stronger. Agronova is part of the Losan Group, a company with Spanish origins and production units in Romania, Spain, the Netherlands, Chile and USA and delivering to 80 countries around the world.

5.2.3.3 Commercial, Financial and Management cases

Considering the hierarchy of services to be delivered by the NbS projects as well as the pains and gains experienced by different actors, choices can be made regarding the funding strategy and the choice of a project delivery and finance mechanism. The prevalent governance mode and sources of revenue (taxes, tariffs or transfers) can be assessed by considering the three main services to be delivered. These are flood protection, access to fish stocks and an improved touristic experience due to improved aesthetics.

Aesthetics is the value created for tourists, willing to pay for the beauty and experience of nature.

For the first service, the corresponding governance mode is public procurement, in this case the river basin authority acting as commissioner. The revenue can come from taxes for water abstraction and wastewater discharge, national budget, European Union Transfers and loans. The second service is more complex as it requires to govern a common pool resource, subject to overexploitation problems. Therefore, it would be needed to impose fishing permits, that can be used to maintain the area. Finally, permits for local tourism would be a way to monetize the value emerging from aesthetics. Yet, it can be highly controversial let alone the fact that this source of revenue requires to be negotiated and validated with communities. An encouraging step is already made by the local authorities who setup an NGO to facilitate the next actions.

Table 32. Service hierarchy, funding and governance structure for Potelu pond, Lower Danube

MEASURES	FUNCTION	SERVICE	TYPE OF GOOD	PREVAILING TRANSACTION GOVERNANCE	COMMISSIONER	TARGET GROUP	LEVELS OF SERVICE			REVENUE MECHANISM
							KPI	BAU	TARGET	
Pond restoration	Water storage	Flood protection	Public good	Public procurement	River Basin authority	Upstream and downstream citizens	Quality of service			TBD
Pond restoration	Carrying capacity fish	Fish stock	Common pool	Informal rules	Community	Potelu community	TBD		TBD	TBD
Pond restoration	Aesthetics	Aesthetic	Public good	Informal rules	River Basing authority	Potelu community	TBD		TBD	TBD

Depending on how the project is framed, different project sponsors are possible. One very plausible project sponsor is the national water authority (NARW), whose main concern is exploring the extent to which the Potelu demo case can be replicable in other potential restoration areas. In this case, NARW could request European funds (transfers), make use of national budgets and if needed raise additional funding upfront through loans or the issuing of green bonds. The last two options would probably require coordination with the Romanian ministry of finance. In this scenario the governance mode becomes a **public procurement contract**.

Another possibility, if the benefits to the local economy deem more significant than the flood protection services delivered by the project, is that the role of project sponsor is taken by a coalition of communitarian groups possibly supported by environmental NGO's. In this case, the investments in the recovery of the pond could be made possible either by the creation of a collective investment vehicle like a water fund or a more loosely coordinated number or **privately driven water stewardship investments**.

Regarding funding and financing strategies, in this last implementation scenario, the network of actors acting as project sponsor could complement own equity investments with funds requested from EU financing or subsidy facilities. They could request for example European subsidies, technical assistance grants or even project finance or corporate finance loans (depending on which entity is the one to assume the debt) to further develop the project and implement it. Equity

investments or loans assumed by local entrepreneurs can be repaid by the profit generated by the new tourism and aquaponics business models they are considering undertaking.

Based on our inventory and analysis of existing project preparation facilities for NbS and water security projects, two project preparation facilities that seem to fit the Potelu demo case are the Natural Capital Financing Facility⁴⁵ (NCFF), administered by the European Investment Bank (EIB) (see **Textbox 6**) and the Dutch Fund for Climate and Development⁴⁶ (DCFD), administered by the Dutch Development Bank FMO in cooperation with WWF, SNV and Climate Fund Managers. The former can serve both public and private **project sponsors**, while the latter is intended for private project sponsors.

Textbox 6. The Natural Capital Financing Facility in a nutshell

The **Natural Capital Financing Facility** (NCFF) offers funding to projects that promote the conservation, restoration, management and enhancement of natural capital for biodiversity and adaptation benefits, including ecosystem-based solutions to challenges related to land, soil, forestry, agriculture, water and waste inside the EU.

The NCFF consists of a combination of the following two components:

- The finance facility can provide financing of a minimum amount of EUR 2 million and a maximum amount of EUR 15 million
- The technical assistance facility can provide each project with a grant of up to a maximum of EUR 1 million for project preparation, implementation and the monitoring of the outcomes

The NCFF combines EIB financing and the Commission's funding under the LIFE Programme, the EU's funding instrument for the environment and climate action. The facility is currently in a pilot phase and can sign projects until the end of 2021. The first loan was signed in April 2017

In any of the two scenarios, the development of a **blended finance** strategy is advised to enable closing the financial viability gap as well as the de-risking of private investments due to the innovative nature of the solution and all transition risks that can be expected from switching to entirely new business models.

In this blended finance strategy different sources of funding and finance could be mixed, financial streams aiming to solve problems in different sectors (e.g. agriculture, transport, water and climate sectors) from public and private actors. Under both implementation pathways the following

⁴⁵ More information about the EIB NCFF facility can be found here: <https://www.eib.org/en/products/blending/ncff/index.htm>

⁴⁶ More information about the DCFD facility can be found here: <https://thedfcd.com/>

sources of funding and financing could be blended to make this economically viable project affordable to local actors: EU concessional and commercial funds, technical assistance grants from other EU development partners or the EC, domestic revenue sources generated through taxes and tariffs and private equity investments.

The following sources of finance have been identified:

- Olt RBA has for 2019 an estimated budget from its own sources of 44.042.000 RON (9.5 million EUR) for expertise, design, technical assistance, execution of works for consolidation and intervention for prevention or removal of flood impacts.
- The Operational Program for Large Infrastructure (POIM) has a budget of 80.817.678 RON (17 million EUR) for "Complex works for the tributaries of the Olt River on the northern branch of Fagaras mountain with potential risk for flash floods".

Regarding bilateral cooperation, there are initiatives such as the Blue Deal promoted by the Netherlands. This technical assistance cooperation programme focuses on drought mitigation and aims at strengthening the capacities of regional water authorities and river basin authorities around the world. Bilateral collaboration could be a good way to address gaps in NbS technical and project preparation expertise experienced in national agencies such as NARW and decentralized authorities such as local governments and river basin authorities. Currently, in 2020 there is already a smaller size pond being recovered with financial support from ANPA yet designed only having the fishing function and benefits in mind.

5.3 The road towards implementation at scale of NAIAD demo cases

The FFWS was applied to all nine NAIAD demo cases through a collaborative business modelling session facilitated by Deltares during the project demo meeting last January 2020 in Copenhagen. This exercise enabled demo leaders to assess the strengths and weaknesses of their NbS strategy in terms of the maturity of their investment case. The results of this assessment as well as some practical recommendations towards upscaling of NbS in the city of Lodz, La Brague and Thames basins cases are presented in this section.

5.3.1 Assessing the bankability of NAIAD demo cases

Before the workshop demo leaders were asked to conduct a simplified self-assessment of the current bankability of their NbS programme or project, by assessing the maturity of each of the five cases for investment: the strategic, economic, commercial, financial and management cases. Based on the results of this self-assessment – presented in **Table 33** – and after a short training on the basic elements of the Financing Framework for Water Security the participants of the demo

meeting worked through the four main steps of the FFWS and further specified the areas that will require more research to bring their NbS program or project from idea stage towards an investable proposition.

Through this process demo leaders engaged with other project partners in an open conversation about their experience within the NAIAD project, and their expectations regarding the completion of the five cases to bring their initiative towards an investable proposition within or beyond the NAIAD project.

The collaborative modelling session was organized in three groups:

- The first group included the demo leaders from La Brague basin, Lodz city and the Lower Danube. In this group the discussion aimed at capturing insights from La Braque and Lodz guided by the experience and reflexions from the demo leaders of Lower Danube, who followed the FFWS project preparation process.
- In the second group the demo leaders of Medina del Campo supported the demo leaders of the Thames basin to work through the FFWS steps and assessment process.
- In the third group, Rotterdam demo leaders illustrated for Lez and Copenhagen demo leaders the logic of the FFWS. Lez and Copenhagen reacted from their experience.

Table 33. Bankability assessment of NAIAD demo cases

	Brague	Lodz	Medina	Copenhagen	Lower Danube	Lez	Thames	Rotterdam
1. Strategic - the scope of the solution. There is a clear scope of the preferred strategy in terms of measures to be implemented (in a bounded geographical area)	●	●	●	●	●	●	●	●
2. Strategic - service levels. There is a reliable quantification of the improvement of the main water services (e.g. flood protection) due to the implementation of the measures	●	●	●	●	●	●	●	●
3. Strategic - institutional alignment. The measures considered in the DEMO are linked (or aligned) to the environmental and economic plans/priorities defined by authorities and existing regulations	●	●	●	●	●	●	●	●
4. Economic - cost-benefit. There is reliable evidence that total benefits outnumber the direct and indirect costs	●	●	●	●	●	●	●	●
5. Economic - winners. It is clear who the direct beneficiaries are, and their willingness to pay for the improvement in water services? (e.g. by taxes, tariffs or transfers)	●	●	●	●	●	●	●	●
6. Economic - losers. It is clear who the direct losers are, and their willingness to accept such a burden. (e.g. due compensation)	●	●	●	●	●	●	●	●
7. Commercial - project structure. Project phases are clearly defined (e.g. eco-designing, restoration, operation) as well as capital investments	●	●	●	●	●	●	●	●
8. Commercial - governance structure. There is a clear list of phases and tasks to be assumed by the project owner, procured in the market or addressed by other means (e.g. collective investments, private stewardship, free market, community)	●	●	●	●	●	●	●	●
9. Commercial - project risk. It is clear risks related to the delivery of measures and their long-term operation	●	●	●	●	●	●	●	●
10. Financial - life-cycle cost. The life-cycle cost is clearly quantified according to the characteristics of the preferred strategy and/or preferred option over time	●	●	●	●	●	●	●	●
11. Financial - revenue streams. There is a quantification of the revenue streams considering Tariffs, Transfers, and Taxes	●	●	●	●	●	●	●	●
12. Financial - funding and financing options. There is access to funding facilities and/or financial instruments for closing funding and/or financing gaps	●	●	●	●	●	●	●	●
13. Management- detailed stakeholders' contribution. It is clear which organisations take a direct responsibility along the life-cycle phase per measure.	●	●	●	●	●	●	●	●
14. Management- procurement strategy. There is a procurement strategy, including the type of contracts and payment incentives to implement the project?	●	●	●	●	●	●	●	●
15. Management- contractual scope. It is clear the scope of contracts needed to implement the project, including payment incentives?	●	●	●	●	●	●	●	●
16. Management- procurement strategy. It is clear how to award the contracts, including the selection procedure and procurement incentives?	●	●	●	●	●	●	●	●

● strongly disagree ● disagree ● no answer ● agree ● strongly agree

As it can be observed in **Table 33** while most demo cases developed the strategic and economic cases of their NbS programme or project, most of them did not worked out the details required to build the commercial case. Only four demos were able to quantify lifecycle costs and only Rotterdam demo case had a quantitative and more accurate assessment of expected revenue streams. Three factors that may explain the differences between demo cases results are: a) the starting point of the initiatives from the planning cycle perspective (see **Chapter 1** for more details), b) the NbS scale of implementation, smaller size NbS like Rotterdam are considerably easier to structure as bankable projects than large scale landscape projects, c) positioning of demo leaders within formal investment planning processes, the familiarity of demo leaders with planning processes as well as with project development techniques varied greatly and could be a reason of advantage or disadvantage versus other demo cases.

5.3.2 City of Lodz, Poland

There are two important processes shaping the future of the City of Lodz: urban sprawl due to lack of a coherent city strategy, proper regulations and spatial plans; but also, a city integrated revitalization programme. The first process leads to the decline of biodiversity, deterioration of water resources of the city (disappearance of rivers springs, drop of minimal flows in rivers, decrease of groundwater level & recharge), decrease of natural capital what results in: severe heatwaves and air pollution, pluvial flooding, poor water quality imposing risk to people and fauna. The critical NBS considered to alleviate these challenges are: detection, delineation and restoration of river sources; re-establishing of wetlands; rebuilding of forest cover for microclimate regulation.

The revitalization programme is an EU co-funded effort of rebuilding the city centre with particular attention given to adaptation to climate change, transfer of ecosystem services from donor areas through a blue-green system and re-establishing of ecohydrological regulatory feedbacks between biota and hydrology. The critical NBS measures are retention ponds and infiltration basins, tree trenches, infiltration ditches – in order to reinforce plant growth, microclimate regulation, groundwater and river recharge, green roofs, squares and street trees for climate regulation, flood protection and biodiversity steppingstones; biofilters and sedimentary ponds for improvement of water quality.

Summarising the city of Lodz demo case involves the implementation of a network of NbS to reduce the risk of pluvial floods⁴⁷ by improving the management of stormwater runoff⁴⁸.



Figure 37. Photo impression of the city of Lodz demo case in Poland

The **strategic case** of the NbS strategy has been advanced by the demo leaders by developing the hydrological models that will enable a more accurate assessment of the impact of NbS on pluvial floods. The declining capacity of the city to handle stormwater and the prohibitively costs of grey infrastructure options reinforce the strategic case for NbS. Unfortunately, there are a number of factors in the institutional setting – like existing regulations- that may serve as barriers instead of enablers to make this shift possible. According to the demo leader, although NbS are mentioned in various policy documents and local stakeholders have grown in awareness of their

⁴⁷ A pluvial flood occurs when an extreme rainfall event creates a flood independent of an overflowing water body and it could be caused either by flash floods or surface water floods occurring when an urban drainage system is overwhelmed.

⁴⁸ **Stormwater runoff** refers to water that is not absorbed by soil (because the surface is saturated or sealed), and flows on impermeable land cover, such as roads. The saturation point of surface areas depends on the soil type, landscape, evapotranspiration and biodiversity of the area. In natural settings, the surface is usually permeable and absorbs large amounts water due to high levels of shallow and deep infiltration.

potential, there is not yet a translation of this interest into concrete changes in regulations and procurement procedures.

The capacity of local organizations and the lack of an enabling environment are a major obstacle to structure a solid business case. An example of such barriers is the fact that city autonomy is limited by national regulation. Cities carry the risk to face the national government in court when promoting a policy that does not align with national government guidelines. This limited autonomy and the possibility of such legal battles, hinders the creditworthiness and willingness of municipal cities to apply for financing either from development or commercial banks.

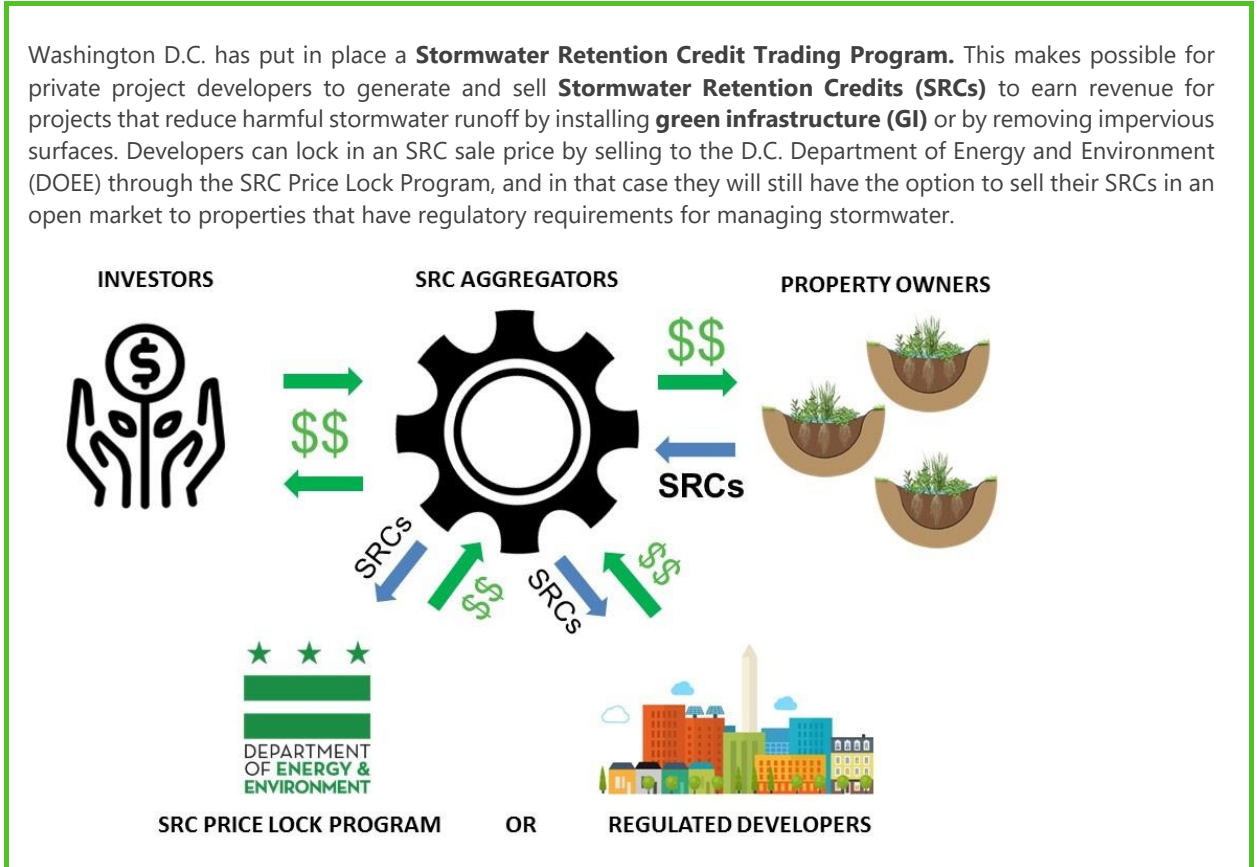
This leaves a few options for the development of the funding and financing strategy. A combination of EU transfers or technical assistance and equity investments by private project developers could be one of them.

These legal limitations of local actors combined with the city ambition to develop as a logistic and service hub opens up other governance modes with greater private sector participation such as the creation of environmental markets more feasible.

One of the options could be the creation of a stormwater market, like the one developed in Washington D.C (see **Textbox 7**). Accordingly, the demo leaders agreed to explore further how NbS could be designed and conceptualized to become an economically attractive option for real estate development companies and will engage with local authorities to assess with them the feasibility of implementing such a market in Lodz.

The development of the stormwater market and the demand for implementation of NbS at scale this market will create could give an important boost to the local economy by creating new types of jobs and demand for new types of expertise. Framed in this way, NbS implementation in Lodz could be supported by city programs such as the Small and Medium Enterprise programme, which can support new business interested in implementing such a kind of solution (GURA). This programme establishes as a condition for sponsorship to give something back to the city.

Textbox 7. Washington D.C. Stormwater Retention Credit Trading Programme (Source: Washington D.C. Department of Energy and Environment, consulted October10, 2020)



5.3.3 La Brague basin, France

The 2015 flood event constituted the starting point of the NbS initiative. The disaster experience proved the inability of existing (grey) flood defences to cope with changing climate conditions and prevent economic and human losses. The disaster also put in motion a cultural change and introduce a change in perception regarding the reliability of grey infrastructure. Authorities and citizens became aware that if an event surpasses the threshold of protection for which the grey infrastructure was designed, there would be a larger volume of water concentrated in a single place versus the situation in a hybrid system. The use of NbS allows for a more decentralized approach and a larger number of options to the risk because flooding then advances more progressively and less sudden than in grey only system. From then a shift in preferences towards a decentralized spread number of nature-based retention areas took place.

The strategic case of NbS has been further developed by the work of IRSTEA and other demo partners. During the NAIAD project they quantified that implementation of NbS would increase flood protection level of service by 100 times and reduce mean annual damage by 30%. Additionally, and NbS strategy would generate additional economic benefits through an increase in tourism activities. The **lifecycle costs** of the NbS strategy has been estimated in EUR 80 million spread over a useful life of 50 years.

- Regarding the financial case, the funding and financing strategies for implementation: a main source of funding would come from taxes whose use is justified by large magnitude of avoided damages. Some of the sources of funding identified are:
- The water agency is willing to cover up to 80% of the costs involved in river restoration, but not the works related to flood protection.
- At the local level, the department for prevention of floods (GEMAPI) can collect taxes that amount up to EUR 2.4 million per year; and from that 0,8 million per year could be allocated to pay back for the NbS investment programme. This yearly amount represents approximately six times more the estimated yearly maintenance costs.
- Finally, citizens according to a survey conducted by NAIAD demo partners, households are willing to pay 30 to 90 EUR per household per year.

The management case has also been advanced, and it has been decided that two entities will serve as project sponsors: CASE, the urban community of Sophia Antipolis and SMIAGE (Syndicat Mixte pour les Inondations, l'Aménagement et la Gestion de l'Eau) the regional Mixed Syndicate for Floods, Development and Water Management. They have previous experience with ecoengineering and NbS projects, enough in-house capacity and a proved track record in river basin management.

Unfortunately, important implementation risks are also present. The most important is the ESG risk introduced by the need to expropriate. Local political leaders are reluctant to execute the expropriations needed to implement the NbS strategy. The expropriation process could delay project implementation up to ten years.

5.3.4 Thames basin, United Kindom

The Thames demo case has been led by renown research institutions such as Kings College London. This has resulted in a different framing of the demonstration case; whose main objective has bene to co-develop and test the **Eco:actuary** policy support tool with project partners and stakeholders in London and surrounding towns. The Eco:actuary allows mapping insurance-relevant natural capital based on local to global data and spatial modelling using the most robust climate, land cover, terrain and mitigation infrastructure data. These are then combined with maps

of socio-economic exposure based on agriculture, infrastructure, population and urban exposure to highlight areas at risk and identify local or upstream mitigating actions.

Through the development of scientific evidence and the Eco:actuary decision support tool the demo has as main objective to impact ongoing public investment planning processes for agriculture development and flood protection in the Thames river basin by allowing a better informed and fair comparison of NbS versus grey only alternative at system scale. Key water risks to be analysed are urban drainage and upstream fluvial floods.

Two national developments that strengthen the strategic case for the development of this decision support tool and NbS in the Thames basin are:

- English government interest in identifying low-cost monitoring for flood protection backing to 2014.
- In 2017, the UK government identified the need for monitoring the effectiveness of NbS, including leaky dams, retention ponds and generative agriculture.

The outcomes from the NAIAD demo case in the Thames provided scientific-based evidence indicating that regenerative ponds outperformed leaky dams and retention goods. Accordingly, the way ahead beyond the NAIAD project to drive the implementation of NbS at system scale seems to be in positioning “regenerative agriculture” as a high potential option that needs to be considered in river basin and agricultural development plans.

Regarding next steps, demo leaders indicated changes being introduced in planning cycles and procedures as well as their intention to increase their understanding of public investment planning processes and of the institutional setting relevant for the implementation of regenerative agriculture. They became aware that understanding of these processes would leave them better equipped to seize future windows of opportunity to position NbS.

Plausible business models to incentivize the adoption of regenerative agriculture at system scale could include options such as the introduction of environmental markets, where farmers adopting this model could gain back part of their investments by payments that are proportion to their water “retention capabilities”, similar to functioning of carbon capture and sequestration markets.

5.4 Semarang city, Indonesia: financing a hybrid urban resilience strategy⁴⁹

The most comprehensive application worldwide of the FFWS – in Semarang city- was part of the Water as Leverage for Resilient Asian Cities⁵⁰ programme funded by Government of the Netherlands in partnership with the Asian Infrastructure Investment Bank, the Global Centre on Adaptation and 100 Resilient Cities. This case is presented in this handbook to illustrate the entire process and building blocks of a sound implementation strategy required to make the investment case of NbS and hybrid (green-grey) infrastructure strategies for water security.

As partner of the Cascading Semarang team, Deltares facilitated the process of transdisciplinary strategy development and project preparation making use of the [Financing Framework for Water Security](#). Through this demo case the potential of this innovative project origination approach which is centred around the water cycle dynamics and at the scale of the river basin was demonstrated to International Financing Institutions (including the World Bank Group, the Asian Development Bank, the Asian Infrastructure Investment Bank and FMO) and Climate Funds (e.g. Green Climate Fund).

5.4.1 The FFWS and Water as Leverage: rethinking project origination

The Water as Leverage for Resilient Asian Deltas initiative aimed to bridge the gaps hindering climate action, with a focus on project origination and for this reason the FFWS approach to close the implementation gap of NbS and hybrid water security strategies by enabling the development of innovative financing arrangements through transdisciplinary collaboration, proved effective and very much in line with the program goals.

Traditional project generation along with weak institutional settings result in investment programs focused on solving yesterday urgent challenges, little inclusive and without a strategic long-term and system perspective where water can serve as leverage for sustainable and resilient economic growth. Innovative approaches to develop strategic investment pathways are shared.

⁴⁹ The text presented combine excerpts from Altamirano (2019) and, Cascading Semarang . Steps to Inclusive Growth, Water as Leverage Report 2nd phase (2019)

⁵⁰ For more information about the Water as Leverage for Asian Cities program visit: <https://waterasleverage.org/>

Water security is the most challenging and complex risk we face and pre-condition to inclusive development. Successful climate adaptation requires social, technical and financial innovations that radically change the dynamics of increasing vulnerability driven by current economic development models and can deal with deep uncertainty. A major barrier is the significant gap between strategic planning processes and project origination processes. Systems-level understanding gained during the former seldom informs the latter. A focus on stand-alone projects, rather than a strategic investment pathway, can result in missed opportunities to deliver both bankable and beneficial investments over the long-term.

Water as connecting stream between so many sectors (energy, food, health) holds a great risk and a great opportunity. Water can be used as leverage for impactful and catalytic change.

The “Water as Leverage” programme aimed to trigger this change in the conception of water from risks to opportunity through a collaborative and transdisciplinary process that leaves no one behind. A project origination approach that involves from the beginning communities, public and private sectors to develop investment programs that are transformational and create a “coalition of the willing” that can take these investments further.

The Water as Leverage initiative enabled the Deltares team to develop a proof of concept for financial institutions and government agencies of the entire FFWS project preparation process. Effective collaboration with communities, local and national government representatives, a multinational consortium covering a wide array of disciplines (urban planning, architecture, ecologists, civil engineers, hydrologists and social scientists), and local and international private sector companies resulted in a paradigm shifting investment programme for resilience that exploits the resilience dividends of nature.

More concretely the process resulted in an investment portfolio in which the most promising clusters are translated into deals that are attractive for public and/or private investors; a strategic procurement plan and blended-finance approach for market development of innovative urban resilience solutions.

5.4.2 A paradigm shifting investment program: the strategic case

Semarang is facing multiple interconnected water-related challenges. Urbanization as well as climate change increasingly exposes the city to flooding from both the sea- and mountain side. Additionally, long term groundwater extraction drives land subsidence and compromise freshwater availability in the long term. In the last 20 years the city has grown from 1 million to 1.8 million inhabitant and land subsidence is up to 17 cm per year in some locations.

Previous city investments and efforts have focused on grey and traditional engineering flood protection measures, including a combination of measures such as polders, sea dykes and normalization canals for optimal discharge of water. Though these large-scale engineering measures have some impact in mitigating impacts in the short term, they don't address the causes of increased flooding, water scarcity and land subsidence, issues which will continue to grow if not addressed.

To address these issues, we need to tap into the abundance of water and store the water that is available. We also need to increase flood resiliency on a more local and decentralized manner, strengthening the finer network and exploiting the resilience dividends of nature. Following the watershed from upstream to downstream opportunities have been defined and explored, which shift the view of water as a threat towards beneficial. By adding the concept of 'cascading' to the current water management system, a series of elements of storage and utilization are created with a complementary and synergetic approach. Thus, creating a paradigm shift from "All the water out" towards "Not a drop of water gets lost". During this process we have defined five concepts for urban growth that have been further worked out into a long-term investment program. These five urban solutions are shown in .

The theory of change on how the investment program proposed drives a paradigm shift is presented in and **Figure 38.** depicts several self-reinforcing mechanisms or vicious cycles that drive a process of exponential growth of vulnerability of the city as it grows and develops.

Firstly, population growth and urban expansion cause the expansion of the urban tissue and an increase in paved and built area upstream of Semarang, which decreases the infiltration rate, causing higher discharge peaks during extreme precipitation events. A higher frequency of floods generates more attractiveness to moving upstream, reinforcing the initial reduction in infiltration rates.

Secondly, an increase in flood frequency increase the Climate Value at Risk for the private (damage of assets as well as foregone revenues during business interruptions) as well as for the public sector (damage to public assets such as infrastructure networks). The first, losses for the private sector erode the tax base of Semarang city. A lower tax base reduces the availability of resources for public spending on water infrastructure development and maintenance; impacting negatively the capacity of the city to deal with extreme events.

Moreover, an increased Value at Risk of public assets leads to higher expected damages. Less resources for maintenance in combination with higher expected damages leads to deteriorated maintenance levels of water infrastructure over time, reinforcing the initially increased Value at Risk of public and private assets through higher flood risk.

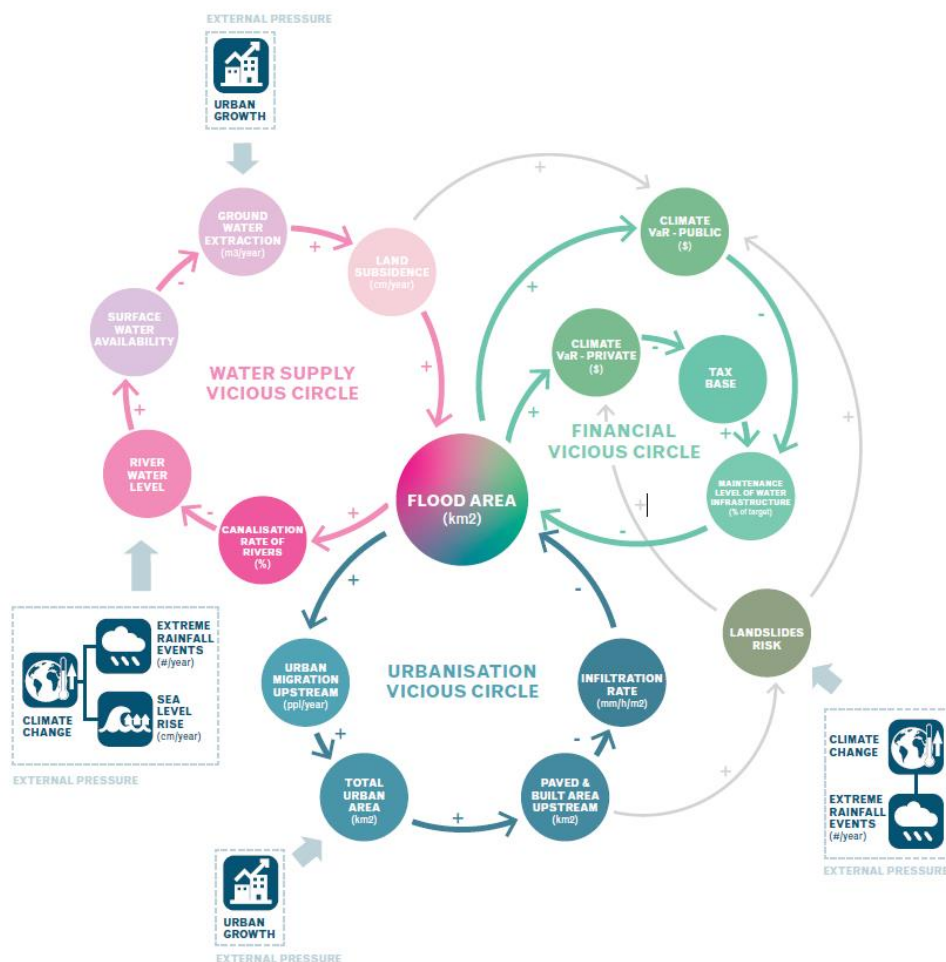


Figure 38. Vicious cycles driving vulnerability and environmental degradation in Semarang

Thirdly, socio-economic activities in Semarang are heavily reliant on groundwater resources. Current abstraction rates are unsustainable, causing aquifer depletion and land subsidence. Land subsidence increases pluvial and coastal flood risk due to a relatively more low-lying coastal/downstream area over time. Increased flood risk has so far led to more canalization of the city for a faster discharge of water in the ocean; affecting negatively the availability.

In this section we present the fundamental elements of the strategic case of Cascading Semarang. As previously explained, current urban development dynamics of Semarang does not seem sustainable. Through five urban development concepts the investment program aims to set in motion a systemic change. These five building blocks and their implementation strategy are designed to achieve resilient and sustainable development and solve Semarang water challenges.

Figure 39 shows the way these five building blocks will impact the water management system and drive resilient and inclusive economic growth in the long-term.

Cascading Semarang theory of change: Setting in motion a new dynamic between water and economic growth

Summarising, Cascading Semarang proposes five urban growth typologies that combined aim to put in motion a change of paradigm, uncoupling economic growth from an exponential increase in vulnerability to floods and landslides and a negative impact to key natural resources, such as water and forests. Cascading Semarang vision is to change in the long term these two patterns by applying these five concepts; that all in all aim at an increase in water storage and infiltration, increase in surface water availability and consumption and significant decrease to stop of groundwater extraction. The ultima goal is to create a reinforcing strategy between economic growth (SDG8) of Semarang through an increase in the tax base, jobs and of local revenue sources, and the achievement of Water Security (SDG6) in the face of Climate Change (SDG13).

The strategic fit of Cascading Semarang is graphically represented in **Figure 39**. As it can be observed here the proposed strategy for resilience fits well existing government plans and goals and develops concrete suggestions and recommendations to enrich the next Semarang Mid-Term Development Plan (2020-2025) that is being developed by the Regional Planning Agency (BAPPEDA).

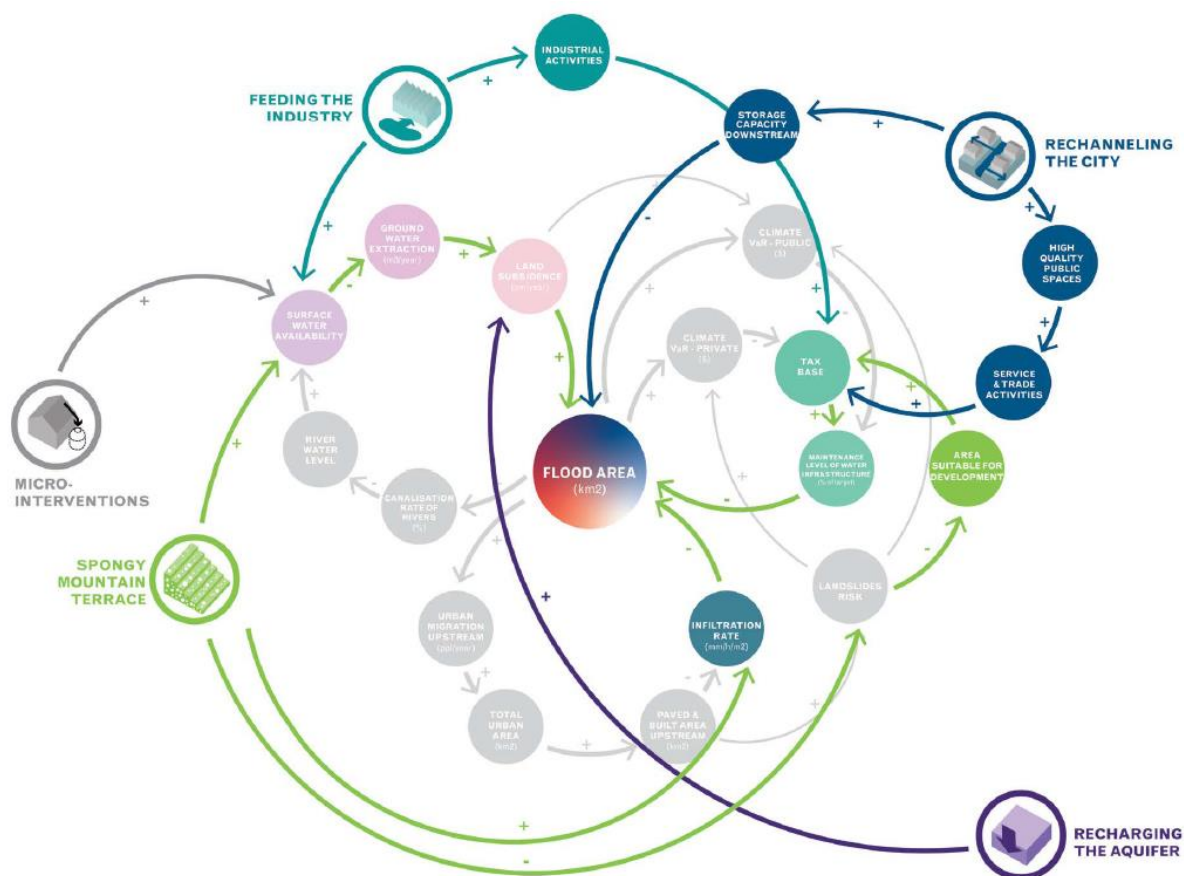


Figure 39. Cascading Semarang theory of change

In terms of enabling conditions, the implementation of the urban resilience strategy poses a significant challenge. Although the “Water as leverage” approach had the institutional support from the Ministry of Public Works and the provincial government authority, there are other authorities that play an equally crucial role to advance towards implementation at system scale. Some of them are the Ministry of Public Works responsible for river basin management and the provincial government authority that is in charge of coastal management.

Indonesia faces several institutional challenges regarding the efficient provision of public infrastructures and the participation of the private sector. Some relevant to the implementation of Cascading Semarang are. Firstly, the urban planning landscape in Indonesia is rather complex and fragmented, with a long-term development plan for twenty years, and mid-term development plans for five years. Secondly, regulations are vague and have not been organised into a central, coherent set of requirements, which means that companies must navigate the complexities of

Indonesian law. Thirdly, poor inter-agency coordination and agencies' capacity to negotiate and manage long-term PPP contracts.

Other key challenges include: a lack of binding sustainability commitments; cases of expropriation and government-enforced price revisions, particularly in the toll road sector; a lack of clear standards for contract termination; and a lack of specific provisions in contracts dealing with renegotiation procedures, the publication of contracts, and alternative dispute resolution mechanisms. Additionally, at city level there is a narrow tax base, limiting the funding of public goods and water tariffs are not yet set to ensure cost recovery.

On the positive side, the Ministry of Finance provides access to a Project Development Facility, designed to support government contracting agencies in the preparation of pre-feasibility studies and bidding documents, and to assist with PPP projects until they reach financial closure.

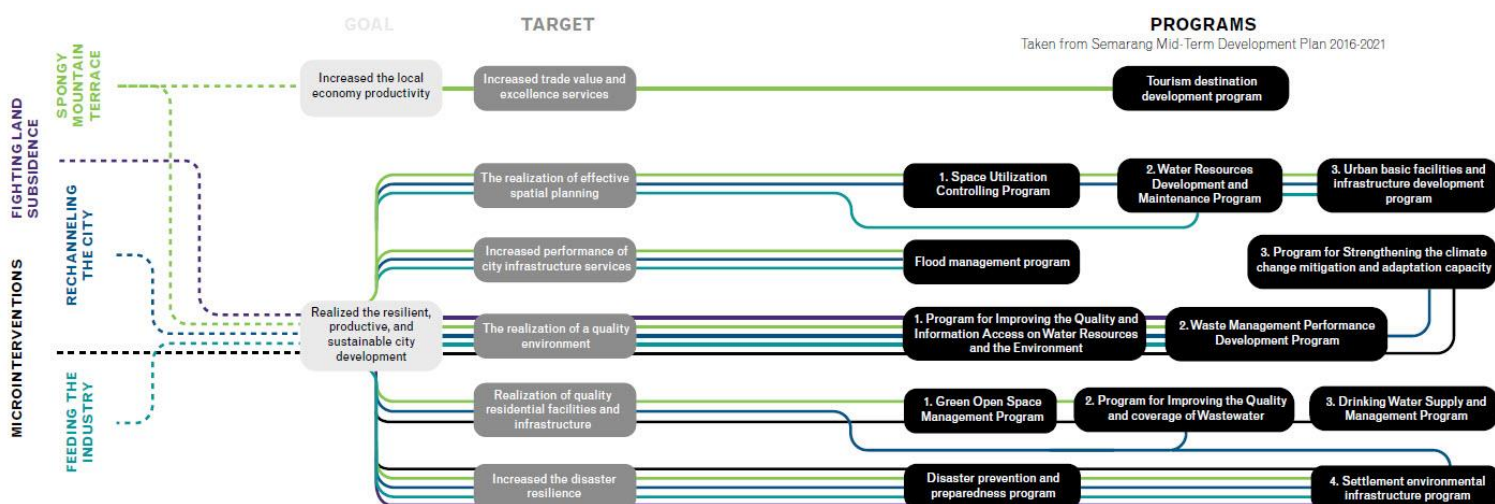


Figure 40. Cascading Semarang strategic fit with local and national government priorities

5.4.3 Economic case

Following up on the **strategic case**, where the evidence is presented on why a change and significant capital investments are needed, the economic case aims to test whether the preferred option represents a "value for money" proposition. This can be determined through considering the likely costs and benefits of the option(s). The way each building block impacts economic growth and resilience is explained below and in **Figure 41** an overview is given of all the key services and benefits each of these clusters of projects provide.

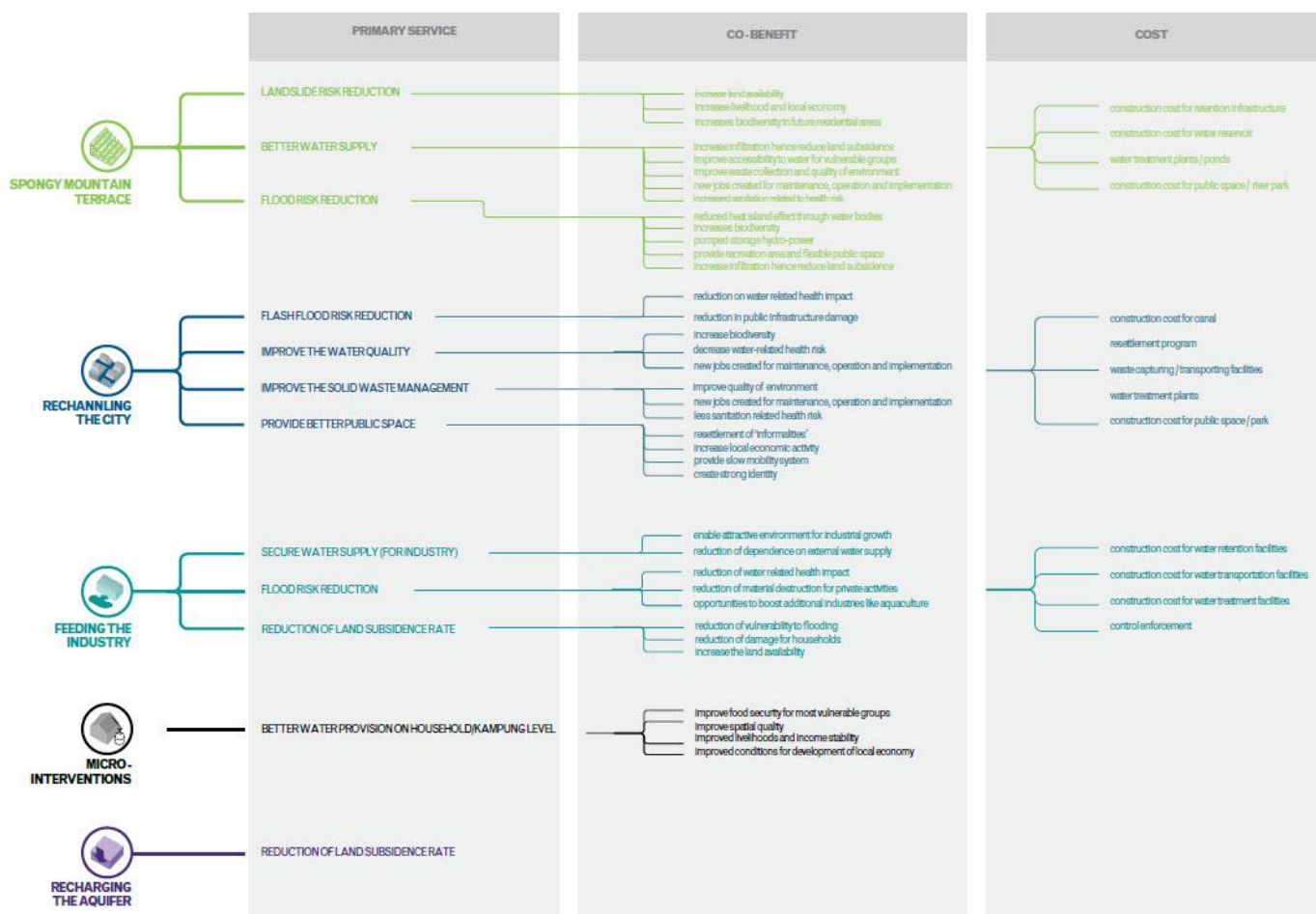


Figure 41. Five concepts proposed in the Semarang projects

The implementation of all five in a phased manner will increase water storage and infiltration, surface water availability and consumption and significantly decrease groundwater extraction.

Micro-interventions will increase the provision of water at kampung level and the potential for vulnerable social groups to develop economic activities, improve food security and income stability. If properly planned and implemented, micro-interventions along with social innovations and market linkages may result in improvements in spatial quality, better quality of life and opportunities for the development of a vibrant local economy.

Surface water availability is also increased by feeding the industry and implementing spongy mountain terraces which increase infiltration rates and reduce landslide risks. The higher infiltration rate prevents floods in the area, while lower landslide risk increases the area of suitable urban development, strengthening the tax base for maintaining infrastructure preventing floods.

Feeding the industry reservoirs create an additional source of water supply besides groundwater, which is currently being overexploited and risks becoming saline due to sea level rise. Higher variability in water availability due to climate change increase the risk of water scarcity for businesses, leading to economic disruption. Moreover, surface water usage instead of aquifer depletion reduces subsidence rates and subsequently flood risk.

Rechannelling the city increases water storage capacity downstream and enables the creation of high-quality public spaces. This favours commercial activities that increase the tax base for maintaining flood prevention infrastructure. Reduced flash flood risk decreases expected damage and economic disruption, also resulting in a healthier tax base for the city. Furthermore, the design includes the installation of nets and improvements in solid waste management that will result in improvements in water quality better living conditions for surrounding communities. All these effects combined, especially better water quality is known to increase economic productivity and reduce public health costs.

Recharging the aquifer is expected to reduce land subsidence (currently 8 cm per year in some areas), thereby mitigating the increase in pluvial, fluvial and coastal flood risk due to climate change and upstream urban developments, which is exacerbated by land subsidence. Land subsidence damages public underground assets and decreases the lifetime of water infrastructure. For example, current investments in flood protection, e.g. the newly developed seawall at the waterfront, will have a shorter lifetime when they sink due to land subsidence, decreasing their effectiveness. Additionally, land subsidence decreases coastal property values due to higher flood risk. Therefore, decreased land subsidence reduces the costs of future additional investments in flood protection and maintains property values.

We assessed the economic business case by looking at:

- Four categories of expected effects: environmental, social, economic and institutional effects
- The effects of the five building blocks for three economic agents: individual/ consumers, producers/firms and government.

All of these benefits are relative, comparing the "alternative scenario" where concepts are implemented; versus the BAU scenario. All the benefits are described as in terms of improvement and or reductions.

The economic case was built on the assessment of costs and benefits of the three main concepts: rechannelling the city, spongy mountain and feeding the industry. All in all the programme will allow 28,500 new households (85,500 inhabitants) to be free from landslide risk in prone areas.

Additionally, it will generate freshwater provision based on surface water for more than 600,000 inhabitants. Other important conclusions that can be taken the qualitative SCBA are that:

- The investment has overall positive environmental benefits, but not all directly for one party. These benefits are mostly improving a “public good”.
- Social benefits are very positive, on household and producer level. The danger here is that in a full quantitative **social cost-benefit analysis (SCBA)** these benefits might not contribute a lot; it will depend on the valuation technique that is applied. If inclusiveness, equality, and poverty reduction (for example) are national policy objectives then enough weight need to be given to these to ensure these social effects are valued.
- Regarding the labour market a change can be expected as new businesses can be developed as more and reliable resources are available (water supply) and the tourist industry will start to grow. To assess full the societal impact we more research is needed about current labour market, educational levels and unemployment rates in the city.

Risk reduction of landslides and floods will increase the value of property and land in each of the areas. This will apply for private, commercial and publicly owned property.

- Economic benefits are mostly positive. Damage reduction is highly relevant in all three concepts, and for many of them the effects will be nearly immediate after project implementation has started.
- Policy effects are related to the larger changes and opportunities in the city. Not for a pilot site but for the entire program. For example, there will be more “safe” space created by the combination of the different measures where different activities can take place which means that spatial planning has more possibility and potential. In the same way, the whole city will only become more resilient to water risks and water-cycle related extreme events driven by Climate Change in the degree that all these five concepts are implemented and that is done at system scale.

5.4.4 A phased implementation strategy

The ultima goal is to create a reinforcing strategy between economic growth (SDG8) of Semarang through an increase in the tax base, jobs and of local revenue sources, and the achievement of Water Security (SDG6) in the face of Climate Change. However, to ensure a high success rate and continuity in the improvements our concepts aim to achieve; not all these changes can be done at once. First the evidence and citizens as well as private sector support and capacity needs to be developed through smaller size projects and sub(concepts) that impact important leverage points such as: groundwater infiltration rate and permeability of urban developments.

The implementation strategy developed for Semarang which combines a large enabling environment component with specific implementation arrangements per concept has been designed to serve multiple goals:

- Increase in green jobs: market development Ecosystem services providers (SME's)
- Increase in PPP's and Performance-based contracts for water supply and Adaptation
- Public-Private synergetic engagement

All of these, while aiming at reducing significantly the transaction costs of upscaling and replicating the concepts at the Semarang and watershed level, ensuring sustainability in service provision and contributing positively to the competitiveness of Semarang private players in the water and urban development sectors.

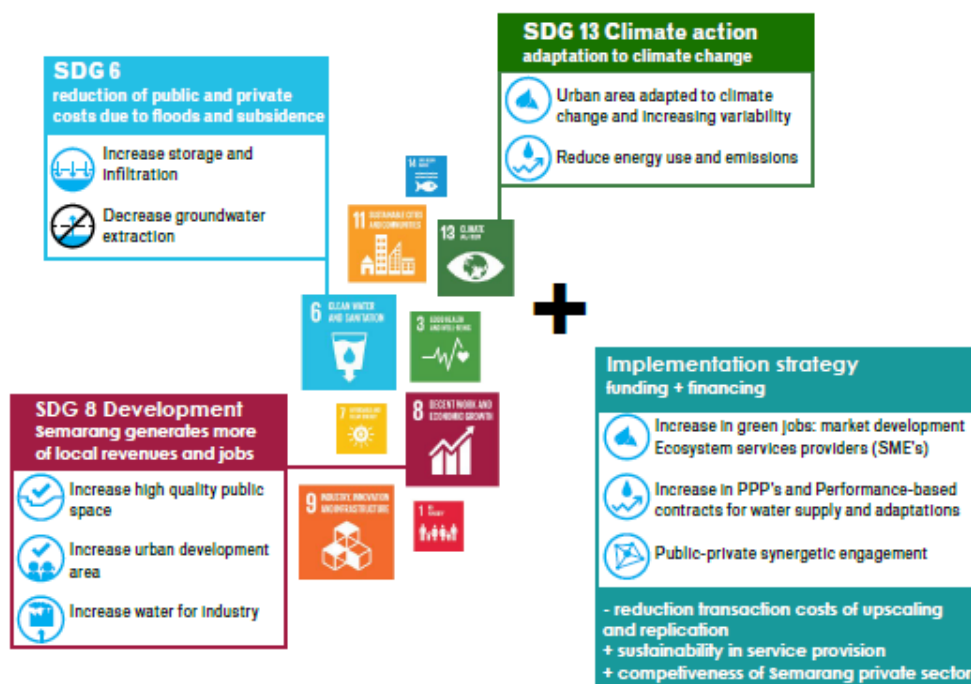


Figure 42. Cascading Semarang goals and implementation strategy

As it has been explained before, does not seem possible to implement the whole Cascading Semarang at city and watershed level at once, because there is resistance to change at different levels and because there is limited implementation capacity -public and private- in place. Aiming at full implementation at scale at once would result either in too high transactions costs or reputational risks that may endanger the political support for the overall strategy.

Therefore, is proposed to start with a number of selected pioneer transactions – ideally one per concept, in locations that maximize support and opportunities for successful implementation, and starting with measures at small scale – that

- a) create the evidence (data on the effects of the different interventions),
- b) generate buy in of communities, public and private sectors and
- c) gradually creates the capacity of public authorities to procure these projects successfully and of private sector to deliver professionally the works or services each of these concepts involve.

Figure 43 gives a graphical representation of this phased strategy to implement the Spongy Mountain building block of the strategy and **Figure 44** presents this phasing for all five building blocks.

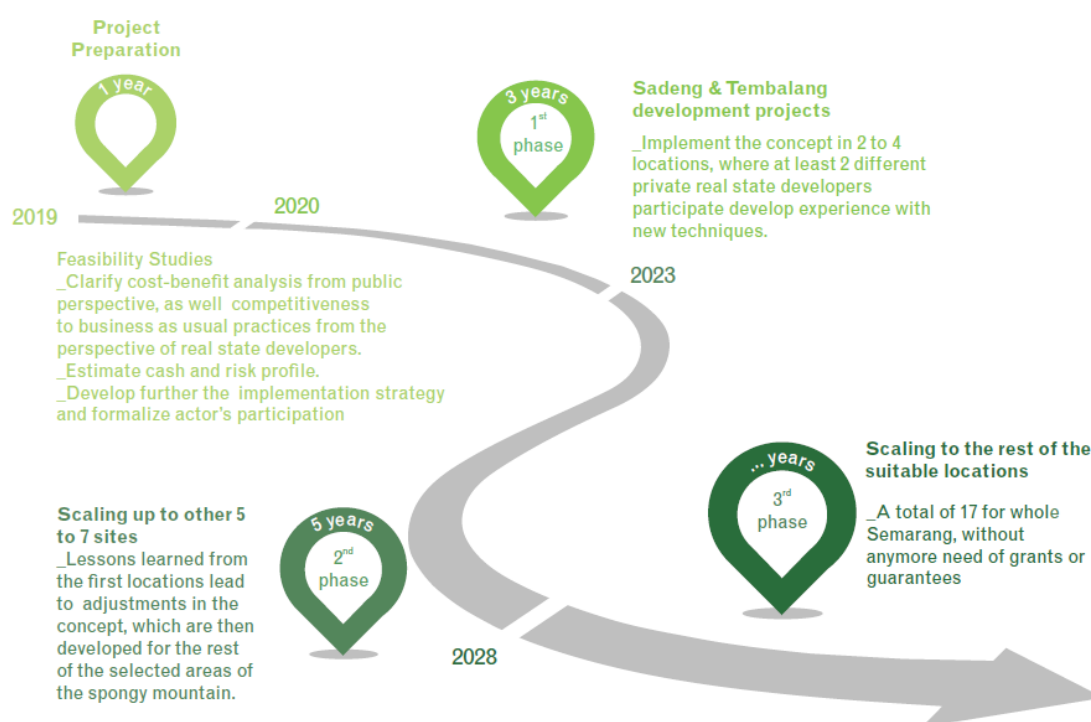


Figure 43 Phased implementation strategy for Spongy Mountain cluster

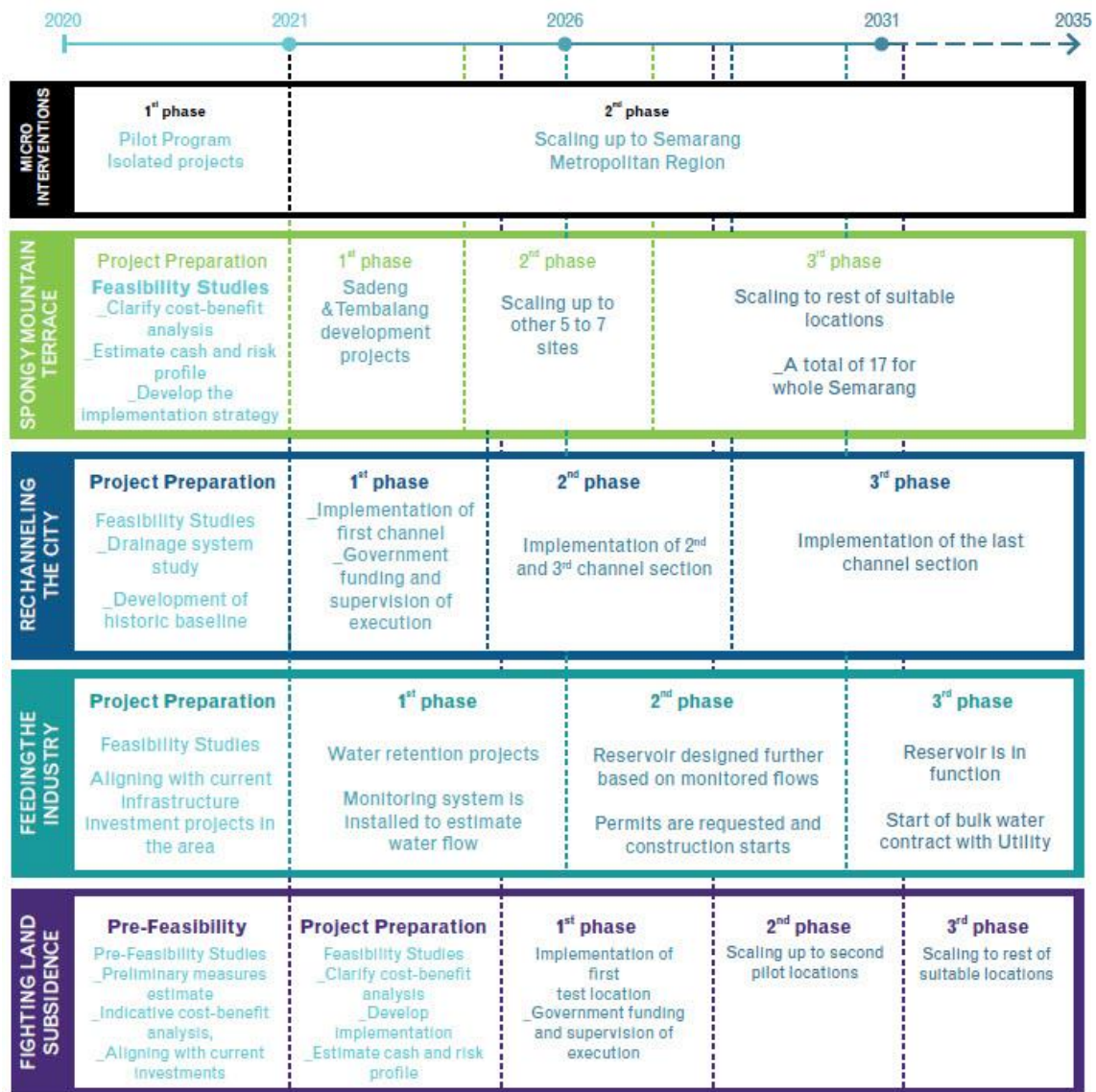


Figure 44. Cascading Semarang phased implementation strategy (2020-2035)

5.4.5 Creating an enabling environment with international development partners

Besides the need for phasing it is crucial to work together with different government layers and with the support of the international development partners, like Multilateral Development Banks, climate funds (e.g. Green Climate Fund and Global Environment Facility) and key donors to reconsider existing incentives created by the way risk, rewards and responsibilities are allocated between different government layers as well as between public and private players in the urban development, water management and disaster risk management sectors. Once this diagnosis has been done, they can together set in motion the changes required to create an enabling environment that would allow the adoption of several innovative business models for efficient and effective provision of water services and the use of innovative financial instruments.

Table 34. Creating an enabling environment to implement Cascading Semarang

1. TAX BASE & BEHAVIOURAL CHANGE	
<ul style="list-style-type: none"> - Increasing tax base / DRM - Spatial planning & value capturing strategy - Revision of water tariffs: cost reflective including ecosystem protection - Water fund or other earmarked tax collections for DRR/CCA - Risk-based insurance premiums 	<ul style="list-style-type: none"> - IFIs (e.g. WB credit worthiness programme) - Public-Private Infrastructure Advisory Facility (Trustfund) - GCF Readiness grant
2. MONITORING SMART WATER MANAGEMENT	
<ul style="list-style-type: none"> - Collect the data necessary to build the development / water security and Climate Business case for public and private investments - Monitoring for PBC and PES 	<ul style="list-style-type: none"> - GCF – Project preparation grant - TNC – Experiences with design & water funds LAC - IFIs
3. BLENDED FINANCE: DEVELOP NEW MARKETS	
<ul style="list-style-type: none"> - Derisking sustainable investments - Slowly reducing risk perception of private sector = service providers - Creating demand for different real state and urbanization models - Focus on SMEs and creation of green jobs 	<ul style="list-style-type: none"> - Public-Private Infrastructure Advisory Facility (Trustfund) - GCF Private Sector Facility: Guarantees & Loans - IFIs & OECD & 100RC – to increase replicability

Table 34 presents the three key elements of this last and transversal component of the implementation strategy for Cascading Semarang while also giving an indication of which parties and funds or Technical Assistance grants seem a good match to support each of these lines of work.

5.4.6 Blended finance to improve the bankability of Cascading Semarang

The implementation strategy developed making use of FFWS aims to improve the bankability of each of the concepts as well as the overall program by:

- Enabling multi-sectoral investments, making possible the financing and procurement of multifunctional projects
- Making use of a blended finance strategy: each concept and project will combine multiple SDG's, public and private goals, allowing of the use of different concessional and commercial funds, such as:
 - Official Development Assistance for SDG6 and SDG8
 - Climate Finance – for the Climate Change Adaptation components
 - Generation of municipality local revenue sources
- Achieving efficiency gains driven by an increase in private sector participation in service delivery and the use of performance -based contracts
- Introducing a new valuing of water and water related climate risks; which would lead to new trade-offs, improving the economic and financial viability of water security investments

Last but not least; a blended finance approach would also allow the use of concessional finance to stimulate the creation of frontier markets, by

- a) utilizing concessional finance to de-risk suitable investments,
- b) allow the introduction of new private players to the sector first as service providers and consequently – once they risk perception has been lowered- as possible financiers, and
- c) creating demand for different real state and urbanization models.

Figure 44 presents the **blended finance** strategy for implementation of all five clusters. The relative advance of the investment case and bankability of Cascading Semarang strategy achieved by the end of the Water as Leverage process is presented in **Table 35**. This assessment also shows the areas that will need further research within the next months.

Table 35. Cascading Semarang bankability scorecard

	SPONGY MOUNTAIN	RECHANNELLING THE CITY	FEEDING THE INDUSTRY	MICRO INTERVENTIONS	RECHARGING THE AQUIFER
1. STRATEGIC CASE					
Solution impact versus Business as Usual (BaU)	●	●	●	●	●
Paradigm shift potential (solution versus problem)	●	●	●	●	●
Strategic fit: alignment with government priorities	●	●	●	●	●
2. ECONOMIC CASE					
Benefits versus costs	●	●	●	●	●
Job creation potential (activity size)	●	●	●	●	●
3. COMMERCIAL CASE					
Private sector interest in implementing and/or investing	●	●	●	●	●
Dependence on regulation of the commercial activity involved in delivering the service	●	●	●	●	●
Risk profile	●	●	●	●	●
Technical implementation risks (e.g. technology readiness level)	●	●	●	●	●
Environmental, Social and Governance (ESG) risks	●	●	●	●	●
Quality of procurement strategy	●	●	●	●	●
4. FINANCIAL CASE					
Affordability of the Solution	●	●	●	●	●
Funding available and/or secured	●	●	●	●	●
Effect on Municipality Tax Base. E.g. real estate development	●	●	●	●	●
Government buy in	●	●	●	●	●
Revenue generating potential	●	●	●	●	●
5. MANAGEMENT CASE					
Capacity of public agency to procure successfully the project	●	●	●	●	●
Monitoring and evaluation systems considered	●	●	●	●	●
<p> ● Very bankable ● Poorly bankable ● Bankable ● Very poorly bankable ● Neutral </p>					

5.4.7 Implementation arrangements per cluster

As explained before, following the FFWS we developed in close collaboration with all project partners a number of alternative implementation arrangements and Public-Private engagement models for each of the five concepts. The viability and further detailing of each of these models is being advanced by a local Water as Leverage taskforce in close cooperation with the innovative project preparation facility called SDG Indonesia One managed by PT SMI. PT SMI is one of the Special Mission Vehicles (SMV) under the Ministry of Finance which is engaged in financing and preparing infrastructure projects. With this platform, the Ministry of Finance and PT SMI aim to transform needs into opportunities for many parties to be able to participate in various infrastructure projects related to SDG achievement

Textbox 8. Blended Finance Facility SDG Indonesia One.

The Government of Indonesia through the Ministry of Finance and PT SMI seeks to achieve the SDGs through the establishment of an integrated platform called “SDG Indonesia One” which combines public and private funds through blended finance schemes to be channelled into infrastructure projects related to the achievement of SDGs. With various experiences in managing various funds from donor/bilateral/multilateral institutions both in the form of grants, technical assistance and capacity building as well as strong support from the Government of Indonesia through the Ministry of Finance, PT SMI will be the implementing agency of this platform. PT SMI not only has the capacity to manage funds but also can accelerate deliverables through various innovative products and monitor the implementation of this project in the ground.

SDG Indonesia One is a platform that includes 4 (four) types of pillars that are tailored to the appetite of donors and investors, namely: Development Facilities, De-Risking Facilities, Financing Facilities, and Equity Fund. The platform aims to raise funding from investors, donors, and philanthropist to be channelled to projects in Indonesia that support the achievement of Sustainable Development Goals (SDGs).

The first pillar of the Development facilities is aimed at encouraging the preparation of infrastructure projects both at the national level and at the regional government level. With this development fund, the preparation of infrastructure projects will be better, both in terms of quality and quantity.

The second pillar is the De-risking facilities aimed at increasing bankability of infrastructure projects so that it is attractive to the private sector in this case commercial banks and investors to participate in infrastructure projects.

The third pillar is the Financing facilities aimed at encouraging and stimulate greater infrastructure financing, by attracting the participation of other parties such as commercial banks or private investors to be able to participate in infrastructure projects. Financing funds can play a role in the form of flexible financing products and function as closing the gap.

The fourth pillar is the Equity fund is intended to encourage the participation of private investors to be able to participate in infrastructure projects related to SDGs. With the existence of an equity fund, there will be a strengthening of capital capacity for new (greenfield) projects and can also act as asset recycling for projects that are already operating (brownfield).

5.4.7.1 *Spongy mountains*

The implementation of spongy mountains will enable runoff retention, storing and reusing water in the uphill areas of the city. These functions lead to decreasing landslides risk, increasing access to water and reducing flash floods. **Table 36** summarizes the governance and funding structure based on the agreed hierarchy of functions and services.

Table 36. Service hierarchy, funding and governance structure of the spongy mountains concept.

MEASURES	FUNCTION	SERVICE	TYPE OF GOOD	PREVAILING TRANSACTION GOVERNANCE	COMMISSIONER/REGULATOR	TARGET GROUP	LEVELS OF SERVICE			REVENUE MECHANISM
							KPI	BAU	TARGET	
Spongy mountains	Retaining water and collecting water	Landslides risk reduction	Private good	Regulated market	Municipality and Housing and Settlement Agency	Real estate developers	New house holds	NA	28.500	Private investment
		Reduce Flash Floods	Public good	Public procurement	Municipality and Public works agency	Inhabitants area	Runoff reduction	NA	80%	Taxes
	Inhabitants Semarang area					Runoff reduction	NA	10.5%	Taxes	
	Collecting and reusing water	Increase access to water	Common pool resource	Public procurement	Municipality and Public works agency	Inhabitants area/Semarang	New Beneficiaries	NA	600.000	Tariff

The spongy mountain measure is designed as a real estate development model, framed from the perspective of climate resilience. Therefore, the prevailing transaction governance follows the logic of regulated market, which eventually requires the support of public authorities due to the positive externalities not captured by real estate developers. Accordingly, the suggested financing and implementing strategy for this concept is the following:

- 1) Funding could be private, as project developers of real estate could be driven to implement this concept provided the right incentives are in place.
- 2) De-risking strategy use of public funds or climate finance to offer private developers a guarantee that could be used by developers in case to cover performance risks which could happen due to the innovative character of the technology, or to cover possible losses due to demand risk.

- 3) Private sector participation to allow for the creation of a level playing field we would advise that at least two project developers are involved from the start in the deployment of the first two projects in SAdeng and Tembalang.
- 4) Technical assistant grants are crucial to incentivize the participation of private project developers in the piloting phase as well as to incentivize local banks to create new financing products that support green real estate developers and/or incentivize the demand for this new type of neighbourhoods.

The pre-feasibility study indicated that soil preparation cost (1,300 ha) would total USD 46.5 Million, forest management (2,600 ha) would reach USD 11.8 Million, residential development (5,200 ha) would require additional investments of around USD 41.1 Billion and building a river park (5,200 ha) would total USD 240 Million. Additionally, the implementation would require changes in spatial planning and land use regulation to enable resilience-friendly real state models. Water tariffs should also be revisited. Additionally, the development of innovative private insurance schemes that recognize the resilience dividends of spongy mountains could also impact positively the demand for this new type of neighbourhoods. The quantitative estimation of the cash flow and risk profiles of these projects is something that needs further research.

5.4.7.2 *Rechannelling the city*

Rechannelling the city involves upgrading the water infrastructure of the city, in such a way that creates a system that stores stormwater locally. The new system will slowly discharge the water after the storm, reducing pluvial and fluvial flood risk. This is to be combined with micro-interventions for retaining water, the implementation of proper green and blue infrastructure to redirect water, increasing storage capacity of the existing channels and cleansing water before arriving at the main drainage canal. **Table 37** presents the suitable **governance modes** and funding structure of the rechannelling the city concept according to agreed hierarchy of services and functions.

Table 37. Service hierarchy, funding and governance structure of the rechannelling the city concept.

MEASURES	FUNCTION	SERVICE	TYPE OF GOOD	PREVAILING TRANSACTION GOVERNANCE	COMMISSIONER/REGULATOR	TARGET GROUP	LEVELS OF SERVICE			REVENUE MECHANISM
							KPI	BAU	TARGET	
Grey and green infra	Retainin g water and collectin g water	Flash flood risk reducti on	Public good	Public procureme nt	Municipali ty and Public works agency	Inhabita nts Semarang	Runoff reductio n	NA	21%	Taxes or Transfers (Climate funds)
Decentrali zed Waste Water Box	Treating wastewa ter	Provisi on of good quality water	Private good	Regulated market	Municipali ty and Public works agency - Utilities	Inhabita nts Semarang	Beneficia ry househo lds	NA	1,600	Tariffs
Waste traps	Retainin g solid waste	Impro ved water quality in chann els	Public good	Public procureme nt	Municipali ty and Public works agency	Inhabita nts Semarang	Solid waste in canals	NA	0	Taxes

Rechannelling the city offers a typical public good in terms of flood risk reduction and water quality, even when there are benefits such as the provision of good quality bulk water to utilities that could be captured and monetized. Overall, public procurement is expected to be the prevailing transaction governance mode. Good quality bulk water to be provided to utilities could be also governed by a regulated market. Accordingly, the suggested funding and financing strategy are the following:

- 1) Funding: general or earmarked taxes unless energy generation is possible, which creates a significant flow of revenues, combined with transfers from climate funds as flood risks are exacerbated by climate change.
- 2) De-risking: if private participation is wanted, guarantees to cover country and/or performance risk for the first years should be offered by the public authorities to private project developers.
- 3) Private sector participation: even in the case these projects being procured by the public sector, significant efficiency gains and sustainability in service delivery could be achieved

- by opting for Performance-Based Contracts for the Operation and Maintenance of reservoirs and channels.
- 4) Financing: in case of the project being funded by public budgets, then finance could be raised through the issuing of municipal (green) bonds. If the public authority opts for the use of Public-Private-Partnership contracts for the implementation of these projects, then also project finance could be an option.
 - 5) Technical assistance grants for project preparation could help to raise the quality and bankability of the projects and could be requested to financiers such as the Asian Infrastructure Investment Bank or the Asian Development Bank.

The pre-feasibility study indicated that the entire rechannelling the city programme would require investments of approximately USD 10,8 million for water infrastructure. Additionally, it would require USD 14.4 million for the process of resettlement and improvements required in the public space. Additionally, the implementation would require the implementation of a monitoring system, which tracks the performance over time of the new system. This performance evidence may enable larger engagement of the private sector in the upscaling initiative. The quantitative estimation of the cash flow and risk profiles of these projects is something that needs further research.

5.4.7.3 Feeding the industry

This concept consists of creating a large-scale reservoir to capture water for industrial use as an alternative source for water supply. It relies on the existing effort of the city's sea wall plan, and medium-scale reservoirs along drainage channels. Together, it will alleviate the pressure on groundwater resources reducing land subsidence. Additionally, feeding the industry contributes to mitigating flood risk with new retention area providing large capacity of capturing excessive runoff. **Table 38** presents the governance mode and funding structure of the feeding the industry concept according to the service hierarchy.

Table 38. Service hierarchy, funding and governance structure of the feeding industry concept

MEASURES	FUNCTION	SERVICE	TYPE OF GOOD	PREVAILING TRANSACTION GOVERNANCE	COMMISSIONER/REGULATOR	TARGET GROUP	LEVELS OF SERVICE			REVENUE MECHANISM
							KPI	BAU	TARGET	
Large-scale reservoir	Collecting and reusing water	Securing water provision for industry	Private good	Public Procurement	Municipality and Public works agency	Industry	Stability of water supply	NA	100%	Tariff
		Decrease land subsidence rate	Public good	Public Procurement	Municipality and Public works agency	Inhabitants area/Semarang	Land subsidence	NA	No defined	Taxes
	Retaining water and collecting water	Flash flood risk reduction	Public good	Public procurement	Municipality and Public works agency	Inhabitants Semarang	Runoff reduction	NA	20%	Taxes

The key choice, in this case, is defining whether the project is supported by a bulk water contract between the project developers and managers of the reservoirs and the utility. In this case, the feasibility of the arrangement depends on the commercial risk. Meaning, to which extent the revenues from industrial water tariffs covers the investment in such a large-scale reservoir. In this context, the financing and implementation strategy proposed for these investments are:

- 1) Funding: combination of public and private finance, in other words taxes could cover the Viability Gap Funding and tariffs paid by the Industries directly, or by public authority through a bulk water contract could cover the rest of the investment.
- 2) Private sector participation could be stimulated through the use of Performance-Based contracts for certain infrastructure assets, and/or even concessions.
- 3) Financing: could be either through the issuance of municipal (green) bonds and/or project finance (in the case of a private investment).
- 4) Use of a mixed PPP paid back by availability fees (to cover the public services and social impacts) and tariffs (paid by the industry or the utility for water supply).
- 5) Technical assistance grants from Multilateral Development Banks could assist in the further preparation of the project, including the specification of the risk and cash flow profiles.

The large-scale reservoirs include a water treatment plan (USD 2.28 Million), a water retention pond (USD 59.9 Million) and a water transportation pipe system (USD 1.3 Million). Additionally, the successful implementation of the measure implies to ensure that water tariffs for industrial use are cost reflective. There is also the need to revisit regulations to create incentives for the use of superficial water instead of groundwater. The quantitative estimation of the cash flow and risk profiles of these projects is something that needs further research. **Figure 45** presents the blended finance strategy for implementation of all five clusters.

CASCADING SEMARANG:
Steps to Inclusive Growth

FIVE STRATEGIES FOR BANKABILITY
 LOOKING AT THE BEST PUBLIC PRIVATE ENGAGEMENT MODELS

Funding: private incentive by new "water bylaw" or pro-active public financing	Funding: Public investments, unless energy generation	Funding: Public & Private/ Taxes & Tariffs	Funding: Public & Private/ Taxes & Tariffs	Funding: public (subsidy), or private depending on household income
Private sector participations: > 2 developers to scale up concept	Private sector participation: Performance based contracts for O&M of reservoirs and channels	Private sector participation: Performance based contracts for O&M of reservoirs and channels	Private sector participation: Performance based contracts for O&M of reservoirs and channels	Private sector: Specialized SMEs providing design, installation, O&M/lease of equipments
Financing: Project finance	Financing: municipal/green bonds issuance	Financing: municipal/green bonds issuance. Project finance/ Special Purpose Vehicle	Financing: municipal/green bonds issuance. Project finance/ Special Purpose Vehicle	Financing to households: Microfinance/corporate finance for SME/green credit lines
TA grants -> for developers and banks	TA Project preparation grant	TA Project preparation grant	TA Project preparation grant	TA grants household evaluations & banks offering products
Derisking: public/climate finance guarantee for performance due to innovation + % losses (demand)		Mixed PPP: availability fee (aquifer recharge) + tariffs (industry water supply) Regulation to increase demand from industry	Mixed PPP: availability fee (aquifer recharge) + tariffs (industry water supply) Regulation to increase demand from industry	Derisking: guarantee % losses & TA to banks offering new green finance lines



Figure 45. Blended finance strategies for Implementation of five clusters Semarang

6 THE WAY TOWARDS IMPLEMENTATION AT SCALE: MAIN FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 Research findings

As we advanced in the implementation of the FFWS and its further development to respond to the needs of our demonstration cases in NAIAD, we have observed that the demo leaders and the proposers of green infrastructure in at least half of our demonstration cases and therefore also the NbS they propose were not yet part of the formal public planning and investment programming process. In many cases the proponents of NbS are organisations active in advocacy and/or academic work and often with little familiarity with public and private investment planning processes. As a result, there is an implicit bias to shape these projects towards the creation of awareness, and less towards demonstration of their revenue generation potential. Our methodology has therefore supported demo leaders in considering how to move forward towards implementation and scale and restructure demonstration cases to create the investment case for public and private sectors alike.

6.1.1 Green versus grey infrastructure projects: structuring investable NbS deals

Multiple factors slow down the rate of adoption of NbS for water security. Some of the more often cited are: uncertain performance, higher (real and perceived) risk and an unattractive cash profile of NbS projects. However, the most fundamental challenge is that public and private investment processes are geared towards grey infrastructure “projects” as investment units and do not fit the characteristics of natural infrastructure investments. Our objective within NAIAD and in further developing the FFWS for NbS has been to enable NbS proponents to engage in strategic planning and investment planning processes.

The way NbS strategies are seen by eco-engineers and proponents in general versus financiers and project developers create an important divide in language and interests. The criteria they both apply to judge the potential of green and hybrid versus grey-only infrastructure strategies are fundamentally different. Key differences between NbS and grey infrastructure projects that need to be dealt with in the development of an implementation strategy are:

6.1.2 Cost-effectiveness of NbS versus grey infrastructure

A key methodological aspect to be considered for the calculation of LCC and a proper comparison of NbS versus grey solutions is that “green infrastructure design and performance is generally

more context-specific than grey infrastructure. NbS solutions for DRR need to be designed and built to fit the soil, terrain and hydrological conditions of each individual site” (American Rivers, 2012, p.9). This difference translates on the one hand in greater complexity and uncertainty in ex-ante cost estimations and cash profile of NbS projects, while in the other hand also often on a greater value as they may address local concerns and values (Altamirano and de Rijke 2017).

6.1.3 Cash and risk profiles of green versus grey projects for water security

Diverse studies point towards the cost-effectiveness of green and hybrid strategies for water risk management versus traditional only grey ones. For example, comparisons made of NbS solutions versus grey infrastructure for storm water management; have found the many in terms of Total Costs of Ownership (American Rivers, 2012, p.9). These include reduced built capital (equipment, installation) costs, reduced operation costs (e.g. energy costs), and reduced repair and maintenance costs. Altamirano, Van de Guchte and Benitez-Avila (2013) also find that in the long term, operation and maintenance costs of NbS are expected to be lower compared to grey solutions, due to the adaptive and regenerating capacities of ecosystems.

Nonetheless, NbS have unique financing challenges inherent to their cash profile and risk profiles. Benefits are often unique, delayed, dispersed, non-guaranteed and non-financial, complicating the estimation of an **internal rate of return (IRR)**. With respect to costs, capital expenditure is often spread over a longer term, in comparison to grey solutions. The spread in costs is inherent to the longer ‘building’ times of NbS regarding the achievement of functionality.

While **total costs of ownership (TCO)** are expected to be lower for NbS versus grey infrastructure in the long term, it is also important to consider the differences in the “perceived” risk profiles of green versus grey and the impact that will have on cost of capital and on the “risk premium” to be charged by implementing parties to the procurement agency when opting for green versus grey. This will be specially the case in the first years of transition towards a hybrid infrastructure market; when risk perception will remain high and companies engaging in providing these NbS solutions won’t have the required track record to prove to financiers that they are in total control of construction and performance risks.

The multifunctional and innovative nature of green versus grey the “financing” of NbS solutions at scale additionally challenging. However also the specific characteristics of NbS that result in a net positive impact on-site aesthetic and provide other co-benefits has proven beneficial to generate new funding sources as it they increase willingness to pay of people in the immediate vicinity of these solutions. For example, in Portland, Oregon, residents were more willing to invest in those on-site storm water projects that additional scenic and other direct benefits (American Rivers, 2012).

Our approach proposes a process to structure NbS projects in a way that improves the cash and risk profiles of NbS projects by developing an implementation arrangement and strategy that includes a governance structure that allows the minimum contractual conditions and agreements between key implementing parties, and support the development of an enabling environment to exploit the full potential of co-benefits as additional revenue sources, while at the same keeping the transactions costs and implementation risks involved in the implementation of multifunctional projects at a minimum.

6.1.4 Specifying multiple levels of services and a clear hierarchy to guide trade-offs

A main advantage of NbS is that they can fulfil multiple functions. This also means that when structured as investment projects they may translate into projects that are contracted by multiple principals (public and/or private) and as there may be trade-offs between these functions this could easily translate into significant contractual risks, during construction and operation of these projects.

To reduce these eventual contractual risks while increasing the possibility to monetize more co-benefits of NbS we propose a number of collaborative modelling protocols that help clarify:

- Hierarchy of functions: specifying which combinations of measures (green, grey and non-structural) ensure together 2 to 4 main functions; and then make clear how to prioritize in case of trade-offs between them. The final prioritization is a function not only of the physical processes, but ultimately a social construct that is influenced by how active different problem owners are and which function is valued more by public and/or private beneficiaries (Altamirano 2019).
- Function curves, Life Cycle Costs (LCC), cash and risk profiles of natural infrastructure measures: the function curves, risk matrixes and LCC of grey infrastructures are often well known, however that is not the case for green infrastructure. A wide variety of technical expertise (e.g. ecology, morphology, civil engineering, and so forth) and simulation models need to be considered to arrive to the definition of these variables which ultimately shape the cash and risk profile of these hybrid investment projects.

These two elements set basis for further in-depth analyses and will lead to the identification of alternative revenue generation strategies (funding strategy) and the choice of a family of implementation arrangements. Depending on whether the services provided - not the assets- can be considered public, toll, common resources or private goods different sources of funding would apply; tariffs can be applied to private and toll goods and taxes or transfers would be required to fund public services. Then depending whether taxes, tariffs or transfers are identified as the most important source of revenue as well as whether the public or the private sector will be the main

project sponsor, different types of implementation arrangements will be considered for further development of the full business case.

6.1.5 Typology of implementation arrangements

The different types of implementation arrangements for NbS we have identified are:

- 1) Public procurement route: here still different options are possible, from direct implementation by the public sector, up to concessional PPP's
- 2) Stewardship (Morgan 2018) investments, by a private company.
- 3) Collective investment schemes, such as water funds (Goldman-Benner et al 2012).
- 4) Environmental markets, such as the mitigation market in the USA.

Although the design process will vary for different types of implementation arrangements, in most cases investments will lead to investment projects and/or the delegation of operation and maintenance activities to third parties. Whenever a public or private entity needs to implement the envisioned activities, they will need to decide whether to do that themselves, or to delegate it to another: public, private or community. In that sense, independent of whether the choice is for 1, 3 or 4; the project sponsor will have to make financing and procurement choices and for doing so we have developed a process that guide them in selecting the project delivery and finance mechanism that reduce transaction costs and ensure the right incentives are created for sustained service delivery (Altamirano 2019).

6.2 The way forward towards implementation at scale

Based on the implementation of the FFWS to the NbS strategies developed by three demonstration cases in NAIAD, diverse consultations with the other five demonstration cases as well as a review of pioneering implementation arrangements worldwide; we have three main conclusions.

6.2.1 The missing link: a full business case

For plans and projects to access funding and financing is necessary to prepare a full business case for the entire investment programme and each of the projects that make part of it. Unfortunately, in most cases the proponents of NbS are organisations with an advocacy and/ or scientific background with limited involvement in public and private investment planning processes. As a result, often NbS pilots and demonstration projects are shaped more as awareness raising projects than as "investment projects" that could attract funds from either public authority aiming at

reducing a risk, or private impact investors willing to accept lower returns in exchange for social and environmental impacts.

The criteria and level of detailing regarding implementation costs and risks differ greatly between the project descriptions of NbS proponents and the requirements for allocation of public funding or granting of loans by impact investors. In simple terms, what in the scientific and advocacy world could be considered a project, within investment cycles is considered a project idea. For this project idea to become an investment project that can be assessed for bankability and/or investability, many much more details and evidence needs to be gathered and more clarity needs to be achieved regarding the way NbS proposed will be implemented.

6.2.2 New partnerships and expertise required

In order to ensure a successful implementation of NbS as well as to guarantee stable levels of service over time; it is key to consider not only lifecycle costs and their distribution over time but even more the skills and expertise required to undertake the activities. Based on an identification of key implementation resources held by different actors, activities and risks can be assigned in such a way that the project can be delivered at the lowest costs, the highest quality while minimizing risks. By considering these aspects, the implementing agencies can be guided in their choices of who should take care of which life cycle phases of the project. In other words, this understanding of cost elements and cost drivers can guide the process of allocation of risks, responsibilities and rewards between the key implementing actors that could be either from the public sector, the private sector or the community.

An in-depth analysis of the strengths of Public, Private, People actors' is required to guide this risk allocation decision. Given the differences in implementation arrangements and actors between NbS and grey infrastructure solutions up until recently, to find suitable implementing parties for large scale NbS projects may prove challenging.

Until recently NbS projects have been often undertaken by community volunteers coached by NGO's and/or environmental government authorities; and more often than not these projects have a piloting function and are of limited scale. In these projects often social objectives are equally important as those related to biophysical conditions or risk reduction; which influences significantly the design of NbS measures, the methods for their construction and the emphasis given to monitoring and data collection systems. This means all in all a very different project management style than the one normally applicable to grey infrastructure projects.

Meanwhile the provision and procurement of regular grey infrastructure is a relatively more formalized process where (large) construction companies and public infrastructure agencies are key players. In this sector risk-based asset management along the entire useful life of the asset is

the new norm. Additionally, due to public procurement rules in this sector; risk allocation and the related liabilities carried per implementing party need to be clarified and agreed upon way in advance before project implementation.

6.2.3 Mosaic projects and need for innovative contracting practices

The future is in mosaic project and their implementation requires innovative contracting practices. As concluded during the 2019 Environmental Market and Finance Summit, the future is in “mosaic” projects. *Over and over, asset managers and market service providers told us that they’re designing projects that can responsively serve multiple markets, depending on where the demand is. This allows them to stack funding from multiple sources: carbon offsets, sustainable forestry, water quality credits, recreational use payments, wetland and habitat mitigation, and other revenue streams.*

Additionally, in a recent market sounding research process undertaken by Deltares in Peru, in cooperation with the Natural Infrastructure for Water Security (NIWS) project it was found that hybrid (green-grey) infrastructure projects are seen as more attractive to project developers than green infrastructure projects alone. According in the “methodology proposed a central building block are hybrid infrastructure clusters. These are after organized into hybrid and multipurpose infrastructure projects and formal performance-based contracts that can be funded by different revenue streams; depending on local institutional conditions and context specific preferences and willingness to pay of beneficiaries” (Altamirano 2019, page 5).

However, the contracting of multiple services by different authorities and blending funds of the public and the private sector that benefit from these services requires the development of new public procurement and contracting practices that can deal with this complexity. In first instance this requires the clarification and agreement on a hierarchy of functions and associated levels of services that enable the making of trade-offs during the whole life cycle of green infrastructure: design, construction, operation and maintenance.

6.2.4 The role of the insurance sector

The insurance sector has also crucial role to play given their in-depth expertise in risk management and the extensive knowledge they have of value at risk in different geographies. They could play a catalyser role and drive the implementation of hybrid infrastructure strategies by a) implementing risk-based premium based on models that take into account the resilience dividends of ecosystems, b) requiring minimum resilience standards and consideration of climate and water risks from the projects they finance as institutional investors and c) offering new insurance schemes and products that allow for the monetization of the resilience dividends of

ecosystems. An example of the last is the parametric insurance policy to cover Mexico coral reef developed through a cooperation between the state government of Quintana Roo, the tourism industry, TNC and SwissRe. However, in first instance insurance companies could support the development of transformational investment pipelines by sharing their data on historic losses and damage with municipalities (as is happening in Norway) and their expertise. By leading the discussion and development of catastrophic models that consider the effect of ecosystems in systemic resilience, they could incentivize investors to look at the portfolio in a systemic way.

6.3 Policy recommendations

European research funds aim at the mainstreaming of NbS need to require a different mix of expertise and roles that ensure the applicability of the knowledge and evidence developed and increase their ability to influence public and private investment decisions.

Along with a different mix of expertise in the consortia, it is important that the right type of coaching is given to demonstration cases leaders to ensure they are able to achieve not only benefits in terms of awareness raising but also serve as pilots to demonstrate the investability and bankability of NbS projects.

Finally, a new type of mission-driven research programmes aimed at implementation of NbS at scale to deal with climate and water risks; needs to include additional mechanisms to increase accountability and impact of research efforts. These mechanisms could include the setting up of advisory boards or users board for clusters of projects where key representatives from public procurement authorities, banks, impact investors and companies are represented and have the opportunity to give feedback about the knowledge and evidence being developed from early on in the project.

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Appendix A. Financing Framework for Water Security Intake

Answer the key sub-questions of the five business cases and please indicate the quality of information:

-  high quality of information
-  space for improving Information quality
-  no information at all

NAME OF DEMO :

REPOSNSIBLE :

1. STRATEGIC CASE: Preferred solution alignment with priorities and enabling conditions		Yes/ No	Info. Quality	MODULE
CRITERIA	Self-assessment questions (level of advance in preparing the investment case)			
Clarity of Solution Scope	Solution scope of preferred strategy Is there a clear solution scope for the preferred strategy? are the measures and their typology included in the preferred strategy clear enough to be explained to all stakeholders?			1.1
Paradigm shifting potential	Theory of change Is there a clear theory of change that explains the difference in system dynamics between the BAU situation versus the situation after implementation of the preferred water security strategy?			1.2
Solution impact versus BAU	Are levels of service clearly quantified for BaU and solution?			1.3
	Are these levels of services plotted and characterised over time?			1.4
Strategic fit: alignment with government priorities, strategic drivers, and wider policy context and enabling institutional environment	Enabling conditions Have cultural values, standards, regulations, and policy priorities driving or hindering the implementation of the preferred solution been identified and analysed?			0.1
	Stakes, supporters and opponents Is there a general stakeholder analysis of supporter and opponents?			0.2
	Capacity levels and social capital and goodwill between the public, private and community stakeholders: community: is it clear whether the involvement of private, public, and third sector in the delivery of water security and associated services (e.g., water supply, protection, quality) is perceived as desirable?			0.3
	Role of the insurance sector: Is there a clear role for the insurance sector in (driving) the implementation of the programme/project/water security strategy?			0.4
	Inventory of funding and financing sources: has an inventory of potential public and private sources of funding and/or financing been realised? Have existing financing facilities and financing instruments been identified			0.5
2. ECONOMIC Value of investing in the preferred strategy or preferred option from a societal perspective		YES /NO	INFO. QUALITY	MODULE
CRITERIA	Self-assessment questions			
Benefits versus Costs	Qualitative Social Cost Benefit Analysis Is there a qualitative analysis of the avoided damages, societal benefits and opportunity costs of BAU versus preferred strategy implemented?			2.1

Job creation potential of NbS strategy implemented versus BAU	Quantitative Social Cost Benefit Analysis Is there a quantitative analysis of the avoided damages, societal benefits and opportunity costs of BAU versus preferred strategy implemented?			2.2
	Pain and gains Have the value chains on the watershed, and their dependence on water been analysed? Have specific winners and losers of BAU versus implementation of NbS Strategy been identified?			2.3
3. COMMERCIAL Is the private sector capable AND/OR interested in assuming the activities or services involved in delivering the project?		YES /NO	INFO. QUALITY	MODULE
CRITERIA	Self-assessment questions			
Dependence on regulation of the commercial activity involved in delivering the services	Characterization of the transaction Is there a clear understanding of the transaction at hand? Have the capital-intensive elements of the water security strategy been identified? Have the services to be delivered by the asset created/ enhanced by the investment being classified in terms of type of economic goods (e.g. public, toll or private good)?			3.1
Quality of the procurement strategy	Make-or-Buy Decision Is there a clear understanding of the tasks involved in delivering the water (security) services and who (public sector, private sector or community actors) is best able to assume each of these tasks and associated risks?			3.2
Technical implementation Risks ESG. Risks	Risk profile Is there a characterization of the risks involved in the implementation of measures that make part of the water security strategy, along the entire life cycle? Is there a plan to manage these different risks?			3.3
Private sector interest in implementing and/or investing.	Market sounding Have private and other non-public organisations (e.g. third sector or communities) capable and willing to assume the required activities/tasks and related risks been identified?			3.4
4. FINANCIAL Is the project affordable, fundable, investable, and/or bankable?		YES /NO	INFO. QUALITY	MODULE
CRITERIA	Self-assessment questions			
Affordability of the solution	Lifecycle Costs Analysis (LCCA) qualitative Is there a qualitative analysis of the implementation costs for the water security strategy/measure; e.g. life-cycle costs, Capital Expenses (CAPEX) versus Operative Expenses (OPEX)?			4.1

⁵¹ Environmental, Social and Environmental risks

⁵² This is to a great degree linked to: a) Dependence of the commercial activity on regulation and its enforcement (enabling environment) and b) Revenue generating potential (Financial case)

Effect on local/regional tax base	Lifecycle Costs Analysis (LCCA) quantitative Have implementation costs (CAPEX and OPEX) been quantified according to the characteristics of the preferred strategy or option over time?			4.2
	Revenue-generating potential	Revenue streams (qualitative) Have revenue streams been identified, is there a qualitative analysis of these streams considering a wide range of Taxes, Tariffs and Transfers?		4.3
Funding available and or secured	Revenue streams (qualitative) Have revenues streams been quantified over time?			4.4
	Cash flow profile of the project Has the project cash flow profile been estimated?			4.5
	Financial Viability Gap Have the remaining revenue gap and required of the financial Viability Gap Funding been calculated?			4.6
	Financing Strategy Have high potential funding sources and financing been identified? Has the potential of existing financing facilities and instruments for water security and NbS projects been analysed? Has government funding for the project or concessional funds that can leverage private sector participation been secured?			4.7
5. MANAGEMENT		YES /NO	INFO. QUALITY	MODULE
Are there robust contractual and organisational arrangements to successfully deliver the project?				
CRITERIA	Self-assessment questions			
Capacity of (public) agency to procure successfully the project	Procurement objectives and boundary conditions (Ambitions, concerns and key implementation stakeholders) Have the ambitions and contribution of different stakeholders for the sustainable implementation of the water security strategy/ measures been identified? (yes/no) Project delivery and finance model: contract scope, financial and tendering incentives Has a procurement strategy been chosen/design, including contract(s) scope, payment mechanisms and other procurement incentives for all measures involved in the water security strategy?			5.1
				5.2
Monitoring and evaluation systems considered	Implementation strategy per Nbs/Cluster Have responsibilities for implementing the water security strategy, considering all life-cycle phase per measure been allocated?			5.3
	Implementation arrangement per Nbs/Cluster Have interdependencies between key implementation stakeholders been made explicit? Have formal agreements (e.g., contractual) required between them for the successful delivery and sustainability in service provision been designed/ analysed?			5.4

Appendix B. FFWS Formats and instructions

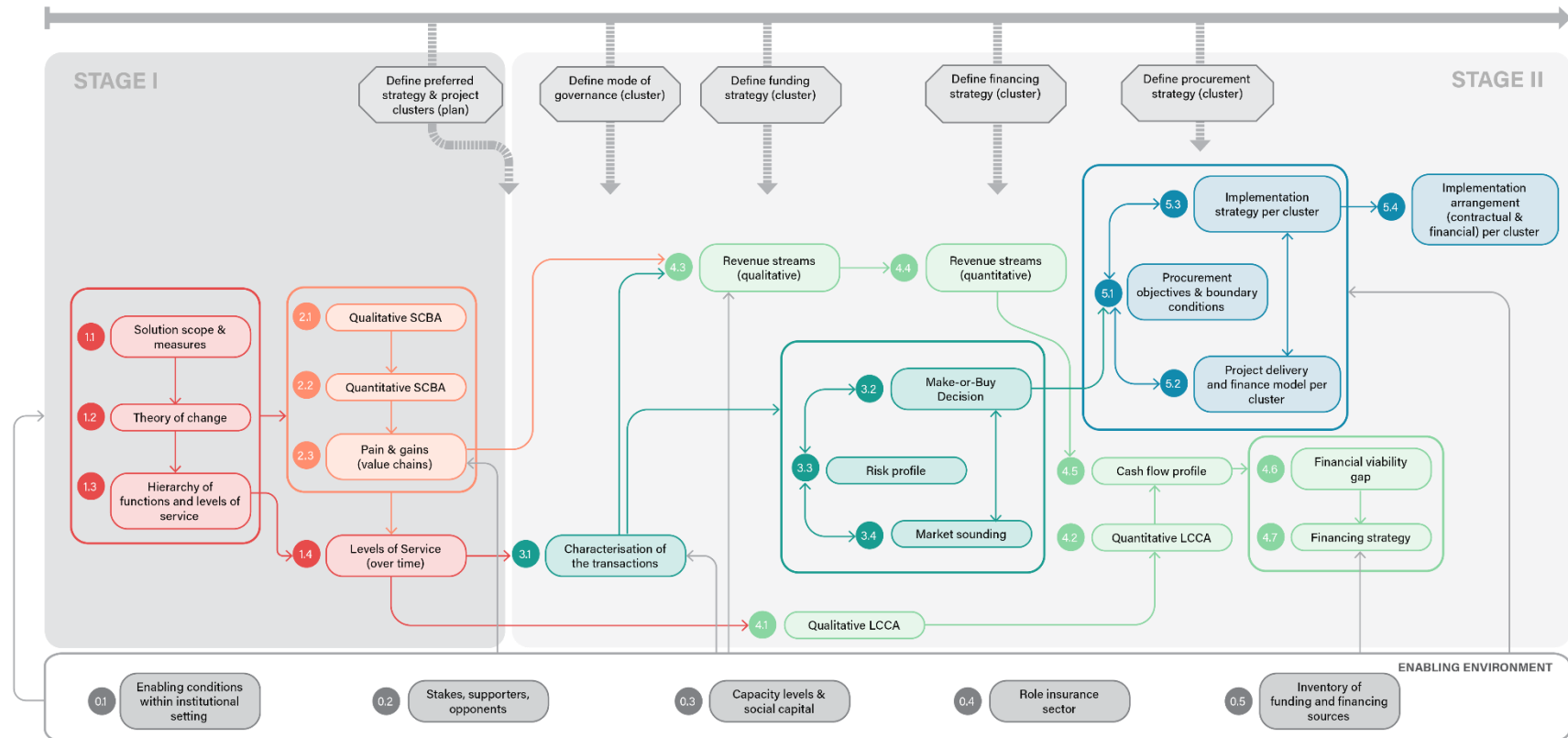
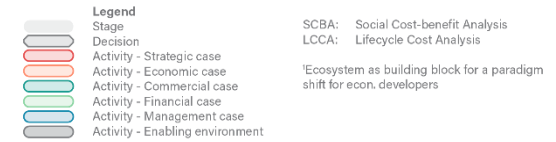
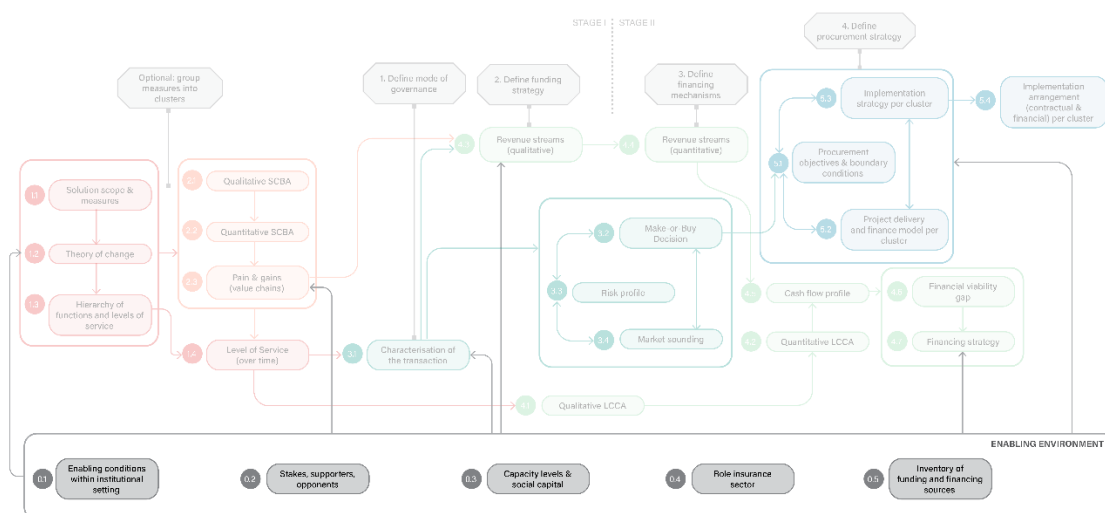


Figure 46. Roadmap that illustrates the entire process covered in this handbook.

B.0 Enabling environment



B.0.1 Enabling conditions within institutional setting

Name the critical project/programme owner and clarify whether they are part of a larger initiative (e.g., river-basin plan, private water stewardship initiative, local government initiative, communitarian initiative, etc.). Additionally, make explicit how the strategy is aligned with social and economic priorities defined by authorities and communities. To introduce the **Table B-1**, make a general statement whether the institutional context favours or imposes important constraints for the implementation of the program/project. (Max. 200 words).

Table B-1. Enabling conditions of the institutional context

Description and narrative: [complete]

INSTITUTIONAL LAYER	INCENTIVES FOR THE IMPLEMENTATION OF NBS	DISINCENTIVES FOR THE IMPLEMENTATION OF NBS IMPLEMENTATION
Layer 1: Social Embeddedness		
Layer 2: Institutional Environment		
Layer 3: Governance		
Layer 4: Individual analysis		

Table B-2. Detailed explanation of the institutional levels for the FFWS

INSTITUTIONAL LAYER:	DESCRIPTION
Layer 1: Social Embeddedness: informal institutions, culture, norms, values, orientations, customs, traditions, religion. Social theory 100 to 1000 years.	Cultural perception of NBS compared to grey infrastructure for water services. Cultural perception of water solutions: is a service you buy? A right you have? Is a collective memory of a flood or drought that back in history, which significant influence on people's perception?
Layer 2: Institutional Environment: formal rules of the game, laws and regulations, constitutions, especially property (polity, judiciary, bureaucracy). Economics of property rights/ positive political theory 10 to 100 years.	Is the delivery of NBS in generally considered task of one or different Ministry (e.g., water, environmental, agriculture)? What are the legal instruments that define these responsibilities? e.g., national legal instruments for implement Directive 2000/60/EC water framework), national legal instruments for compiling with 2014/25/EU. Are decisions made at basing, local, or national level? According to which law, decree, regulation. Are there funding and financing facilities available that support the implementation of NbS and/or water risk management projects?
Layer 3: Governance: Play of the game, especially contracts, agreements, and negotiations. Transaction cost economics 1 to 10 years.	Is the solution embedded in a specific master plan? Which public organisation takes the lead of commissioning tasks in the master plan? Is there authority for the basin, which coordinates actors in the area? Is the coordination of actors assumed by non-public entities? What kind of procurement practices has been used in the past? (e.g., contracts focused on deliver task, a service?).
Layer 4: Individual analysis, resource allocation, and employment (prices and quantities, inflation, income, incentive alignment). Neoclassical economics/ agency theory Frequency: continuous	What are the property rights of the land and water rights in the specific (implementation) area? Are easy or difficult to modify? Is there an NBS market in the area?

B.0.2 Stakes, supporters and opponents

The central outcome of this step is **Table B-3**, which is a coordinate plane, situating stakeholders according to their levels of influence and interest. However, you must fill the inventory tables previously.

Step (a) Fill in all the stakeholders [persons or groups with interest in the problem or solution]. You can freely add more roads to the table if more stakeholders are included in one category; additionally, if necessary, modify the 'others' column to fit any other level].

Table B-3. Inventory of stakeholders.

LEVEL		NAME OF ORGANISATION
NATIONAL	STKH [1]	NAME STAKEHOLDER [1]
	STKH [1]	NAME STAKEHOLDER [2]
REGIONAL		
LOCAL		

Step (b) From the actors detected in the first table indicates further features in the following table. Please note that for the 'Roles and responsibilities' field, you must show the **general responsibilities** that the stakeholders have [not in a relationship with the solution]. Key to symbols: indicate resources in terms of money, authority, networks, expertise, or other. Be aware: at this stage, you are not mainly talking about the problem perception, but the solution perception. We already assume that actors consider the problem and the solution together.

Table B-4. Characterisation of stakeholders.

STAKEHOLDER	SOLUTION PERCEPTION	VALUES [SOCIALLY ACCEPTED BEHAVIOUR]	RESOURCES [SOURCES OF POWER] INDICATE IN TERMS OF MONEY, AUTHORITY, NETWORKS, OR OTHER.	NEEDS	ROLES & RESPONSIBILITIES REGULATORY & ENV. GOVERNANCE MODE
STKH [1]	The solution affects stakeholder in [what way? /because]	Local economic development [...]	Authority: Local authority Money: funded by municipalities budgets and local taxes [...]	Must generate new jobs, enhance the economic growth of the region [...]	Compliance with local regulation [name of regulation]

Step (c) Indicate the influence/power they have in the implementation of the strategy [all measures]. Also indicate whether they consider themselves, as winners and losers and the intensity and resources in which they are [positively/negatively] impacted by the implementation of the strategy (Rank from 0 to 10).

Table B-5. Assessing stakeholders' power and influence.

STAKEHOLDER	INFLUENCE/POWER	POSITIVE IMPACT ON STKH	NEGATIVE IMPACTS ON STKH	SUPPORT OR NOT?	MAGNITUDE OF SUPPORT OR REJECTION	OTHER COMMENTS
STK [1]	▲ Order from more influential to less influential in the project ▼	0-10	-	YES	0-10	-
STAKEHOLDER [2]						

Step (d) Map stakeholders in the map. Indicate whether they are public or private and whether they support to resist the solution. Key to symbols: ▼ Public stakeholder, ▲ Private stakeholder / Winner [magnitude], Loser [...], Neutral.

Table B-6. Stakes, supporters and adversaries.

▼ Public stakeholder, ▲ Private stakeholder / Winner [magnitude], Loser [...], Neutral)					
INFLUENCE / POWER OF STAKEHOLDER ^ ^ (+) < < (-)	[MEET THEIR NEEDS] Keep satisfied		[KEY PLAYERS] Manage closely		
	▼STKH[1] [+++] ▼STKH [2] [- - -]	▼STKH [3] ▼STKH [4] [++]	▲STKH [5]		
	[LEAST IMPORTANT] Monitor		[SHOW CONSIDERATION] Keep informed		
	▲ STKH[6] ▼STKH [7]	▼STKH [2] [- - -]	▲STKH [9] [+]		
0 << (-) INTEREST OF STAKEHOLDERS [on the solution] (+) >>					
#STKH and name	Solution perception	Values (socially accepted behaviour)	Resources	Needs	Roles and responsibilities

B.0.3 Levels of capacity and social capital

In the **Table B-7**, you shall rank different aspects of social, political, and human capital relevant for the project/program/solution (from 1 to 5). Shortly explain the ranking, focusing on the main strengths and main challenges regarding trust, coordination, and good-will for implementing the project (Max. 200 words).

Table B-7. Levels of capacity and goodwill between public, private and community

HERE: THE DESCRIPTION AND NARRATIVE			
Levels of trust between citizens to engage in collective action towards DRR+water security		Levels of technical capacity of the public sector to deliver/regulate DRR+water security services	
Levels of trust of citizens in authority delivering/regulating DRR+water security services		Levels of technical capacity of citizens to engage in collective actions towards DRR+water security	
Levels of trust between the public sector and private companies in the DRR+water security sector		Levels of technical capacity of market parties to deliver DRR+water security services	
Levels of trust between citizens and private companies delivering DRR+water security		Levels of community entrepreneurship in aspects related to DRR+water security	
Levels of good-will and coordination between local, regional and national government in the sector		Levels of governmental capacity to collect taxes/levels of payment	
Levels of coordination between actors within and between sectors (e.g., energy, food, development)		Levels of governmental capacity to enforce rules (e.g., water extraction quotas)	

B.0.4 Role of the insurance sector

Summarize the role of the insurance sector at the national level in the table; you detail if they are taking a role as investors or as an insurance provider. According to the **NAIAD D.8.1 Mapping insurance value in EU Policy frames Study Report**. Accordingly, indicate the insurance regime. In short, there are three insurance regimes in Europe

- Voluntary insurance (Germany, Italy, Slovenia)
- Semi-voluntary (Denmark, Sweden, Poland, the Netherlands, and the UK).
- Mandatory (France, Spain and Romania)

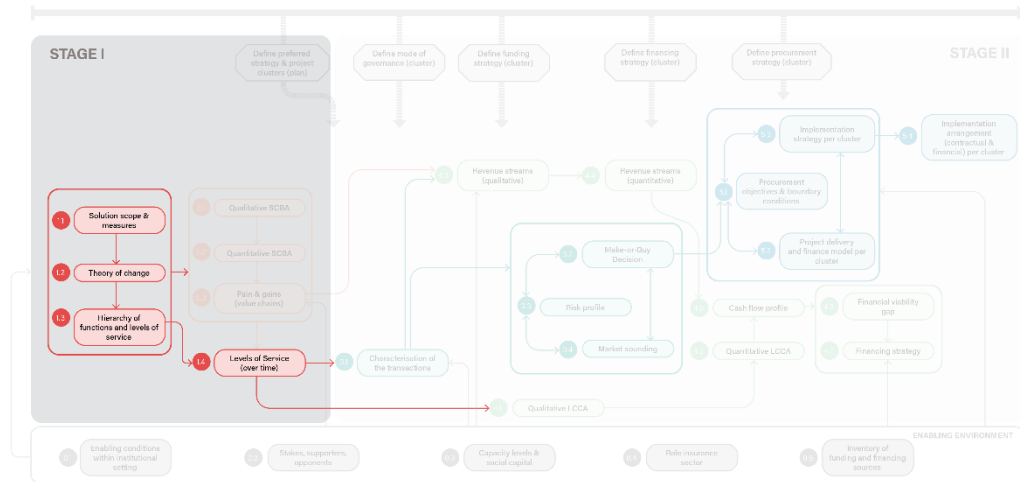
Table B-8. Role of the insurance sector.

Role of insurance sector at a national level: [summarise]

Insurance regime: [complete]

ROLE		YES/ NO	DESCRIPTION AND NAME OF THE INSURANCE COMPANY
As an investor of the NBS	Investing in equity (direct investment)		
	As an institutional investor (providing debt)		
As Institutional investor (infrastructure)	Setting minimum standards in resilience/ climate proofing of assets that incentivize investments in hybrid water security strategies		
As insurance provider	Implementing risk-based premiums: that taking into account the Insurance value or Resilience dividends of ecosystems, incentivize public and private clients to increase systemic resilience and invest in Natural Assurance Systems (a minimum resilience level is required for granting insurance or reducing insurance risk premium to beneficiaries).		
	Insuring Ecosystems (new products): the insurance hedge the risk of a contingent or uncertain loss of the NBS and measure implementation		
	Strategic advisor (new services): advising on Disaster Risk Management and Disaster Risk Finance Strategy - taking into account the resilience dividends of Ecosystems		

B.1 Strategic case



B.1.1 Solution scope and measures

Briefly describe the problem and the Nature-based Solution (NbS) to address that problem (e.g., wetland restoration for Disaster Risk Reduction). Include country(s), geographical area, and watershed name if applicable where the investment project/program will be taking place (km²). Then, refer to the geographical scale of expected benefits and beneficiaries. Describe the stage of the project/programme (master planning, procurement, execution, operation), and define the expected timeframe of implementation. In **Table B-9**, you will further detail the measure, type and subtypes along with the related functions. Also, point out the asset created/regenerated by means of the measure implementation. You can check section 1.4.3 Typology of policy instruments to achieve water security.

Table B-9. Solution scope and measures.

Description and narrative: [complete]

MEASURE	TYPE	SUBTYPE	ASSET CREATED/REGENERATED	RELATED FUNCTIONS

B.1.2 Theory of change

Here we present a short explanation based on the theory of change developed for Medina. We have opted to develop a Theory of Change in the form of a causal loop diagram, making use of system thinking and qualitative system dynamics techniques. For more information on different Group Model Building script you could use to develop similar causal loop diagrams in a participatory manner check the scripts developed by **Hovmand et al. (2011)**⁵³.

Step one. First, get familiar with the basic language of Qualitative System Dynamics based on Causal Loop Diagrams. These diagrams describe the individual relationships between key variables, that must be ordinal, interval or ratio. You cannot use nominal variables, but you can reframe them in a way that is able to change over time. So, you will use blue and red arrows. Blue arrows must have a positive sign, while the red ones a negative sign.

- a) A '+' sign means the same effect so that an increase in one variable leads to an increase in the other, and a decrease in one variable leads to a decrease in the other.
- b) A '-' sign means an opposite effect so that an increase in one variable leads to a decrease in the other variable, and a decrease in one variable leads to an increase in the other.
- c) The '+' and '-' signs are not "good" or "bad." They just reflect the direction of change.
- d) If there is not a clear direction, you can use [?].

Additionally, you must understand the idea of reinforcing and balancing loops. When you create a loop between variables using the named arrows, you either create a cycle where (i) variables interact in a such a way that reinforce each other leading to a snowball effect or (i) variables interact in a way that they balance each other leading to an equilibrium point.

Step two. Create a story of the problem first and how existing policies are insufficient to address the problem. In the case of Medina del Campo, green infrastructure and police interventions might contribute but are not enough to address the depletion of the aquifer as explained in this Handbook (see 4.5 Medina del Campo). Then, the shift of paradigm is developing the transformation of agriculture that increases productivity while reducing water consumption.

Start with a very simple idea of a vicious circle. In this case, the more groundwater, the higher the extraction, reducing the existing levels of groundwater. Notice the use of the blue and red arrows.

53 Hovmand, P., Rouwette, E., Andersen, D., Richardson, G., Calhoun, A., Rux, K., & Hower, T. (2011). Scriptapedia: a handbook of scripts for developing structured group model building sessions. Available here: https://www.researchgate.net/publication/254898602_Scriptapedia_A_Handbook_of_Scripts_for_Developin_g_Structured_Group_Model_Building_Sessions/figures

Blue indicates the change in the same direction, and red change in the opposite direction. You can use dotted arrows to point out a meaning. For example, rain in the area is unpredictable. You can also play with the thickness of arrows to indicate some quantitative appreciations. Here, groundwater extraction is higher than the input coming from rain.

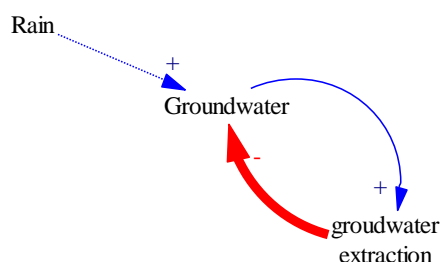


Figure 47. Explanatory figure 1.2a. Representation of a problem for the theory of change.

Step three. Include additional variables reflecting the socio-complexity of the problem. The inclusion of these variables must capture the core of the problem, rather than the details. Always make sure you create a vicious cycle. In this case, we add the tension between the requirement from the Water European Directive to establish an ecological minimum, in conflict with the water need for agriculture. That creates a deficit which increases economic pressure leading to non-sustainable practices of water extraction, increasing, even more, the extraction of groundwater. This is a reinforcing loop which leads to the collapses of the depletion of the water system. Likewise, the economic pressure reduces the incentives for adopting sustainable practices, which still implies water extraction but at lower rate than unsustainable practices. Notice that the blue arrow from non-sustainable practice is thicker than the arrow from sustainable practices.

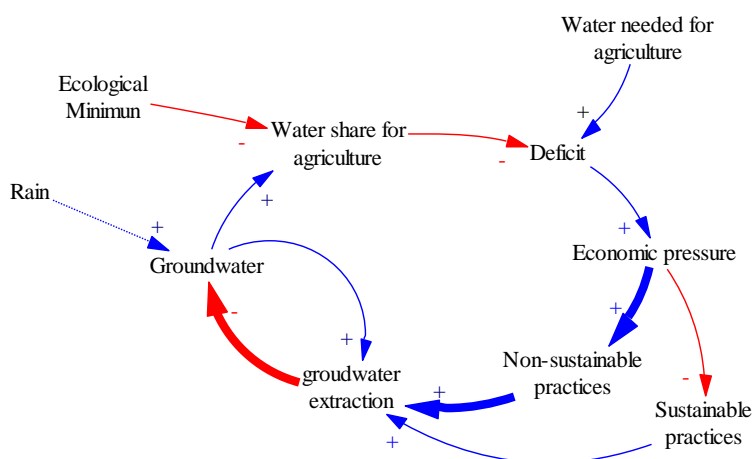


Figure 48. Explanatory figure s1.2b. Representing a problem for the theory of change

Step four. Now include the measures of your strategy and how they aim at addressing the vicious circle. You can explain one by one or all of them together. In the case of Spain, we present one by one with a little explanation.

- Measure 1: Recharge - Directly increases groundwater levels, but in this case, the magnitude might not compensate the rate of extraction (represented by the thick red arrow)
- Measure 2: Controlling extractions is triggered by the lower levels of water, and directly punishes non-sustainable practices and favouring sustainable practices (which might extract water in balanced magnitude than the recharge of the aquifer due to rain and man-made recharge).
- Measure 3: The digital transformation of agricultural practices will reduce the water needed for agriculture, reducing deficit, economic pressure leading to more sustainable water extraction practices. Notice that the black arrow makes explicit that digital transformation depends on the water share available for agriculture considering the ecological minimum. Nevertheless, it is information feedback without a specific symbol.

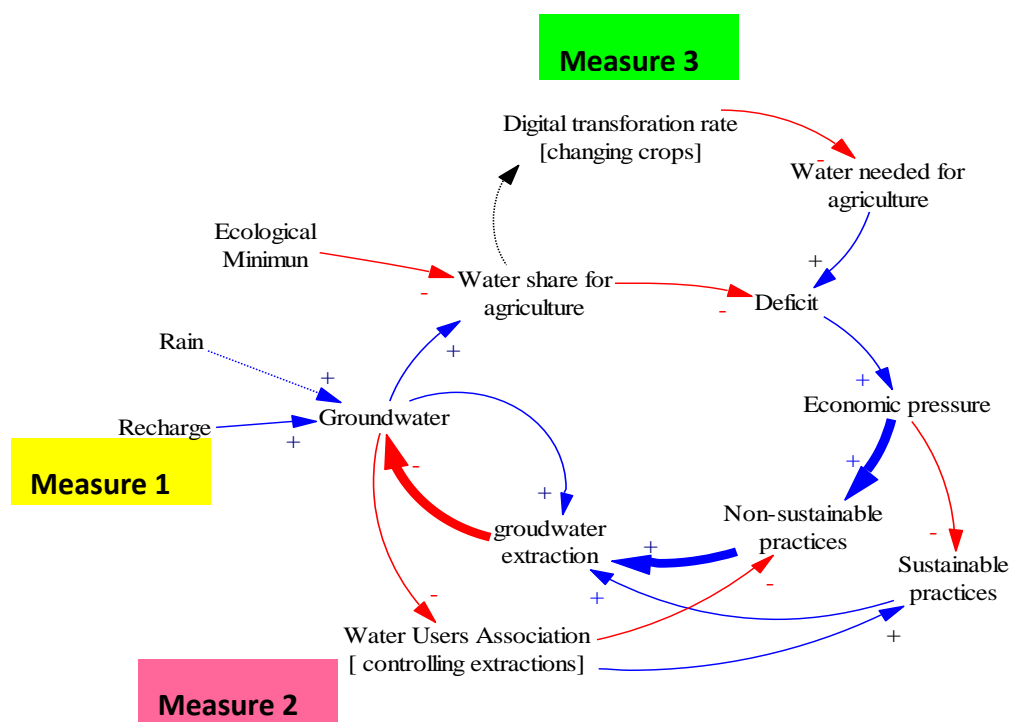


Figure 49. Explanatory figure s1.2c. Representation of a problem for the theory of change

B.1.3 Hierarchy of change and levels of service over time

Describe the process through which implementing measures lead to functions that address the problem over time. A strategy includes several measures, which separately or together deliver functions providing services to economic and social actors of the DEMO. Point out which are the expected services and their ranking in terms of priority. In the **Table B-10** you will organise the service provision from the most to the least important.

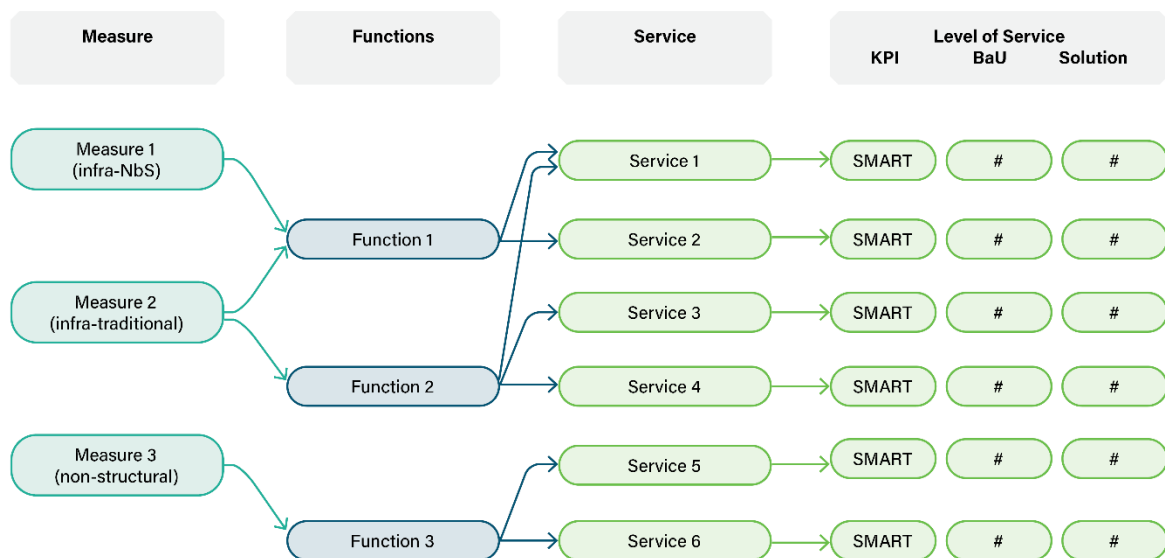


Figure 50. Cascade measure, function and levels of service.

Figure 50 illustrates the hierarchy of functions and services to be delivered by the solution. Consider the overall preferred solution as the system of all measures, which offers functions providing services.

- Step (a) You will focus on the overall top three functions, ranking them in order of relevance. Use your informed opinion on stakeholders to rank these functions. Consider including more tasks if necessary.
- Step (b) Identify backwards the measures that are linked to these top three functions. In the example, Function 1 depends on two measures. It can also be the case that one function depends on one measure.
- Step (c) Identify the services produced by functions. A service can be the result of different functions such as Service 1 in the example.
- Step (d) Per "service" think. What is the current level of service? (e.g., frequency of floods?); and, (2) which improvement is the project meant to achieve? How does the asset/measure

will improve the current level of service? You must define a **quantitative indicator**. Indicators should be SMART⁵⁴. Some examples are:

- Service coverage (including poor households)
- Quality of service (hours of supply a day, share of drinking water samples testing (-) pathogens)
- Operating efficiency (share of non-revenue water, percentage of customers metered)
- Employee productivity (# employees/1000 water connections)
- Step (e) quantify per service the indicator for Business as Usual measure. Meaning, **if no solution implemented**
- Step (f) quantify per service the expected value of the indicator if you implement your solution.

As you already might have noticed, one measure can perform one or more functions. Likewise, a service can depend on several functions which are delivered by different measures. You might report cross-relations in a complex structure.

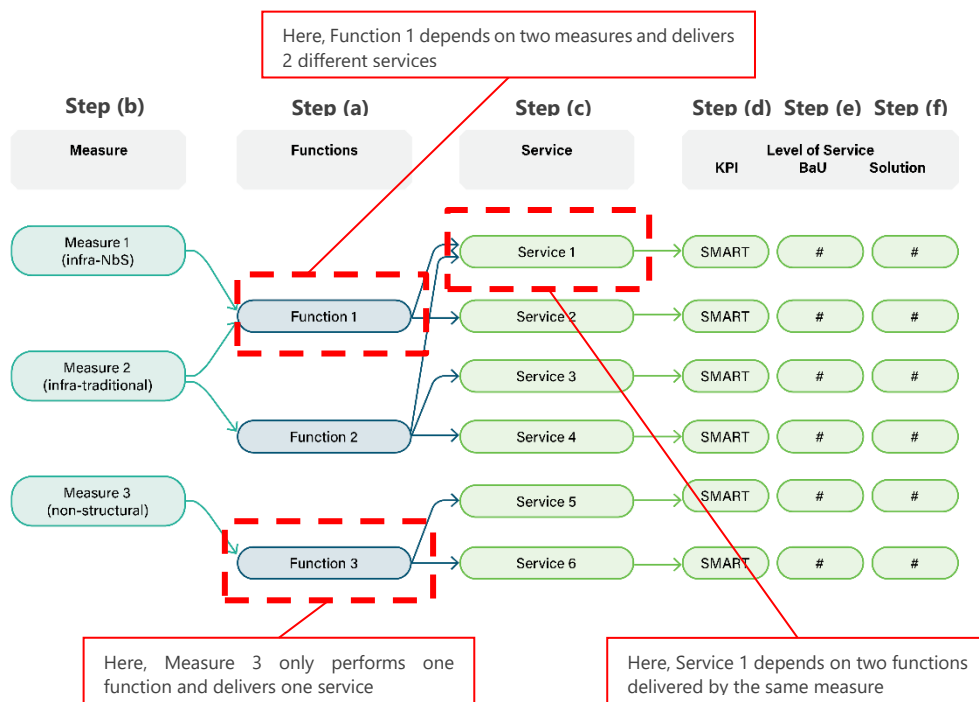


Figure 51. Steps to complete the table for the Cascade measure, function and levels of service.

⁵⁴ For a reference on SMART indicator, consult: https://eca.state.gov/files/bureau/a_good_start_with_smart.pdf

B.1.4 Levels of service (over time)

Now, scratch over time the expected levels of services BaU and measure over time. That will allow you to make clear the theory of change. Draw one graph per three top services. Therefore, you must have three different graphs. Aim at defining years and measures of levels of service. Your graphs should look like the one below.

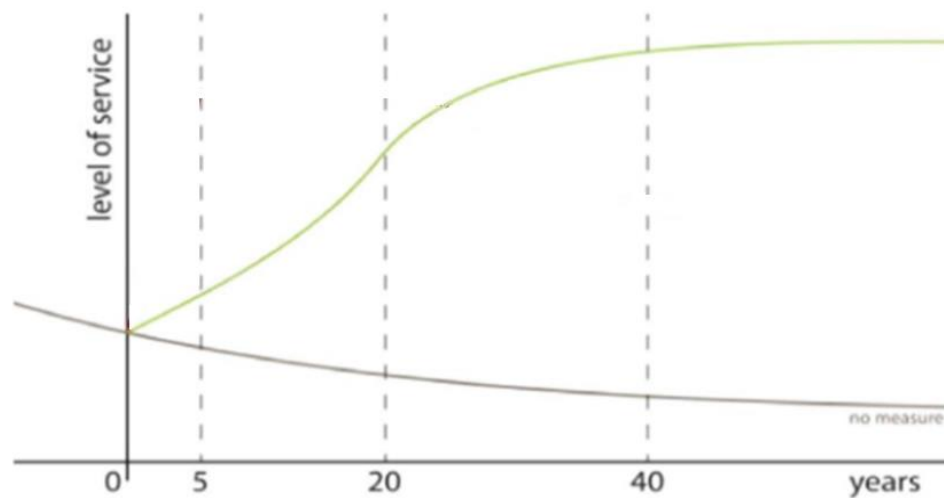
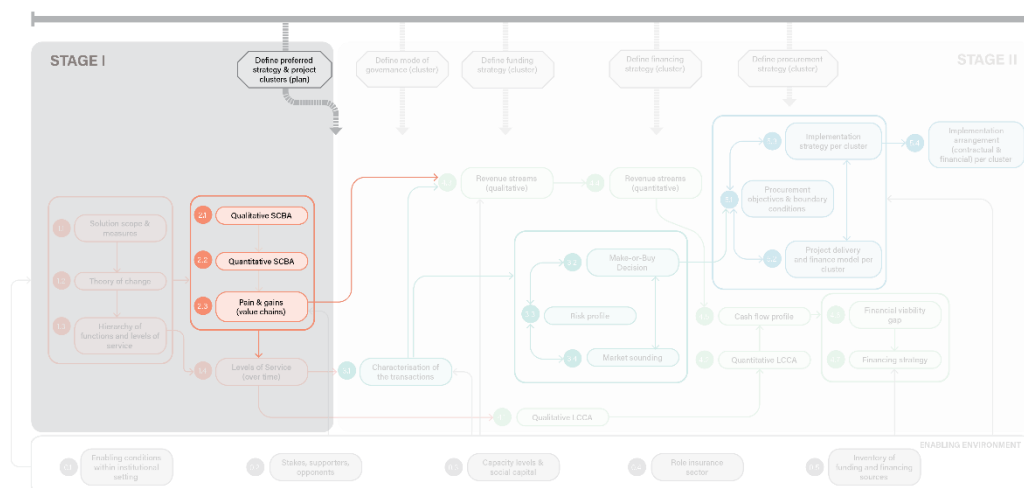


Figure 52. Example of a level of service graph

B.2 Economic case



B.2.1 Qualitative Social Cost-benefit Analysis (SCBA)

For the economic case, you may make use of NAIAD guidelines for economic assessment for NbS for water security, presented in D4.1 General framework for the economic assessment of NbS and their insurance value. Alternatively, you may use generic guidelines to conduct a SCBA.

A SCBA is an evaluation method to assess the impact of policy decisions. It provides an overview of current and future pros and cons of a particular investment or policy project for society as a whole as objectively as possible. For this purpose, effects are denominated in Euros whenever possible and can be aggregated. The analysis then shows whether the project under evaluation leads to a desired increase in social welfare.

This means that SCBA differs fundamentally from a financial analysis (business case), which reveals the costs and benefits for a party. As SCBA assesses the overall public interest, certain financial costs and benefits that are included in a business case disappear as they are offset by benefits respectively costs of another party. A SCBA is based on a broad definition of the term 'welfare'. Besides goods and services, SCBA considers intangible effects and expresses them in monetary terms. These include effects on the environment, landscape, nature and spatial quality. The value of those effects is calculated in monetary terms through specific valuation techniques, as no market prices are readily available.

A SCBA compares the costs and benefits of one or more project alternatives with a so-called baseline or business-as-usual scenario (BAU). The baseline scenario is the most likely development

that will occur when no policy decision is taken. The difference between the project alternative and the baseline is the starting point for SCBA. SCBAs are widely used in public infrastructure investment evaluations and other ex-ante policy evaluations in many EU countries.

Describe the conclusion of the cost-benefit evaluation of the solution. Is it economically worth investing in the solution? Yes or no. Is there a more compelling reason? Follow the NAIAD guidelines to conduct the economic analysis. Do not forget raising awareness on the limits and uncertainties. Indicate which aspects were quantified and which ones were assessed qualitatively (Max. 100 words).

In case there is no reliable quantitative data, you must develop a more extensive narrative of the cost-benefit analysis. Therefore, you must describe implementation cost, opportunity cost, avoided damages, and other benefits (Max. 300 words).

B.2.2 Quantitative Social Cost-benefit Analysis (SCBA)

In the case of no reliable quantitative data, you must develop a more extensive narrative of the **Social Cost-benefit Analysis**. Therefore, you must describe implementation cost, opportunity cost, avoided damages, and other benefits (Max. 300 words).

Table B-10. Social Cost-Benefit Analysis.

BUSINESS AS USUAL (BAU) – 2050					
Environmental values		Productive market values		Damages	
€		€		€	
Solution – 2050					
Environmental values		Productive market values	Implementation cost		Damages
€		€		€	
Cost-benefit analysis – 2050					
Co-benefits	Avoided damage	Implementation cost	Opportunity cost	Benefits-Costs	BPVB 2050
€	€	€	€	€	

B.2.3 Pain and gains (value chains)

Name which sectors are impacted by the BaU and the solution, and in the narrative, focus on the most relevant sector positively and negatively impacted. For those ones, make clear in the narrative how the BaU and the eventual solution transform their socio-economic or other valuable activity. In **Table B-12**, you will list not only the most relevant, but all sectors and actors being positively or negatively affected (pains and gains per actor belonging to these sectors).

Table B-11. Value chains: winners and losers

Description and narrative: [complete]

SECTOR	TARGET GROUP	WINNER/LOOSER	BAU-2050		SOLUTION -2050	
			PAIN	GAIN	PAIN	GAIN
Sector 1 (e.g., Agriculture)	Group 1	Winner	Yes/No	Yes/No	Yes/No	Yes/No
			i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)
	Group 2	Looser	Yes/No	Yes/No	Yes/No	Yes/No
			i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)
Sector 2	Group 3	Neutral	Yes/No	Yes/No	Yes/No	Yes/No
			i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)
	Group 4	Winner	Yes/No	Yes/No	Yes/No	Yes/No
			i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)	i.e. Describe why (Max 15 words)

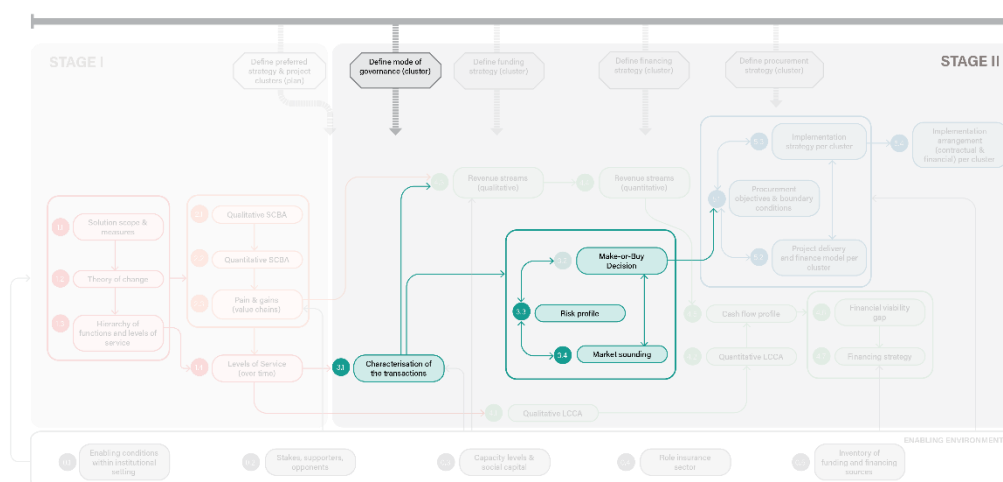
Economic actors organize their internal activity as processes or events that add value to the article, service, or commodity they produce. Accordingly, you will consider who is “experiencing” the pain due to the current low levels of service (and might benefit from the solution). Likewise, you should find those who might experience pain due to the implementation of the solution.

The pain or gain might be related to groups of actors acting as producers or consumers of articles, services, and commodities whose production depends on the quality of water functions and ecosystem services. (Which key economic activities and production processes take place? How dependent are their value chains (e.g., agricultural commodities) from water?).

Therefore, BaU and eventual implementation of the solution can have a positive or negative impact on their processes. For each economic and social sector, identify the extent to which BaU imposes barriers for performing a related economic and social activity, and mainly how it increases costs in the production of articles, services or commodities (pains).

Likewise, define the extent to which BaU enables performing the related economic and social activity; and particularly how to add the value of articles, services, or commodities (gains). Make the same analysis for the case of implementing the preferred solution. In the case of pains, make emphasis on the opportunity cost in terms of losses in adding value to the production of articles, services, and commodities. In the case of gains, make emphasis on the avoided damage and co-benefits generated by the implementation of the NbS strategy.

B.3 Commercial case



B.3.1 Characterisation of the transaction

Here, you will define the common governance form for delivering services and the measures that will be the object of further commercial and financial analysis. First, in your narrative make explicit the nature of the services as economic goods (public, private, common pool or toll), and the dominant transaction governance form (centralized procurement, a network of arrangements, markets or small-scale associations).

Explain why, using arguments of the explanation included in the instructions. Then clarify that only some measures delivering those service, and the specific governance form for water transactions. Notice that in this example, there is no necessary correspondence between the prevailing economic transaction governance and the specific governance water transaction. You must explain why it is so, by bringing into light the reasons for your governance water transaction along with public procurement, private water stewardship, collective investment vehicle and environmental markets. Usually, the reasons rely on the specific institutional context.

Step a. Classify the services in terms of economic following the theory presented in section 3.4.3 **The four type of economic goods** . Bear in mind that we are not taking at this stage on the owner of the asset, but the service. Meaning, you will have to classify every service in terms of how difficult is excluding potential beneficiaries (due to physical or legal barriers) and the levels of subtractability of use (are you depleting the source or reducing existing stocks?). Express levels in terms of high difficulty (++++) and low difficulty (+). Likewise, high subtractability of use

(++++) and low subtractability of use (+). Then, define the prevailing governance form. Only report the indicated columns

Table B-12. Identifying the type of good.

SERVICE REPORT	DIFFICULTY IN EXCLUDING BENEFICIARIES	SUBTRACTABILITY OF USE	TYPE OF GOOD	PREVAILING GOVERNANCE FORM
Service [X]	+	++++	Private good	Market, firms and private alliances
Service [X]	++++	+	Public good	In house or centralized public procurement.
Service [X]	++++	++++	Common-pool	Network of formal and informal arrangements.
Service [X]	+	+	Toll goods	Small-scale association upon membership

Step b. Clarify that only some measures will be the object of further commercial and financial analysis. Bundle the measures according to the institutional analysis. Then discuss the specific governance water transaction form. Now you can complete **Table B-14** Characterization of the transaction

Table B-13. Characterization of the transaction.

Description and narrative: [complete]

SERVICE	TYPE OF GOOD	PREVAILING ECONOMIC TRANSACTION GOVERNANCE	MEASURES	SPECIFIC GOVERNANCE WATER TRANSACTION	WHY?
S1	Public good	In house or centralized public procurement	Name measure 1	Public Procurement	
			Name measure 2		
			Name measure 3	Environmental market	
S2	Common pool	A network of formal and informal arrangements.	Name measure 4	Collective Investment Vehicle	
			Name measure 5	Public procurement	
			Name measure 6		
S3	Private good	Market, firms, private alliances	Name measure 7	Private water stewardship	
	<i>Toll good</i>	<i>Small scale association</i>	<i>Name measure 8</i>	<i>Private water stewardship</i>	

B.3.2 Make-or-Buy decision

Here, briefly summarize the tasks that will be assumed by the government (public-in-house), market or collaborative networks. Remember we are now taking in terms of potential deals only including eligible measures for commercial and financial cases (For now, do not refer to tasks concerning financing). To advance from this point, you must fill an additional table in the detailed instructive (**Table B-15**). This table makes an inventory of the stages and the task-related to selected measures, as well as the expected timeline. You will use the inventory and the codes for referring to the main task associated.

Step a. Inventory of measure stages and tasks

- Consider the categories of a life-project related to landscape restoration. Namely, "planning [PL]," "land acquisition [LA]," "design [DE]," "construction [CO]," "maintenance [MA]" and "operation [OP]". Fill stages name (i)
 - [WARNING] If you are using adaptative planning, you also need to include the stages and activities of the alternative paths. This is very important for calculating the risk-adjusted cost of the investment. If you do so, present the adaptative path as an additional measure with a sub-index. In the description, what is the tipping point that triggers the measure?
- You will need to include all the cost generating activities, and therefore you will define here the aggregation level of the subtask per stage. In the case of NBS, you can refer to the typology, functionalities, and cost generating activities to identify the required skills and technical capabilities for delivering such kind of measures. On the third column (ii), named as 'activities,' indicate the tasks that make up the main lifecycle stages, in the case that it is not possible to disaggregate the stage in smaller tasks, repeat the stage mane for this column and continue filling the requested data.
 - [WARNING] Be wise aggregating/desegregating activities. If you aggregate activities which actual implementation is measured differently, you will create confusion calculating their costs. On the other hand, if your disaggregation is too detailed, you also face clarity problems. For example, you will end up with a long list of activities with marginal impact on your costs.
- For the name and code columns (ii), this classification should be carefully drafted since it will repeat in subsequent formats. Nevertheless, both can be denominated freely and according to what is most efficient. In the code it is ideal to mention to what measure each task belongs to, i.e., 'M2.PL.01' which means task 01 of measure 01 in the planning stage
- For the dependency column (iv), indicate whether the initiation, execution, or termination of a given activity depends on another activity. First, also be the code of the predecessor activity (iv.a). Secondly, give a short explanation of the relationship or how both activities

are related (iv.b). If you need further help to fill in this column, ask yourself, does this activity depend on the realization, execution, completion i.a of another? If yes, which one? Activities can be related to tasks in other measures.

- For the columns indicating time features (v.), point out if the task is on time [momentary/punctual] or continuous through time.
- Consequently, fill the estimated start per task in full years and months. Indicate a duration only if the activity once it starts.
- Finally, describe what each activity entails. In the case of repetitive activities such as maintenance, clarify in the description of the maintenance policy. For example, let's assume different maintenance/monitoring policies for mangroves depending on their maturity. The first four years, monitoring-maintenance should be conducted every four months. Then, the second maintenance/monitoring policy should be carried out every eight months.

Table B-14. Inventory tasks and time features.

STAGES NAMES (I)	TASK CODE (II)	TASK (III)	DEPENDENCY (IV)		(V) TIME FEATURES		C START YEAR	D DURATION		DESCRIPTION/NOTES	
			A TO WHAT ACTIVITY?	B DESCRIBE THE RELATIONSHIP	A ONE TIME	B RECURRENT		MONTH	YEARS MONTHS		
[M1] Measure 01											
Planning [PL]	M1.PL.01	List of requirements	No	-	X		0		0	1	
	M1.PL.02	Preliminary design	M1.PL.01	Is based on the completion of	X		2		1	0	
	M1.PL.03	Task	M1.PL.02	-	X		3		1	0	
	M1.PL.04	Task	No	-	X		4		1	0	
Maintenance [MA]	M1.MA.01	Task	No	-		X	0		0	1	This is activated if tipping point: XXXX
	M1.MA.01	Task	No	-		X	2		1	0	
[M1] Measure 02											
Planning [PL]	M2.PL.01	List of requirements	No	-	X		0		0	1	
	M2.PL.02	Preliminary design	No	-	X		2		1	0	
Construction [CO]	M2.CO.01	Task	M2.PL.02		X		1		0	6	
	M2.CO.02	Task	M2.CO.01	Can only start after M2.CO.01 finishes	X		3				
Maintenance [MA]	M2.MA.01	Task	M2.CO.02	Can only start after M2.CO.01 finishes		X	4		15		
Operation [OP]	M2.OP.01	Task		Requires ongoing M2.MA.01		X	4		15		

Once you have defined the measures that will be analysed as project investment, you will define the commissioner (the direct responsibility for delivering the measure). Additionally, you will define the transaction choice.

Step b. Indicate the selected measures and the commissioner or responsible for delivering the measure. You should have included the commissioner in your list of stakeholders. Additionally, describe their ambitions and concerns.

Step c. Define the transaction choice for each activity, from the perspective of the commissioner (most of the time, it is an authority).

- Per task, define whether a private party might have higher know-how and capital resources (e.g., machinery) to comply with the task in comparison to the commissioner.
- Express levels in terms of higher private capacity over public (++++) and lower private capacity over public (+). Then express whether the authority of public authority is needed to execute the task, including its intervention to re-allocate the costs of executing the task to the actual beneficiaries (e.g., through taxes or regulating tariffs).
- Express levels in terms of high need of public authority (++++) and low need of public authority (+). Finally, assess whether the execution of the task depends on decentralizing collaboration of non-commercial actors nor authorities (e.g., landowners with access to groundwater avoiding depletion). Express levels in terms of high dependence on decentralized collaboration (++++) and low dependence on decentralized collaboration (+).

After analysing, select the choice to deliver the task along with four categories (i) assumed in the house (ii) procured-PPP (iii) assumed by the market (iv) assumed by a network. Follow **Table B-15** below to make your choice.

Table B-15. Defining responsibilities for assuming tasks.

TASK	COMPARATIVE PRIVATE CAPACITY OVER PUBLIC (E.G., KNOW-HOW; RESOURCES; ROOM FOR INNOVATING)	DEPENDENCE ON PUBLIC AUTHORITY (E.G., RE-ALLOCATE COST TO BENEFICIARIES; PROCEDURES; BUILD CONSENT BETWEEN COMPETING STAKEHOLDER INTERESTS)	DEPENDENCE ON DECENTRALISED COLLABORATION (E.G.,	MAKE OR BUY DECISION INCLUDING MAKE-IN-HOUSE/ PROCURE IN MARKET/ ASSUMED BY THE MARKET/ ASSUMED BY A NETWORK
Task X	+	++++	+	Assumed by public sector – implemented directly by in house personnel
Task X	++++	+	+	Delegated to private sector (traditional contract)
Task X	+	+	++++	Delegated by a network/ community

Task X	++++	+++	+	Delegated to private sector (e.g. via PPP contract)
Task X	++++	+	++++	Consider separating the task in two and delegate it to different actors (networks/community/private sector)
Task X	+	++++	++++	Assumed by a network/community
Task X	++++	++++	++++	Consider separating the task in two (networks- procured/PPP?)

Step b. Now you will define the degrees of freedom. Degrees of freedom refers to the space of private autonomy to define the process and characteristics of the outcome commissioned. This step is an initial characterization that you will detail further in the management case, regarding procurement strategy. This classification only applies for “procured-PPP” type of tasks. The analysis does not apply for public-in-house, assumed by market and assumed by network tasks.

- Define a high degree of private managerial freedom (++++) those tasks with low complexity. Remember that low complexity in this context is defined by two aspects. First, a task that is relatively easy to ex-ante define and enforces ex-post. Second, tasks which value capture can be easily defined in advance. These two aspects operate as a precise constraint for optimization.
- Define with a low degree of private managerial freedom (+) those tasks with high complexity. Meaning, it is difficult to define in advance the characteristics of the transaction or enforce the terms of the transaction, as well as there is high uncertainty in the possibility of capturing value.

Finally, you can fill the **Table B-16**. The task to be assumed in house/ procured in PPP/Market/ Network

Table B-16. Tasks to be assumed in house/procured in PPP/Market/ Network

Description and narrative: [complete]

MEASURE	COMMISSION ER	MAIN TASKS ASSOCIATED	PUBLIC-IN-HOUSE/ PROCURE IN MARKET/ ASSUMED BY THE MARKET/ ASSUMED BY A NETWORK	DEGREES OF PRIVATE MANAGERIAL FREEDOM
Name Measure 1	STKH[X]	M1.PL.01	Public-in-house	NA
		M1.PL.02	Assumed by the Market	NA
Name Measure 2	STKH[X]	M2.CO.01	Procured-PPP	++
		M2.MA.02	Procured-PPP	++++
Name Measure 5	STKH[X]	M5.CO.01	Procured-traditional	+
		M5.OP.01	Assumed by a Network	NA

B.3.3 Risk profile

Risk in projects refers to the possibility of failure, which implies that a project might fall short of schedule, budget, or technical performance goals by a significant margin. First, you will fill a detailed **Table B-17**, and then you will summarise in **Table B-18** Characterisation of Risk

Table B-17. Extensive characterization of risk.

RISK DESCRIPTION					PRE-RESPONSE ASSESSMENT			RISK RESPONSE			
Risk Code	Task-related	Category	Cause	Risk Event	Consequence	Probability	Impact		response	Can you purchase insurance for this risk?	description
							Cost?	Delay/service failure?			
RISK-01 [NAME]	M1.CO.01 M1.CO.02	Implementation	<i>Soil conditions assessments are restricted to limited areas in comparison to the project size</i>	<i>The predictions for the soil settlement/treatment does not match the design</i>	<i>Extra costs and time to review or renew soil report</i>	H	H	M	TRANSFER	Yes/no [NAME PRODUCT]	<i>Through an effective procurement strategy, the risk of soil conditions is assumed by the construction party. To achieve this, the party should oversee the design. The potential collaborative structure includes Design-Build, Design-Build- Operate, etc.</i>
RISK-02 [NAME]	M1.PL.01 M1.PL.02	Implementation	<i>The project is located nearby an active agricultural/farming area</i>	<i>The local community is economically affected by the</i>	<i>Lack of community support and potential blockade of the works</i>	L	L	L	REDUCE	Yes/no [NAME PRODUCT]	<i>Early involvement of the community is vital. By engaging leaders and opening communication channels with the community, the concerns</i>



RISK DESCRIPTION				PRE-RESPONSE ASSESSMENT			RISK RESPONSE				
				<i>construction works</i>							<i>will be easily raised and attended, without interfering with the regular progress.</i>
RISK-03 [NAME]	NON-SPECIFIC TASKS	Financing	<i>Financing sources and investment decisions differ in currency, demanding that the financial transaction is in another currency than the domestic currency of the project.</i>	<i>Loans and international financial sources are not enough due to currency devaluation</i>	<i>New financing sources, re-negotiation of initial agreements, and/ or scope reduction.</i>	Unknown			AVOID	Yes/no [NAME PRODUCT]	<i>Assess the possibility of hedging the risk with an external financial service provider. By this means, the external financial actor would maintain the exchange rate at expected levels. Option: include in the cash flow the cost (fee) of this service.</i>
RISK-05 [NAME]	M2.MA.01 M2.MA.02	Performance	<i>Global climate conditions are more extreme every year, which makes challenging to forecast ecological conditions</i>	<i>The biodiversity in the area is not naturally adapted to new climate conditions and therefore, has been reduced</i>	<i>The forecast and expected level of biodiversity in the project is not achieved during the life cycle of the project</i>	M	M	-	ACCEPT [RETAIN]	Yes/no [NAME PRODUCT]	<i>Climate conditions are unpredictable. Consequently, biodiversity may decrease even with the best efforts and preventive measure for it to happen. Consider the possibility of including flexible performance indicators regarding biodiversity in the contract. If not, enough information is found, do not prescribe the condition for the operator.</i>

Step a. For the inventory table, name the risk and then assign a code, and relate to the list of tasks defined previously. The second column includes the category. We use three broad categories (please use these three categories, regardless of the fact that the list provided includes another categorisation).

- **Implementation:** Risks that affect the Planning, Design, and Building phases. They are usually linked to technical conditions (e.g., solid characteristics), but also socio-driven risks such as the stakeholder resistance
- **Financing:** Risk related to the possibility that that financial conditions unfavourable changed for the project. It includes bankruptcy of project partners, inflation, fluctuation of rate interests, price increases, change in bank conditions, i.a
- **Performance:** Risk related to the malfunctioning of the asset, and interruption of the service itself. Usually, they are related to long-term asset performance.

Step b. Describe the risk in terms of cause, event, and consequence. In the inventory table included here, you have different columns to describe the risk. However, in the final report, you will need to make a short summary, linking the three aspects.

Step c. Establish the qualitative tolerance thresholds that will be used as a reference when drafting a risk management strategy. Blue cells are fixed, contents of white fields serve only as an example of the type of information that the table should be filled with. First establish the units with which you will measure, probability, over-spending, and delay, this should apply at the strategy level. Beware that there are only three levels of impact, low [L], medium [M], and high [H], it is recommended but not compulsory to define the values in a distributed way. Also beware that for both probability and over-spending, the values in the upper bound of the LOW level of impact should coincide with the lower bound of the MEDIUM level, this also applies to the HIGH level of impact. According to our example, for instance, a low level of probability will be from 0 to 33%, while a medium level of probability will run from 33% to 66%; finally, a high level of probability would be any from 66% to 100% probability of occurrence. In the delay row: a delay from 0 to 6 months is classified as a low importance delay, a medium importance delay would be a lag of 6 months to 1 year of duration, finally if the delay lasts between 1 year, and up to 1 year and a half, the delay would be critical and of high importance.

	UNITS		L [LOW]		M [MEDIUM]		H [HIGH]			
	BOUND		LOWER	UPPER	LOWER	UPPER	LOWER	UPPER		
PROBABILITY	%		0	33	66	100				
OVER-SPENDING	million		0	2	4	6				
DELAY	Year	Month	0	0	0	6	1	0	1	6

Step c. Finally, choose one of the following responses: accept, avoid, transfer, reduce. To pick an adequate response, consider the guidelines below. Additionally, describe the response to the risk.

- **Accept/retain:** While you have identified the risk, you take no immediate action. You acknowledge there is a risk and that if it presents itself, you will deal with it in the future. It is suitable for low impact – low probability risk
- **Avoid:** Prevent a risk from happening, decide based on how much time or budget this reaction entails. It assumes that your organisation has the capabilities to avoid the risk. Else, you must transfer and carefully define the selecting procedure. It is suitable for high impact – high probability risk.
- **Transfer:** Pay someone else to bear with the risk for you; this can be both in terms of insurance or through the procurement of certain activities [outsourcing]. It assumes that other organisations are in a better position to assume the risk. Else, you might need to avoid or mitigate in house. It is suitable for high impact – high probability risk.
- **Reduce:** If you cannot avoid the risk, you can take some action that will reduce the damage to your strategy. If you have capabilities, you better reduce/mitigate in house. Otherwise, you must consider transferring. It is suitable for low impact – low probability risk.

Step d. Filling the risk characterization is an iterative activity linked to the allocation of risk and market sounding assessment. Therefore, you must revisit the inventory table and these steps in the light of c.3.2 and c3.4 activities. Once you finish this iterative process, you can summarize risk characterization in **Table B-19**. In the narrative point out the top three most relevant risks and how that might affect the successful implementation of the strategy. Then, shortly describe the response. Finally, point out that the table below includes all the relevant risks identified and the responses from the perspective of the commissioner.

Table B-18. Characterization of risk.

Description and narrative: [complete]

RISK CODE [NAME]	CATEGOR Y	RISK DESCRIPTION CAUSE – RISK EVENT – CONSEQUENCES	PROBABILI TY	ASSESSMENT		RISK RESPO NSE	CAN YOU PURCHASE INSURANCE FOR THIS RISK?
				COST	IMPACT DELAY/ SERVICE FAILURE		

B.3.4 Market sounding

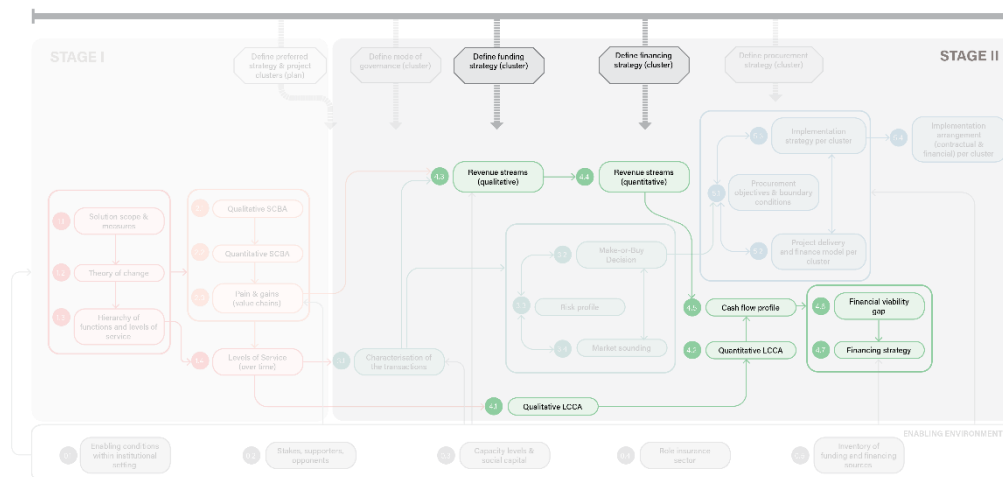
Now, focus on the tasks and risk that can be transfer to the market or procured. In the **Table B-19** market appetite, list the name of private organisations in the area that might be interested in taking these responsibilities. In the narrative, make a statement on the local market capacity to assume these risks, and the gaps of market capacity perceived for assuming a specific task and related risks. Additionally, make a statement of the extent to which organisations have shown their interest. In this respect, clarify whether the organisations perceive tasks as profitable or not.

Table B-19. Market appetite for tasks to be commissioned.

Description and narrative: [complete]

TASK TO BE ASSUMED	RELATED RISKS	NAME OF THE COMPANY	SIZE / LOCAL, NATIONAL, MULTINATIONAL	PREVIOUS EXPERIENCE?	CLEAR INTEREST IN THE TASKS/RISK?
Task X	Risk X Risk X	X	1.000 National	Yes (Name project)	yes

B.4 Financial case



B.4.1 Qualitative Lifecycle Costs Analysis (LCCA)

This section’s goal is to describe the main characteristics of the solution lifecycle, making manifest which variables are context-specific. In the case of NbS, you can refer to Table “cost of infrastructures: elements of a method for their estimation.” First, you will advance a qualitative assessment, which a rough estimation of CAPEX and OPEX. Then, you are asked to provide more quantitative details.

Lifecycle costs (LCC) are also named Total Cost of Ownership (TCO), which considers “total cost of acquisition, use/administration, maintenance and disposal of a given item/service” (Ellram, 2002, p.1). For more information about LLC, refer to **Appendix A: LLC Guidelines for NAIAD demo sites of the WP4.2 “Cost of infrastructures: elements of a method for their estimation.”** Concerning **NAIAD task 4.1**, the LCC methodology corresponds to the calculation of ‘implementation costs.’ Correct identification of LCC provides the information needed to keep systems functioning permanently. Creating a temporal distribution of expenditures will generate the ‘cash profile’ of an asset. The cash profile can subsequently be linked to forms of income, e.g., tariffs or debt, to ensure the asset owner remains able to make payments and that infrastructure remains operational. First, you will make a rough qualitative analysis of the lifecycle cost.

Step a. Use the stages, task, and codes defined in inventory **Table B-15** tasks and time features. Then classify these activities as Capital expenses (CAPEX) or Operation expenses (OPEX).

- CAPEX includes typical front-end investments for delivering assets (planning, design, and construction), and expenditures on direct and indirect supporting activities during planning, design, and construction phases. Expenditure on direct support includes activities directed to local-level stakeholders, users, or user groups.
- OPEX include operating and minor maintenance expenditure as well as asset renewal, replacement, and rehabilitation as significant maintenance activities. It also includes direct activities that spread out during the maintenance and operation phases.
- [WARNING] Be careful with including indirect activities, that might inflate the cost of the investment while they are not directly related to the asset. For example, an indirect activity might be the need for new regulations or standards. That cost will be assumed by the regular bureaucratic expenses, so including this cost will distort your financial case. Likewise, do not include activities referring to financing nor cost of capital. We will go into detail in further steps of the Financial case.

Step b. Now, you will define the Unit of the CAPEX and OPEX and the order of magnitude. Remember, CAPEX is always one-shot expenditures, and therefore, their unit of measure does not include time. For example, the capital expenses for reforestation are measured in €/ha, while CAPEX of riverbank protection is measured in €/bank meter. On the contrary, the measures of OPEX include a time dimension as they are recurrent expenses. The OPEX for reforestation is calculated in terms of €/ha/year. Meaning, the amount of money to maintain and operate a hectare per year. Likewise, OPEX for bank protection is measured in €/meter/year. Meaning, the amount of money to main and operate a bank meter per year. **Table 4 - CAPEX and OPEX figures of Nbs of the WP4.2** provides a guide of measures for CAPEX and OPEX.

Step c. Now, you will define the Unit of the CAPEX and OPEX. Remember, CAPEX is always one-shot expenditures, and therefore, their unit of measure does not include time. For example, the capital expenses for reforestation are measured in €/ha, while CAPEX of riverbank protection is measured in €/bank meter. On the contrary, the measures of OPEX include a time dimension as they are recurrent expenses. The OPEX for reforestation is calculated in terms of €/ha/year. Meaning, the amount of money to maintain and operate a hectare per year. Likewise, OPEX for bank protection is measured in €/meter/year. Meaning, the amount of money to main and operate a bank meter per year. **Table 4 - CAPEX and OPEX figures of NBS of the WP4.2** provides a guide of measures for CAPEX and OPEX.

Step d. Now, you will roughly define the magnitude of expenses typically expressed in powers of ten in €. Remember that CAPEX is one shoot expenditure while OPEX is recurrent over time.

1	one
10	ten
100	hundred
1,000	thousand
10,000	ten-thousand
100,000	hundred-thousand
1,000,000	million
10,000,000	ten-million
100,000,000	hundred-million
1,000,000,000	BILLION

Step e. Finally, define the CAPEX/OPEX ratio. Remember that a ratio is a quantitative relation between two amounts showing the number of times one value contains or is contained within the other. For example, the CAPEX/OPEX ratio for re-afforestation is expected to be over 10/1. Meaning that the CAPEX is ten times higher than OPEX. **Table 3 of the WP4.2** provides some insights into CAPEX/OPEX ratios. At this point, you shall fill the **Table B-20** Qualitative Lifecycle Cost Analysis.

Table B-20. Qualitative Lifecycle Cost Analysis.

Description and narrative: [complete]

MEASURE	STAGES	TASK	CAPEX / OPEX	UNITS	ORDER OF MAGNITUDE LIFECYCLE €	CAPEX:OPEX RATIO	
		CODE	NAME				
Measure 1	PL	M1.PL.01	Task	CAPEX	€/measure	Thousands	10:1
	CO	M1.CO.01	Task	CAPEX	€/ha	Millions	
		M1.CO.02	Task	CAPEX	€/ha	Hundred-thousands	
	MA	M1.MA.01	Task	OPEX	€/ha/yr.	Ten – thousands	
Measure 1	PL	M2.PL.01	Task	CAPEX	€/measure	Thousands	3:1
	CO	M2.CO.01	Task	CAPEX	€/mts	Millions	
	MA	M1.MA.01	Task	OPEX	€/mts/yr.	Hundred-thousands	

B.4.2 Quantitative Lifecycle Cost Analysis (LCCA)

Now, you will advance in quantitative estimation of lifecycle costs. The narrative should indicate the source of your estimations. Since the information required to fill this section is very specialized and extensive and because the definition of lifecycle costs is iterative, we advise answering the fields aiming to fill in as much as possible [according to the available info].

Step a. Fill the **Table B-21** following the **LLC Guidelines for NAIAD demo sites of the Appendix A of the WP4.2 “Cost of infrastructures: elements of a method for their estimation”**. Remember, that we simplify the LLC categories in only two (CAPEX and OPEX), according to step 1 in the qualitative lifecycle cost assessment. Additionally, notice that we do not include the cost of capital.

Table B-21. Extensive characterization of lifecycle cost.

MEASURE	STAGES	CODE	DESCRIPTION, COST REFERENCE, AND FURTHER COMMENTS	CAPEX/ OPEX	UNIT PRICE [€ EX-TAXES]	QUANTITY IN DEMO	UNITS PER YEAR	NUMBER UNITS FOR 30* YEARS	COST FOR A 30 YEARS PERIOD
Measure 01	PL	M1.PL.01	Description and costs references	CAPEX	€				€
	CO	M1.CO.01	Description and costs references	CAPEX	€				€
		M1.CO.02	Description and costs references	CAPEX	€				€
		M1.MA.01	Description and costs references	OPEX	€				€
Total cost for MEASURE 03									€
Measure 02			Description and costs references		€				€
Total cost for MEASURE 03									€
Measure 05			Description and costs references		€				€
Total cost for MEASURE 03									€
TOTAL COSTS									€

Step b. For reporting purposes, it is advisable to present the **Table B-22**.

Table B-22. Qualitative Lifecycle Cost Analysis.

Description and narrative: [complete]

MEASURE	STAGES	CODE	CAPEX / OPEX	UNIT PRICE	QUANTITY IN DEMO	UNITS PER YEAR	NUMBER UNITS FOR 30 YEARS	COST FOR A 30-YEAR PERIOD
Measure 1	PL	M1.PL.01	CAPEX	€				€
	CO	M1.CO.01	CAPEX	€				€
		M1.CO.02	CAPEX	€				€
	MA	M1.MA.01	OPEX	€				€
Total measure 1								€
Measure 2				€				€
				€				€
				€				€
Total measure 1								€
TOTAL COST								€

B.4.3 Revenue streams (qualitative)

The focus shifts towards the capacity of the measure to generate revenue. In comparison to the previous table, in which the costs are segmented according to the provided services. To define the revenue streams, you must characterize the potential beneficiaries that are willing to pay for services delivered.

Step a. First, bear in mind that this analysis is based on previous steps carried out for the strategy and commercial case. You have to bring back to the analysis the hierarchy of services, including the expected levels of service defined, and the characterization of services as economic goods.

Step b. You must specify the level of service they expect to achieve and the eventual mechanisms for funding the expected level of service. Consider Taxes, Tariffs and Transfers. Taxes are typically used for public goods. Tariffs with variable rate are typically used for the provision of private goods. What you consume you pay. These tariffs are also used for common-pool resources when it is possible to measure the extraction of the resource. In this case, tariffs also operate as a regulatory mechanism for avoiding overexploitation. In other occasions, flat tariffs apply to common-pool resources, when it is challenging to measure consumption levels. Toll goods usually operate with flat tariffs too. However, once you pay the flat rate tariff, you access to the good irrespectively of service levels. Transfers are a kind of funding source. They apply upon the

existence of funds available, supported by external actors (e.g., Official Development Aid from global north supporting development in the global south).

Step c. Make sure the characterization is aligned to your previous institutional, economic and stakeholder analysis. Then fill the **Table B-23** Revenues streams (qualitative).

Table B-23. Revenue streams (qualitative).

SERVICE	TYPE OF GOOD	RESPONSIBLE	TARGET GROUP	LEVELS OF SERVICE			REVENUE MECHANISM
				KPI	BAU	TARGET	
Service 1	Public			SMART	#	#	Tax
Service 2	Common pool			SMART	#	#	Tariff
				SMART	#	#	Tariff
Service 3	Public			SMART	#	#	Tax
				SMART	#	#	Tax
							Transfer

B.4.4 Revenue streams (quantitative)

Now the focus should be shifted towards the capacity of the measure to generate revenue. In comparison to the previous table, in which the costs are segmented according to the provided services, in the following table, the revenues will be determined by the level of expected supply in the future.

Step a. First, you must mention the service, target beneficiaries, and the target level of service.

Step b. Then, name the source of funding, clarify if is secured source, an available source (which requires to be activated) or a completely new source (e.g., is it needed a new tariff to cover the investment?). Then, define when the revenue is activated. For example, revenues from tariffs usually are available once the service is delivered. Then, define the amount of revenue expected from that source (along the entire lifecycle).

Step c. The last stage is relevant for defining cash flows. First, define the probability (according to your judgment) to collect the named revenue. Then, define the yearly estimated income from the time the revenue is available. Additionally, define the year when the revenue stream will be available, and the end of the revenue stream. Remember that we are using years concerning the beginning of the project, and we are not using the calendar year. Now fill **Table B-24** Revenue streams (quantitative).

Table B-24. Revenue streams (quantitative).

SERVICES	LEVEL OF SERVICE AFTER IMPLEMENTATION		FUNDING AND CASHFLOW FEATURES							
	TARGET GROUP [PAYERS]	TARGET LEVEL OF SERVICE [KPI SMART]	SOURCE OF FUNDING	SECURED, AVAILABLE OR NEW?	PAYMENT TRIGGER?	TOTAL AMOUNT	PROBABILITY	YEARLY INCOME	BEGINNING OF INCOME	END OF INCOME
Service 1	Group 1	SMART	Tariff [Name]	Secured	End construction	€	%	€	2	30
Service 2	Group 2	SMART	Tax [specific]	Available	Capacity of payment reached	€	%	€	3	30
Service 2	Group 3	SMART	Tariff [Name]	New	Start of the provision of service	€	%	€	2	50
Total project revenues						€		€		

B.4.5 Financial viability gap

Retrieve the information from previous formats (**B.4.2** and **B.4.4**) and calculate the remaining funding gap.

Table B-25. Remaining revenue gap

TOTAL PROJECT COSTS		TOTAL PROJECT REVENUES		REMAINING FUNDING GAP	
Order of Magnitude	Amount	Order of Magnitude	Amount	Order of Magnitude	Amount
millions	\$	millions	\$	millions	\$

B.4.6 Cash flow profile


Beware that this process will result in a cash flow that is value for the whole strategy [not per measure], prepare the information already gathered from previous formats in terms of planning [stages, tasks, and timing] and regarding costs.

Step a. In the general cashflow graph, define the units to plot each one of the input axes. The horizontal axis expresses the 'duration' of the whole strategy, indicate the number of years or months that the project will span on [define this with the same units you used for the definition of the lifecycle tasks], this will give us an overview from the start of the capital expenses and up

to the end of the revenue streams. For the vertical axis, introduce the 'money' quantities, follow the same logic. Beware of expressing them in the same proportional aggregates for both costs or revenues [same leaps with the same magnitude – 10, 20, 30 million for both]. Note that the red horizontal line expresses the limit from costs and revenues [in numerical terms, it refers to '0'-zero]. Also, consider that the numbering for costs and revenues are independent, this means that for the costs, the numbering should start from the red line [0] downwards while for the revenues the logic will be reversed; therefore, the numbering starts be from the red line [0] and goes upwards.

[example]

Direction of numbering



<i>money</i>	▲	20														
	▲	10														
	▼	10														
		20														
	<i>Time></i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Step b. It is now time to visualize the task burden per time-unit distribution, for this goal, fill the following inventory table, beware that this will is not part of the reporting and it is just support material to understand the cost distribution over time.

First, indicate the stages [1] and tasks [2] [already processed in the LLC format] in the two first columns, on the third, indicate the total cost [3] per activity, it is advisable to express all the tasks costs in the same units [e.g., all in millions]. Colour in grey the total duration per activity [4], consequently, divide the total cost per task between the number of time-units in each task's duration [5] [e.g. 50 million of total cost, divided between 2-time units results in 25 million per time unit] write the distributed cost per time unit in each cell. Finally, sum the total costs per time unit in each column in the bottom part of the table [6]. Remember to add a negative sign for the cost values after the calculation [7]. In the excel, Add as much as columns as years of your project

Table B-26. Inventory total costs per task.

Stages	Task name	Budget [total cost]	Money unit	Stages		Budget	Money	Time units						
				Task name	[total Time cost]	unit	1	2	3	4	5			
				1	2	3	4	5						
Stage 1	Task 1	50	millions	50	1									
	Task 2	100	millions		Task 2	100	millions	50	50					
	Task 3	10	millions		Task 3	5	millions	5	5					
	Task 4	20	millions		Task 4	10	millions	10						
Stage 2	Task 5	30	millions		Task 5	20	millions	10	10					
	Task 6	50	millions		Task 6	30	millions	50						
[STRATEGY LEVEL] Costs per time unit				0	Task	50	millions							50
TOTAL COST				210 MILLION										

Step c. To plot the income for the whole strategy, you conduct a similar process to step 02 for the costs. The difference lays in the fact that instead of distributing the cost per tasks in time, you will distribute the contribution per funding source in time. Follow the same logic to colour and distribute and sum the revenues. In the excel, add as much as columns as years of your project.

Table B-27. Inventory total income per source.

Funding source name	Total contribution	Money unit	Start of income		End of income		Duration [Y]	Time units								
			Y	M	Y	M		1	2	3	4	5	6	7	8	9
Fund 1	90	millions	5	0	8	0	3					30	30	30		
Fund 2	20	millions	6	0	8	0	2						10	10		
Source 3	80	millions	6	0	1	0	4						20	20	20	20
Source 4	30	millions	6	0	7	0	1						30			
Source 5	10	millions	7	0	9	0	2							5	5	
Fund 3	10	millions	5	0	6	0	1					10				
[STRATEGY LEVEL] REVENUE PER TIME UNIT								0	0	0	0	40	90	55	25	20
TOTAL INCOME								230 MILLION								

Step d. After the distributed costs and income are calculated, express them in the general cash-flow graph mentioned in step 01. Fill the upper row with the revenue values [income per unit time [7] and similarly with the cost [c/t] [6] in the bottom, make sure that these values were obtained from the inventory tables in step 02 and 03. Remember to add a negative sign to the c/t values and leave a positive sign to the income ones.

Additionally, in order to colour the columns to express the magnitude per time values, since this is a rough visualization, if the value does not correspond with the aggregates expressed in the vertical axis, round the value upwards for costs and downward for revenue [to account for the worst-case scenario], e.g., if vertical axis has leaps of 10 million, and if the c/t is 55mil, round up to 60, therefore colour the corresponding the six bottom cells for that time-unit.

Table B-28. Example cash-flow: revenue vs. costs over time.

Revenue	0	0	0	0	40	90	55	25	20	-	-	-	-
100													
90													
80													
70													
60													
50													
40													
30													
20													

10													
10													
20													
30													
40													
50													
60													
70													
80													
90													
100													
Time>	1	2	3	4	5	6	7	8	9	10	11	12	13
costs	0	- 55	-75	-20	-60	0	0	0	0	-	-	-	-

Step e. For the calculation of the rows named cumulative revenues and cumulative costs [do each one separately], start by copying the value for the first-time unit [for both cost and revenue] in the first column. Continue with the second column by summing the value of the first- and second-time units and continue with this logic adding the current time-unit value to the cumulative value in the previous cell. The following table explains the logic.

Table B-29. Costs cumulative value calculation [example].

Costs value [from step 02]	0	- 55	-75	-20	-60
Time units	1 [Y1]	2 [Y2]	3 [Y3]	4 [Y4]	5 [Y5]
Cumulative value	0 [CV ₁]	0-55= -55 [CV ₂]	-55-75= -130 [CV ₃]	-130-20= -150 [CV ₄]	-150 - 60= -210 [CV ₅]

CV₁= **CV₂=Y₁+Y₂** **CV₃=CV₂+Y** **CV₄=CV₃+Y** **CV₅=CV₄+Y**

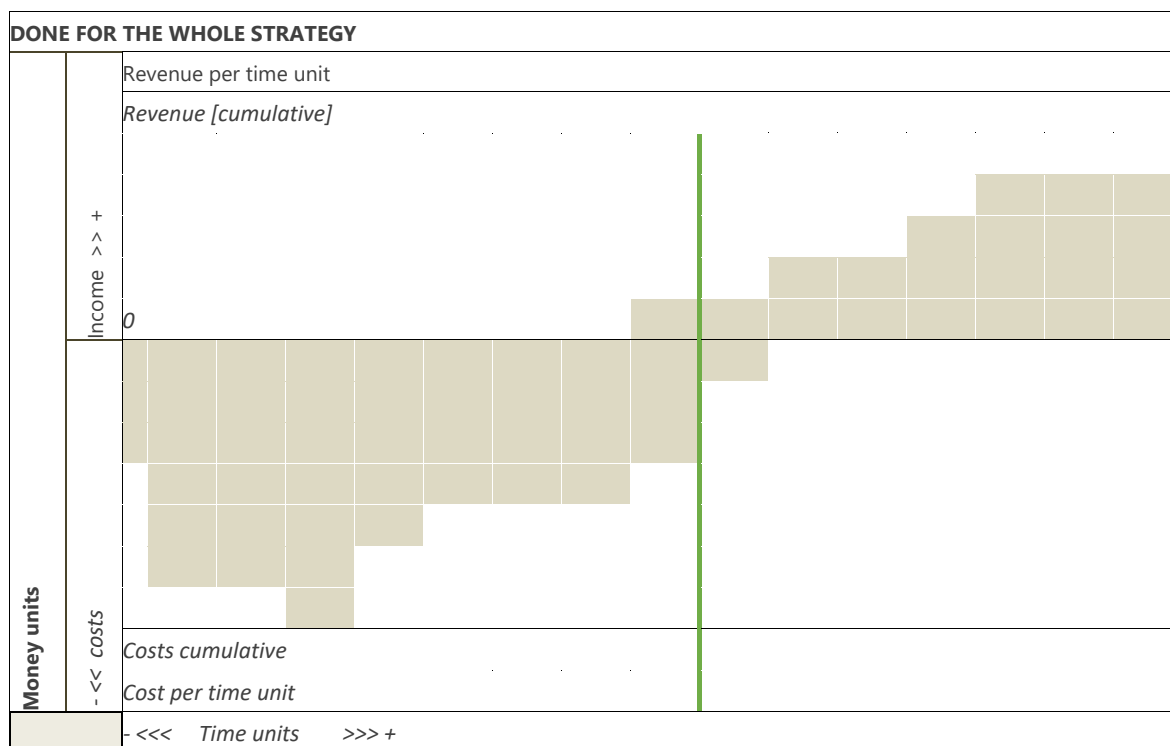
Step f. Once the cumulative values of cost [CV_C] and revenue [CV_R] have been calculated, proceed to determine the total cumulative sum —for the whole strategy [in the bottom of the cash flow graph]. To do this, add the cumulative cost value to and the cumulative revenue value, continue to do this until the last time-unit of the strategy. Highlight in red the negative values.

Table B-30. Total cumulative sum.

Time unit	1	2	3	4	5
Total cumulative sum [TC]	$TC_{Y1} = CV_R \text{ in Y1} - CV_C \text{ in Y1}$	$TC_{Y2} = CV_R \text{ in Y2} - CV_C \text{ in Y2}$	$TC_{Y3} = CV_R \text{ in Y3} - CV_C \text{ in Y3}$	$TC_{Y4} = CV_R \text{ in Y4} - CV_C \text{ in Y4}$	$TC_{Y5} = CV_R \text{ in Y5} - CV_C \text{ in Y5}$

Beware that the breakeven point is the moment in which the total cumulative sum transitions from negative cash flow to positive values [when the stream crosses 0]. Indicate where your breakeven point would be by highlighting it in green.

Table B-31. Cash flow.



The breaking point line serves to be aware between what year and what year you will start to produce income despite the investments. Look at the example in the table below [green line], the breakeven point will happen between year 5 and 6.

Table B-32. Example of a cash flow – including breaking point (example)

revenue	0	0	0	0	40	90	55	25	20				
Cumulative revenue CV _R	0	0	0	0	40	130	185	115	135				
100													
90													
80													
70													
60													
50													
40													
30													
20													
10													
10													
20													
30													
40													
50													
60													
70													
80													
90													
100													
Time>	1	2	3	4	5	6	7	8	9	10	11	12	13
cost	0	- 55	-75	-20	-60	0	0	0	0				
Cumulative costs CV _C	0	-55	-130	-150	-210	0	0	0	0				
Total cumulative sum [TC]	0	-55 +0 = -55	-130 +0 = -130	-150 + 0 = -150	-210 +40= -170	0+ 130= 130	0+ 185= 185	115	135				

▲ Breakeven point
 [somewhere there]

B.4.7 Financing strategy

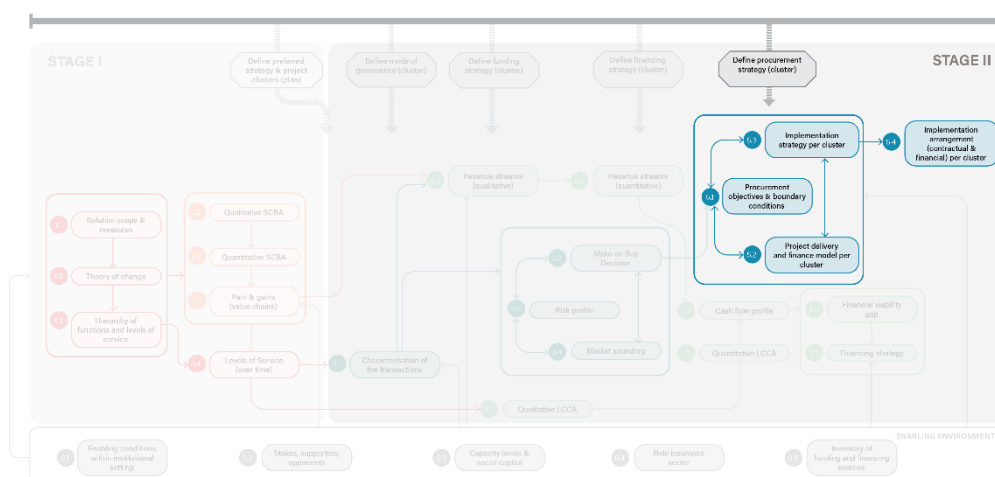
Finally, define the method of investment attraction: Define if it is a direct investment (equity) or debt. Additionally, determine if it is expected that the investors engage in a joint venture or if it is

likely that the investor purchases a financial instrument (e.g. bond) or take part in a fund? Now, make clear what are the covered capital and operational investments, and what the financial gap is. Describe the financing instruments that are available for reaching the financing gap. Shortly describe the financing strategy for breaching the financing gap. (The instructions for filling this table can be found **NAIAD WP 7.1**).

Table B-33. Financing strategy

CAPITAL INVESTMENTS		EXISTING: (EU 2019)			
		REQUIRED INVESTMENTS: (EU 2019)			
Operational investments		Existing: (EU 2019)			
		Required investments: (EU 2019)			
Describe the financing instruments that are available for reaching the financing gap. Shortly describe the financing strategy for breaching the financing gap.					
Name	Proven mechanism?	Facility/instrument/ Private collective action?	Generic definition	Size (EU)	Managing institution (link)
	Yes/No	Instrument	PPP Bond	\$	

B.5 Management case



B.5.1 Procurement objectives and boundary conditions (Ambitions, measures and key implementation stakeholders)

Before going into details on the implementation arrangement characteristics (contracting scopes, financial/payment incentives, and procurement incentives), you must summarize the ambitions to be reached per measure. Make a general statement of the ambitions of the investment project to reach by procurement choices and management practices (summarizing the insights collected so far from the strategic, economic, commercial and financial). Ambitions can be related in terms of quality of the services, efficiencies to introduce (savings), integrating functionalities, introducing innovations (typical for NbS), etc.

You can bring together here the insights from previous cases. Ambitions can be related in terms of quality of the services, efficiencies to introduce (savings), integrating functionalities, introducing innovations (typical for NbS), etc. Then, you must make a general screen of the stakeholders which are bringing resources to reach these ambitions. Do not include those stakeholders with indirect relation, nor opponents. For now, do not focus on the specific phases of the project delivery but the general resources they can bring by measure. Key to symbols: Money (\$) - write \$ to \$\$\$\$ to indicate who should be the main contributors; Authority (A), Expertise (E) and Networks (N).

Table B-34. Ambitions, measures and stakeholder’s main contribution

		MEASURE 1	MEASURE 2	MEASURE 3	MEASURE 4
AMBITIONS ->					
Stakeholders		Main contribution (\$) (A) (E) (N)			
Code	Name	Measure 1	Measure 2	Measure 3	Measure 4
STKH [1]					

B.5.2 Project delivery and finance model per cluster: contract scope, financial and tendering incentives

This is the backbone of the management case, and you will need to go through a few steps for filling the final table reported in the assessment.

Step a. First, you must assess the extent to which is valuable to bundle and transfer stages to the building stage. In **Table B-35** you must describe the advantages and disadvantages of bundling Planning, Design, Engineering, Maintenance, Operations, and Financing. Finally, decide whether the phase should be bundled or not to construction according to the ambition you define previously in 5.1 Management, and risk analysis made in the commercial case. The conceptual part of this handbook provides theoretical insights for choosing bundling phases to construction.

Table B-35. Inventorying the advantages of bundling different phases to construction.

MEASURE	M1 [name]		Should be integrated?
	Advantages of bundling to construction	Disadvantages of building phase to construction phase	
Planning and list of requirements [P]			Yes/no
Land acquisition [L]*			Yes/no
Designing [D]**			Yes/no
Building [B]			
Maintenance [MA]			Yes/no
Facility Services [OP]			Yes/no
Financing [FN]			Yes/no

*Take as trade-offs for Land acquisition those ones who apply for planning

** Includes Engineering

This step allows you to understand how many contracts you are going to tender, as commissioner. Now, remember the rules of typical integration of contracts

- If you integrate Planning to Building, you necessarily integrate Design.
- Design and Build can be integrated, without an additional phase to integrate. Likewise, they can be procured separately
- If you integrate Maintenance or Operation to Building, you necessarily integrate Design.
- You can integrate Maintenance and Operation without an additional phase to integrate.
- Operation only applies if the functionality of the measure includes recurrent execution of activities beyond avoiding deterioration
- If you integrate Financing to Building, you must integrate Design, Maintenance, and eventually, operation.
- You can always keep in the house at any stage. However, all your choices should be aligned with the transaction and risk analysis made in the Commercial case.
- If at this stage of the analysis, you must review previous assumptions of the Commercial case., review accordingly.

Step b. At this stage, it should be clear for you how many contracts each measure might involve. Fill the following table accordingly

Table B-36. Defining the scope of the contract(s) per measure

MEASURE 1	CONTRACT 1	CONTRACT 2	CONTRACT 3
Planning and list of requirements [P]	Yes/No	Yes/No	Yes/No
Land acquisition [L]	Yes/No	Yes/No	Yes/No
Designing [D]	Yes/No	Yes/No	Yes/No
Building [B]	Yes/No	Yes/No	Yes/No
Maintenance [M]	Yes/No	Yes/No	Yes/No
Facility Services [O]	Yes/No	Yes/No	Yes/No
Financing [F]	Yes/No	Yes/No	Yes/No

Step c. Now, per the contract, you will examine the payment mechanisms are appropriate according to explanation. You must assess the feasibility considering the characteristics of the stages bundled. Some rules of thumb are:

- If you bundle Financing, you necessarily must select performance/availability.
- If you considered not bundling Maintenance to Building, you could not select payment for availability. However, you can use bonuses/malus and performance.

Table B-37. Defining payment/financial incentives

MEASURE 1 CONTRACT 1	M1 [NAME]			MAIN PAYMENT MECHANISM
	<i>Payment for progress or milestones</i>	<i>Payment for performance/availability</i>	<i>Payment based on pot risk sharing</i>	
Feasibility				Main category [Sub category]
Advantages				
Disadvantages				

Step d. Now, per the contract, you will examine the procurement incentives. You will use as reference the European guidelines as was explained. Here you consider (i) selection criteria (iii) MEAT and (iv) complex procedure for solutions are not available out of the shelf. For selection criteria, describe the minimum requirements in terms of experience, and filters to be eligible as proponent. For MEAT, you must rank from 1 to 3, 1 the most preferred between Quality of the service (Value for Money), reducing LCC, or selecting the cheapest. Finally, define if it is needed to negotiate the scope of the contract due to complexity thought the five aspects to consider a complex procurement process. Some rule of thumb

- If you are not integrating DBMO, you cannot structure procurement based on reducing LCC. You must select either cheapest or VfM.
- If you are bundling Financing implies that the core of your added value is the introduction of efficiencies available in the market and not the development of innovation non-available in the market.

Table B-38. Defining procurement incentives and procedure

MEASURE 1 CONTRACT	M1 [NAME]					
	<i>General selection criteria</i>	<i>MEAT</i>		<i>Complex process procedure</i>		
Contract 1	Describe	Quality of the service (Value for Money)	Yes/no, why?	Are minimum requirements and award criteria part of the discussion with chose participants?	Yes, no, why?	Define the European procurement procedure

				Value from efficiencies introduced by private	Yes, no, why?	
				Value from resolving complex socio-technical problems	Yes, no, why?	
				Innovation is necessary	Yes, no, why?	
		Reducing LCC	Yes, no, why?			
		Cheapest	Yes, no, why?	Levels of technological readiness	Yes, no, why?	

Step e. Finally, fill Table bringing together the outcomes of the analysis. In this table, you find two additional tasks (Performance Monitoring and Impact evaluation). As these are monitoring activities, they never can be bundled with the regular lifecycle of the measure. If contracted, they will need to be assumed by independent organisations.

Table B-39. Contractual scope, financial/payment and procurement incentives

MEASURE	M1 [NAME]			
	# of contract within measure ►	Contract 1	Contract 2	Contract 3
Planning [P]				
Land acquisition [L]				
Designing [D]	X			
Construction [C]	X			
Financing [F]				
Maintenance [M]			X	
Operation [O]				X
Performance Monitoring [PM]				
Impact evaluation [E]				
Scope of contract				
Payment/Financial incentives				

Procurement [Selection criteria]			
Procurement [MEAT criteria]			
Procurement [European Procedure]			

B.5.3 Implementation strategy per cluster

Table B-41 summarises the commercial, financial, and procurement analysis. In other words, it constitutes the implementation arrangement per measure. You must select with (X) the cell when an STKH is directly responsible for the phase. Most of the times, DBFMO activities will be taken by a contractor. If it is not selected yet, you can name the contractor in generic terms. However, make sure you separate the expected number of contractors will take responsibility

Table B-40. Implementation arrangement per cluster of measures.

<i>HERE THE DESCRIPTION AND NARRATIVE</i>							
<i>IWRM/Category – Type of instrument</i>							
<i>CAPEX and OPEX</i>							
	<i>Organisation</i>						
<i>LIFE CYCLE PHASE (PLAN, PROCUREMENT, DESIGN, OPERATION, MAINTENANCE, MONITORING) - in which phase does this organisation plays a vital role? Moreover, which role?</i>	<i>STKH X (Name)</i>	<i>STKH X (Name)</i>	<i>STKH X (Name)</i>	<i>STKH X (Name)</i>	<i>STKH X (Name)</i>	<i>STKH X (Name)</i>	<i>STKH X (Name)</i>
<i>FUNDING (\$ to \$\$\$\$)</i>							
<i>FUNDING (Taxes, Tariffs, Transfers)</i>							
<i>FINANCE (\$ to \$\$\$\$)</i>							
<i>FINANCE (Indicate type of instrument)</i>							
PROCUREMENT							

PLANNING							
LAND ADQUISITION							
DESIGN							
IMPLEMENTATION							
MAINTENANCE							
OPERATION							
SERVICE DELIVERY							
PERFORMANCE MONITORING							
IMPACT EVALUATION							

B.5.4 Implementation arrangement (contractual and financial mechanisms) per cluster

Finally, you will plot the web of formal relationships and exchanges in a matrix. As you can see, the upper-right part of the table describes the exchange going from the STKH (Colum) to STKH (Row). The bottom-left part of the table describes the exchange going from STKH (Row) to STKH (Colum). You must briefly define if the agreement is a contract, administrative regulation/authorization, memorandum of understanding, or collective agreement. If you cannot define the formal nature of the relationship you should state, there would be no formal relationship. Accordingly, make clear that who exchange for what. Usually, the exchange consists of payments for services/tasks. Therefore, abstain from defining relationships that are ambiguous or cannot be formalized in a document (e.g., Trust or reciprocity). Additionally, only include those stakeholders with a formal role in the implementation agreement. Do not forget to include a narrative with the summary of relations, susceptible to be formalized (e.g., contracts, administrative authorization/regulation, memorandum of understandings (MoU) or collective agreement). Also, include a summary of the exchange

Table B-41. Formal agreements between key stakeholders

<i>Here the description and narrative</i>				
	STKH [1]	STKH [2]	STKH [3]	STKH [4]

	(e.g., Commissioner)	(e.g., Contractor)	(e.g., Contractor)	(e.g., user)
STKH [1]		[1] → [2] <hr/> Contract DB (payment for a task)	[1] → [3] <hr/> Contract MO (permit to operate)	[1] → [4] <hr/> None
STKH [2]	[1] ← [2] <hr/> Contract DB (task delivery)		[2] → [3] <hr/> None	[2] → [4] <hr/> None
STKH [3]	[1] ← [3] <hr/> Contract MO	[2] ← S [3] <hr/> None		[3] → [4] <hr/> Contract service (Deliver water service)
STKH [4]	[1] ← [4] <hr/> None	[2] ← [4] <hr/> None	S [3] □ S [4] <hr/> Contract service (Pays for water service Tarif)	

Appendix C. FFWS Institutional characterisation format

In this appendix we present the complete process of institutional analysis we recommend to undertake right at the beginning of the project preparation process, illustrated for the example of La Brague demo, with the support of Université Nice Sophia Antipolis.

C.1 Geographical scope (demo)

The French demo site is the catchment of the Brague River located in the South-East of France in the Alpes Maritime Department. It is a 61 km² catchment in which the Brague begins at about 350 m altitude on the hillslope of Châteauneuf-Grasse City and joins the Mediterranean Sea in Antibes City after traveling 20 Km. The Brague travels cross rural/suburban areas at the headwaters of the catchment, forested areas at the hilly mid-part of the catchment through rocky lanes in the heart of the departmental natural park and finally urbanised lowlands where the slope softens to 0,4% and the Brague's flow slows down. Four main tributaries, namely the valley of Combes (4,6 km), the valley of Horts (4,1 km), the Bouillide River (7 km) and the Valmasque River (8 km), coalesce with the Brague by urbanized lowlands. The catchment includes Châteauneuf-Grasse City (356 hab./km²), Opio City (233 hab./km²), Valbonne City (695 hab./km²), Biot City (624 hab./km²) and Antibes City (2860 hab./km²).

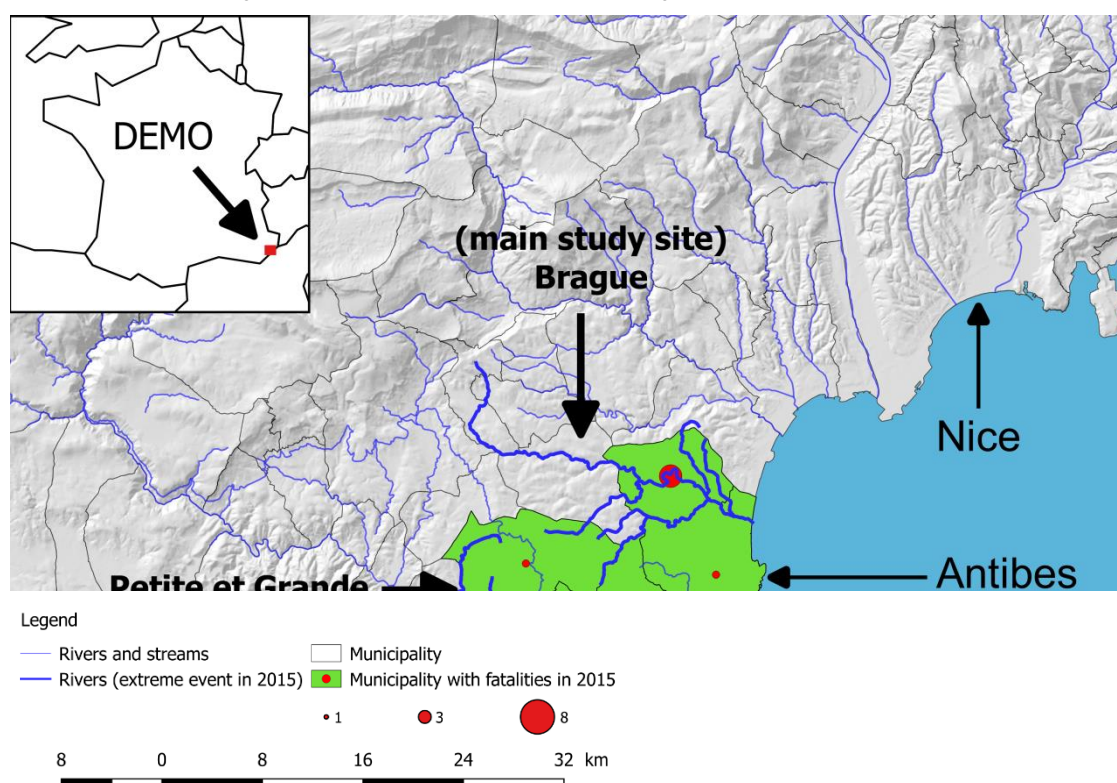


Figure 53. Brague catchment demo site

C.2 Problem definition (gap: current level of service versus required/desired)

The main risk in the Brague catchment is the torrential flood/quick flood in quite urbanized area. This risk is concentrated in the flat lowlands, while the upper plateau and mid-basin hills are less concerned. **Figure 54** shows that the Brague catchment is composed of three main landscape units:

- A plateau in the headwaters where a low flood hazard may exist but is limited by the small size of the upstream catchment;
- A large hilly mid-part of the catchment where the relief is marked and confines rivers preventing large flood hazard zone apparition;
- Lowlands located close from the sea, where the flood hazards are aggravated by transport infrastructures (highways and railways).

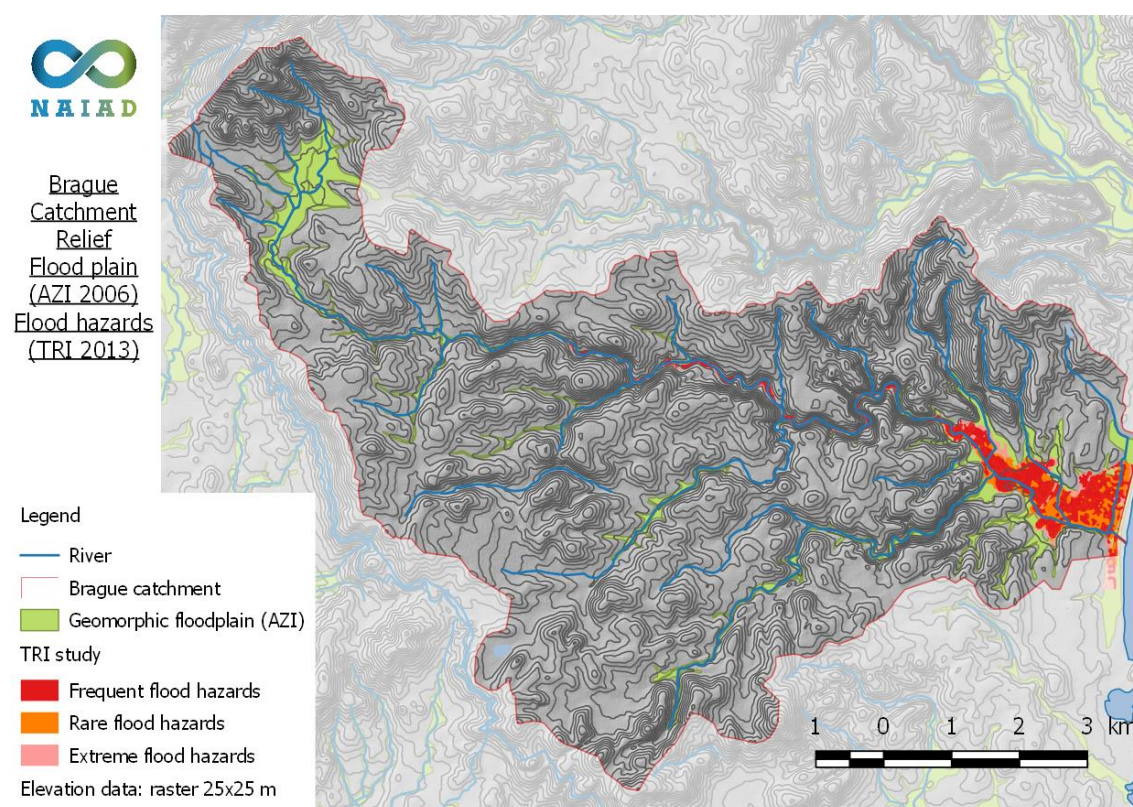


Figure 54. Elevation and flood hazard in the Brague catchment

Since the early 2000's, the catchment has experimented different flood episodes (table 1). The most disaster flood occurred within a time frame of two hours on 3rd, October 2015, both in

term of flooded area extension and cumulated insured damages. These damages have been essentially located in lowlands cities, Biot and Antibes, where 4 people died and insured damages are higher than 50 M€. A particular feature of the October 2015 flood event was the massive amount of large wood pieces that have been recruited by erosion and transferred downstream (phenomenon of logjams formation). This feature worsened the damages. The starting hypothesis of the Brague catchment Demo is that Nature Based Solutions (NBS) will help, among others, to tackle the phenomenon of logjam formation, store and slow the runoff, prevent bank/dike erosion, thus reduce the damages associated to flood risk. The plan is to do a feedback to see how NBS measures reacted to the big flood. And how the grey infra reacted to proof that NBS were sufficient

Table C-1. Flood experiences in the Brague Catchment since 2000's

DATE	EXCEEDANCE PROBABILITY
December 2000	1/10
December 2005	1/10
November 2011	1/30
October 2015	1/100

The current strategies of the flood risk reduction include the following measures:

- Combating the rising of flooding water and control of surface runoff: The Construction of dam and catch retention is the main measure implemented to slow the runoff. At the October 2015 flood, three catch retention are operational in the Brague catchment: the catch retention of Combes (15 000 m³) in Biot City, the catch retention of Saint Claude (30 000 m³) in Antibes City and the catch retention of Val (10 600 m³) in Valbonne City. This measure is efficient for low intensity of rain and low flooding but has negative effects on risk perception and biodiversity.
- Reducing the erosion of river bank by enrockment of banks and civil engineering that decrease the quality of biodiversity;
- Maintenance of water courses through forest clearing;
- Definition of zoning plan in order to control the vulnerability of assets (PPRi de Antibes 1998, PPRi de Biot 1998)

C.3 Range of measures being considered- From grey to green – key options proposed by actors (not researchers)

As a consequence of the level of damages of the October 2015 floods, the French State carried out an administrative closure of the highly vulnerable campsites and about twenty owners was expropriated throughout the Barnier.⁵⁵ The French State has been defined the new activities that can be implemented on these lands and a call for projects has been launched for land

⁵⁵ The Barnier Fund is the national funds dedicated to finance the national policy on disaster risk reduction (law n°95-101, of the 2 February 1995)

uses reconversion. To further reduce damages from flood risk in the Brague catchment, the urban community of Sophia Antipolis⁵⁶ (CASA) has planned to secure the banks and widen the minor bed of the Brague within 3 and 20 m around. In addition, a range of measures that aim to lands use conversion, slow the runoff, increase the storage capacity of soil, and deal with the phenomenon of logjams formation are planned/proposed based on the consultation with stakeholders. These measures are summarized in the **Table C-2**.

Table C-2. Flood risk prevention measures

MEASURES	ORIGIN	GREEN/HYBRID/GREY	OBJECTIVES
Lightweight civil engineering for logjams trapping at high vulnerability point.	Suggested by the Brague Water Agency (SIAQUEBA)	Grey	Combating the rising of flooding water and control of surface runoff
Forest management and maintenance oriented towards resilience to forest fires	Suggested by the Brague Water Agency (SIAQUEBA)	Green	Combating the rising of flooding water and control of surface runoff
Ecological restoration of the Brague	Planned by the Brague Water Agency (SIAQUEBA)	Green	Limiting the erosion of river banks/restoration of ecological functions
Wet meadows acquisition and management	Planned by the Antibes municipality, CEN-PACA (Regional Conservatory of Natural Spaces) and AE-RMC (the Rhone-Mediterranean and Corsica Water Agency)	Green	Increase ecosystem resilience
Riverbed and banks stabilization with vegetal engineering	Suggested by the Brague Water Agency (SIAQUEBA)	Green	Increase water infiltration and slow the runoff
Restoration of hydraulic connections between minor bed and floodplain	Suggested by the Brague Water Agency (SIAQUEBA)	Hybrid	Combating the rising of flooding water and control of surface runoff
Bicycle and pedestrian lane alongside the Brague, from Biot to the see (Antibes)	Suggested by citizens	Hybrid	Reduce human and assets vulnerability/ Increase the river corridor
Catch retention infrastructures	Planned by the urban community of Sophia Antipolis (CASA)	Grey	Combating the rising of flooding water and control of surface runoff

⁵⁶ This community includes among other, all municipalities in the Brague catchment.

C.4 Mapping of Stakeholder- Typology

This section maps a key stakeholders identified to participate in the first and the second round of interviews.

Table C-3. Map of stakeholders

STAKEHOLDER MAPPING	
LEVEL	Organization
National public agencies	ONF RTM (national Forest Office - Torrent control service)
	AFB Agence Française pour la Biodiversité http://www.afbiodiversite.fr/
Financing bodies, investors, structural funds	Agence de l'eau Rhône Méditerranée Corse (AE - RMC - The Rhone-Mediterranean and Corsica Water Agency)
	Département des Alpes Maritimes
	Région PACA
	The Barnier fund
Regional	SMIAGE Syndicat Mixte pour les Inondations, l'Aménagement et la Gestion de l'Eau
	DDTM-AM Direction Départemental des Territoires et de la Mer des Alpes Maritimes
	CEN-PACA Parc départemental de la Valmasque et la Brague et la Vaugrenier
	Force 06
	DREAL 06 (Service Biodiversité Eau Paysages) : Direction Régionale de l'Environnement, de l'Aménagement et du Logement Alpes-Maritimes
	Conservatoire du littoral
Local public	SIAQUEBA (Syndicat Intercommunal de l'Amélioration de la Qualité des Eaux de la Brague et de ses Affluents)/ Urban community of Sophia Antipolis (CASA) http://www.riviere-brague.fr/
	Antibes Juan-les-Pins municipality
	Biot municipality
	Valbonne municipality
Flood victims	Citizens (F. Arias)
	ASLIB (Association syndicale de lutte contre les inondations du bassin de la Brague)
	Département des Alpes Maritimes

Public and Private Companies /SMEs	ESCOTA: highway company
	Cabinet MERLIN
	CEREMA (Centre d'Etudes et d'expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement)
NGO	IFSTAR (Institut français des sciences et technologies des transports, de l'aménagement et des réseaux)
	CYPRES
	ASEB-AM
	ORRM-PACA (Observatoire Régional des Risques Majeurs en Provence-Alpes-Côte d'Azur)

C.5 Stakeholder analysis. Identifying main problem owner- Responsible authority for solving the gap identified

This analysis concerns stakeholders from table 4 that participated at the first-round interview.

STAKEHOLDER	PROBLEM PERCEPTION	VALUES (SOCIALLY ACCEPTED BEHAVIOR)	RESOURCES/ SOURCES OF POWER MONEY AUTHORITY NETWORKS RELEVANT EXPERTISE	NEEDS	ROLES AND RESPONSIBILITIES- REGULATORY ENVIRONMENT GOVERNANCE MODE
SIAQUEBA	Flash floods, phenomenon of logjams formation, land use changes and catchment shape prone to very flashy phenomena	Brague River management and protection, local interests	Funded by municipalities budgets and local taxes, state subsidies, private donations; Not an authority, assists and advices municipality; Municipalities (Antibes, Biot, Grasse, Châteauneuf-Grasse, Mouans-Sartoux, Mougins, Valbonne, Le Rouret, Opio and Vallauris), CEN-PACA, DDTM-AM, NGOs (ASEB-AM and citizens) Engineering and hydrological models, operational maintenance and water quality control.	Needs to generate better knowledge on the hydrological functioning of the catchment and contribute to the Brague protection and restoration	Main manager of the Brague, Operational responsibilities in maintenance of natural habitats of the catchment, water resource management, population awareness on flood risk.
Antibes municipality	Flash flood, catchment shape and urban run-off	To aim for local development	Funded by local taxes, state subsidies; Local authority; Other municipalities, SIAQUEBA, DDTM, NGO and flood victims;	Compliance with the Law (PPRi), Economic growth, Jobs creation and wellbeing of citizens	Urban development planning, Brague river management

DDTM-Alpes Maritimes	Flash flood and phenomenon of logjams formation	Reduce human and assets vulnerability, regional interests	Funded by national budget; Main authority that represents the State authority in the Department; Municipalities, Flood victims, Agence de l'eau Rhône Méditerranée Corse, SIAQUEBA, NGO ; Engineering and hydrological models, definition of spatial planning policy, sea and coastal policy, sustainable development of territories	Needs to generate better knowledge on floods arise and enforce the spatial planning rules in order to control human and assets vulnerability.	State service in the Alpes Maritimes department in charge of water management policy and risk prevention, define construction rules in floodplains, participate in urban strategy definition
ONF RTM	Flooding	Forest protection, sustainable forest resource management, national interests	Funded by national budget; National authority in forest management; Municipalities, DDT (Alpes Maritimes department), DREAL (region), AFB (national); Expertise is diverse: forest resources management, ecological restoration, environment (energy transition), economy and territorial development.	-	Support of the local executive authority (the Prefect) on natural hazard-related issues (risk prevention and crisis management)
Agence de l'eau Rhône Méditerranée Corse (AE - RMC - The Rhone-Mediterranean	Flooding and flash floods in autumn, drought in summer, overexploitation of water	Water resources and quality management, regional interests	Funded by national budget and local taxes; Regional authority; Municipalities, DDTM, DREAL; AFB, ARS (Regional Health Agency) NGO (ASEB-AM, ASLIB and FNE (France Nature Environment which a federation of	Needs to generate better knowledge on aquatic ecosystems and water resources.	It 's role Help elected representatives and local communities, economic stakeholders and inhabitants use water resources rationally and fight against the

and Corsica Water Agency)			associations including those concerned by water issues); Expertise on ecology, biology and hydrology (Impacts studies, applied and experimental studies, projects funding)		pollution and deterioration of aquatic environments
CYPRES	Flash and torrential floods, Mediterranean heavy rainfalls, ground movements.	Risk prevention, national interests	Private funding, membership fee, subsidies; Not an authority, but influences public opinion, raising awareness; Prefect, DDTM, DREAL, Regional and Departmental Councils, Municipalities. NGOs (environmental protection association, industrial unions, other populations (schools, etc.), potentially all citizens via documentations, etc.); Expertise on training, risk diagnostic, risk awareness.	-	Produce information about industrial, technical and natural risks, public authority awareness on risk prevention and preparedness on crisis.
Citizens (F. Arias)	Flash and torrential floods	Reduce food damages, personal interests.	not funded; not an authority, no influence but relays information on flood risk management and others; Biot municipality and NGOs (NGO (ASEB-AM, ASLIB, and other citizens) No expertizes	-	As a citizen, he participates to the meetings organized by the municipality of Antibes. He promotes the development of a bicycle lane alongside the Brague, from Biot to the see (Antibes)
CEN-PACA	Flooding/torrential floods, due to the fact that PPRI (prevention planning of flood risk) are not complied with	Protection of natural heritage, regional interest.	Funded by public subsidies, donations and income from its activities. Not an authority but influences public opinion;	Needs to generate better knowledge on natural ecosystems.	CEN-PACA works with the actors of urbanism (cities, etc.) and is involved, as an expert, in the definition of local urban planning. About



	concerning urban planning		Antibes municipality, Urban community of Sophia Antipolis, ONF RTM, SIAQUEBA Scientific and technic expertizes on ecological studies, maintenance et protection of natural habitats, population information and awareness		water/flood hazards, it essentially works on wetlands (inventory).
ASEB-AM	Flash floods occurring every 6 year due to uncontrolled urbanization	Environment protection, local interests.	Funded by public subsidies, membership fee and donations; Not an authority but influences public opinion; Municipalities, Flood victims and citizens; Scrutinizing spatial planning projects and disclosing information on their impacts on environment.	-	His role: whistleblower concerning natural risks and environmental concerning.

NBS Measures and Stakeholders

Measures- what role do the stakeholders play in relation to the measures- planning, implementation and sustainable operation the NBS/DRR solutions being considered- (decision making & practical implementation, monitor, maintain). The previous exercise should help to define what resources could be implemented by the actors for each of the measures selected (if no concrete NBS proposed, draft it general).

INFLUENCE/POWER	STAKEHOLDERS	FOREST MANAGEMENT AND MAINTENANCE ORIENTED TOWARDS RESILIENCE TO FOREST FIRES	LIGHTWEIGHT CIVIL ENGINEERING FOR LOGJAMS TRAPPING AT HIGH VULNERABILITY POINT	RESTORATION OF HYDRAULIC CONNECTIONS BETWEEN MINOR BED AND FLOODPLAIN	ECOLOGICAL RESTORATION OF THE BRAGUE	WET MEADOWS ACQUISITION AND MANAGEMENT	RIVERBED AND BANKS STABILIZATION WITH VEGETAL ENGINEERING
+ From more influential to less influential	SIAQUEBA (CASA)*	A, \$\$\$\$ (for investment and maintenance), E, N	A, \$\$\$\$ (for investment and maintenance), E, N	A (approval) \$\$\$\$ (for investment and maintenance), E, N	A, \$\$\$\$ (for investment and maintenance), E, N	A, \$\$\$\$ (for land acquisition), E, N	A, \$\$\$\$ (for investment and maintenance), E, N
	DDTM-Alpes Maritimes	A, \$\$\$ (for investment), E, N	A, \$\$\$ (for investment), E, N	A (for authorization), \$\$\$ (for investment), N	A, \$\$\$ (for investment), E, N	A, \$\$\$, E, N	
	Antibes municipality	-	A, \$\$\$ (for investment and maintenance), E, N	A (approval) \$\$\$\$ (for investment and maintenance), E, N	A, \$\$\$, E, N	A (authorization), \$\$\$\$ (for land acquisition)	
	Biot municipality	-	A, \$\$\$ (for investment and maintenance), E, N	-	A, \$\$\$ (for investment and maintenance),	-	



-	Agence de l'eau Rhône Méditerranée Corse (AE - RMC - The Rhone-Mediterranean and Corsica Water Agency)	\$\$\$ E	\$\$\$	\$\$\$ E	\$\$\$ E	\$\$\$	\$\$\$ E
	Région PACA (Regional Council)	\$\$ (for investment)	\$\$ (for investment)	\$\$ (for investment)	\$\$ (for investment)	\$\$ (for investment)	\$\$ (for investment)
	Département des Alpes Maritimes (Departmental Council)	\$\$ (for investment)	\$\$ (for investment)	\$\$ (for investment)	\$\$ (for investment)	\$\$ (for investment)	\$\$ (for investment)
	ONF RTM	E (for headwater forest management)	E (for headwater forest management)	-	-	-	-
	CEN-PACA	E (for natural management of landscapes)	-	-	-	\$, E (for natural management of landscapes), N (for public awareness)	-
	CYPRES	E (NBS design), N (public awareness)	E (NBS design), N (public awareness)	E (NBS design), N (public awareness)	E (NBS design), N (public awareness)	-	E (NBS design), N (public awareness)
	ASEB-AM	N (public information & awareness)	N (public information & awareness)	N (public information & awareness)	N (public information & awareness)	N (for public information & awareness)	N (public information & awareness)
	Citizens (F. Arias)	N (public information)	N (public information)	N (public information)	N (public information)	N (public information)	N (public information)

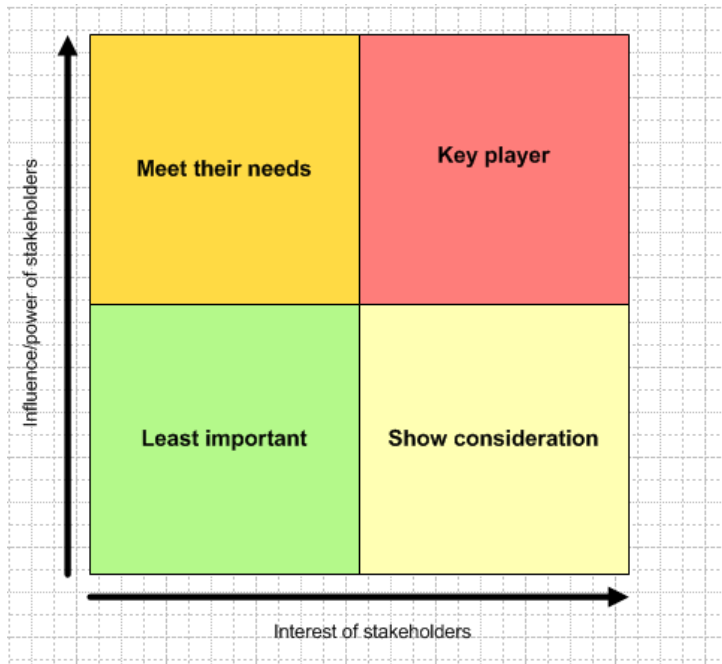


Key to symbols: Money (\$) - write \$ to \$\$\$\$ to indicate who should be the main contributors; Authority (A), Expertise (E) and Networks (N)

*: Since January, 2018, the SIAQUEBA (the Brague Water Agency) had merged with the CASA (the Urban Community of Sophia Antipolis). So far, the French State is the main financier of the flood protection measures and it finances around 60% of the planned measures over the 2014-2019 period. However, this is going to change in next the years thanks to the new GEMAPI competencies gained by the CASA (Law n° 2014-58 of the 27 January 2014). Its authority and financing role will be increased in the next years. For example, the GEMAPI law allows the CASA to collect a new tax, "taxe inondation" and up to 40€/Hab., to finance flood protective measures.

C.6 Influence/Interest stakeholder matrix

Place each stakeholder in the matrix



C.7 Institutional Context and incentives gap

Analysis per project: institutional context, incentives and boundary conditions. If possible, add an annex with a more detailed description and analysis of the institutions creating or hindering incentives.

What is possible and not in the local specific context? what drives or hinders successful implementation?

INSTITUTIONAL LAYER	INSTITUTIONS THAT CREATE INCENTIVES FOR INVESTMENT AND SUCCESSFUL IMPLEMENTATION OF THE MEASURE	DISINCENTIVES FOR INVESTMENT OR SUCCESSFUL IMPLEMENTATION
<p>Layer 1: Social Embeddedness: informal institutions, culture, norms, customs, traditions, religion. 100 to 1000 years. Social theory.</p>	<p>DRR Grey: The social belief that Grey infrastructures are the unique solution to flood risk reduction.</p> <p>NBS: Environmental protection and climate change awareness is starting to penetrate in cultural drivers.</p>	<p>DRR Grey:</p> <p>NBS: Low social awareness and acceptance of flood risk; strong social perception of the effectiveness of grey infrastructures</p>
<p>Layer 2: Institutional Environment, formal rules of the game, specially property (polity, judiciary, bureaucracy). 10 to 100 years. Economics of property rights/ positive political theory.</p>	<p>The Water Framework Directive incentive to take preventive measures in general</p> <p>DRR Grey: National solidarity in the financing of DRR management, purely technical approach of the flood risk (vs ecological approach); centralization of flood risk management and limited room for local participation. Existence of explicit incentive mechanisms for the development of DRR Grey (fond Barnier)</p> <p>NBS: The merger of the CASA (the Urban Community of Sophia Antipolis) and the SIAQUEBA (the Brague Water Agency) and the GEMAPI law are an opportunity for NBS; the funding of AE-RMC (The Rhone-Mediterranean and Corsica Water Agency).</p>	<p>DRR Grey:</p> <p>NBS: Standardization of flood preventive measures; criteria of the Barnier fund are too restrictive and hinder the innovative update (table A1 in appendix). Less than 50% of submitted requests for friendly land acquisition of property exposed to a high flood risk (26 out of 61) were considered eligible; lack of explicit incentive mechanisms for the development of NBS</p>
<p>Layer 3: Governance: Play of the game, especially contracts, agreements and negotiations. 1 to 10 years. Transaction cost economics.</p>	<p>DRR Grey: In general, Grey infrastructures are more politically persuasive, visible and have immediate efficiency; electoral pressure for urbanization; taxes on touristic activities</p> <p>NBS:</p>	<p>DRR Grey: -</p> <p>NBS: High opportunity costs of land reconversion (the loss local election and taxes revenues); lack of empirical effectiveness of NBS;</p>
<p>Layer 4: Individual analysis, resource allocation and employment (prices and quantities, inflation, income, incentive alignment). Frequency: continuous.</p>	<p>DRR Grey: Believing in the power and efficiency of grey infrastructure; land price and land speculation; revenues from tourism activities including local taxes abatement.-</p> <p>NBS: -</p>	<p>DRR Grey:-</p> <p>NBS: High opportunity costs of land reconversion, no believing in the efficiency of NBS.</p>

Neoclassical economics/ agency theory.		
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C.8 Choice of Governance mode and Funding and gaps

Analysis of Gaps

Identify why of funding gaps: misalignments between who carries the costs and who the benefits of disaster risk prevention measures (and possibly ideas on how to fix it, and/or how we will in the demo's deal with these issues)

DISASTER	WHO INVEST IN PROTECTIVE MEASURES	WHO CAN INFLUENCE THE RISK? AND HOW? (E.G. PRACTICES THAT INCREASE/REDUCE VULNERABILITY)	WHO EFFECTIVELY CARRY THESE RISKS? (PER DIFFERENT TYPE OF ASSET)	WHO EXPERIENCE THE BENEFITS OF HIGHER PROTECTION?	WHO IS IN CHARGE OF CRISIS MANAGEMENT AND RECOVERY? WHICH FUNDS AND INVESTMENTS ARE MADE AND BY WHOM?	WHO BENEFITS FROM FUNDS/INVESTMENTS FOR CRISIS MANAGEMENT AND RECOVERY? – WHICH INCENTIVES DOES THIS CREATE FOR EFFECTIVE RISK MANAGEMENT?
Flood risk	SIAQUEBA/Urban community (CASA) Biot and Antibes municipalities, State, DDTM-AM, Regional and Department councils, Agence de l'eau Rhône Méditerranée Corse	DDTM-AM influences the structural vulnerability and risk perception with the PPRIs; Municipalities by spatial planning projects; SIAQUEBA/Urban community (CASA) by increasing the Brague's corridor; Citizens by non-compliance	Citizens (victims of flooding) Businesses (commerce tourism, transport) <u>Département des Alpes Maritimes</u>	Citizens (victims of flooding) Businesses (commerce tourism, transport) <u>Département des Alpes Maritimes</u>	DDTM-AM <u>Force 06</u> ONF RTM (national Forest Office - Torrent control service) SIAQUEBA/Urban community (CASA) Municipalities, etc.	Citizens (victims of flooding) Businesses (commerce tourism, transport) <u>Département des Alpes Maritimes</u>

		with urban planning rules.				
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C.9 Additional information on Institutional context

Table C-4. Subsidies from the Barnier Fund to implement RPP's vulnerability reduction measures

For whom? The beneficiaries	Local authorities					Natural or legal person	
For what? <i>The studies, works and subsidized acquisitions</i>	Friendly land acquisition of property exposed to a major natural risk	Friendly land acquisition of property damaged by a natural disaster	Studies, works and preventive equipment	Recognition and filling of underground cavities	Studies and works imposed by a PPR		
Level of financing? <i>Variable rates</i> ¹	100% max.	€240 000/land unit max.	Between 25% and 50% max.	30% max.	Private house 40% max.	Companies 20% max.	
Risks involved?	Landslides; subsidence due to an underground cavity or due to a natural or man-made that does not result from the past of ongoing mining operation; torrential rains or fast rise;	Any risks likely to cause a disaster that may be the subject of a declaration of "natural catastrophe"	Any major natural hazards	Risks of land subsidence due to underground cavities or hinges due to natural or human origin and not resulting from the past or ongoing mining exploitation	Any risk covered by a PPR		
Which conditions? <i>Depending on the</i>	Serious threat to human lives Acquisition expenses of	Assets covered by an insurance contract including the guarantee against the	Communities covered by a prescribed or approved PPR	Reconnaissance operation: proven dangers for buildings and human lives	Assets covered by a "multi-risk home insurance" and existing at the date of approval of the PPR if the envisaged operations		

nature of the risks	properties, lower than the average cost of safeguarding and population protection Property covered by a "multi-risk home insurance" including the "natural catastrophe" guarantee	effects of natural disasters and their base lands (for companies with less than 20 employees) Damaged properties to more than half of their initial value excluding risk and indemnified under the "natural catastrophe" guarantee	Assets covered by a "multi-risk home insurance" if the envisaged operations concern directly the property exposed to natural hazards	Filling operation: serious threat to human lives and cost of works less than the cost of expropriation compensation	concern directly the property exposed to natural hazards.
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1/ According to eligible transaction costs

References: Based on Ministry of Environment 2016 & www.mrn.asso.fr – adapted by IRSTEA, Nov. 2017

Source: Deliverable 3.2, Institutional analysis report: baseline analysis and policy recommendation.

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D.7.3

Appendix A and B.

Handbook for the Implementation of Nature-based Solutions for Water Security: guidelines for designing an implementation and financing arrangement

END PAGE

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