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EXECUTIVE SUMMARY

This report provides the results of Task 5.4: Integrated and comparative institutional analysis. This task aim is to build on the ex-ante work developed in WP3 and prepares the ground for further work in WP4 and WP7. By looking in depth at 3 demos we characterize the main incentive frameworks that will in many ways drive or constrain the range of NBS measures to be implemented. The deliverable thus exemplifies by application to three different demos how to characterize the institutional framework that underpins the incentives driving many of the stakeholders. It is a descriptive analysis, which will be used as the basis for other deliverables. It presents 10 methodological sequential steps for this characterization, namely i) geographical scope definition (demo), ii) problem definition (gap: current level of service versus required/desired), iii) range of measures being considered- From grey to green – key options proposed by actors (not researchers); iv) mapping of Stakeholders – Typology; v) Stakeholder analysis- Identifying the main problem owner i.e. Responsible authority for solving the gap identified; vi) NBS Measures and Stakeholders, vii) Influence/Interest stakeholder matrix ,viii) Institutional Context and incentives gap; and ix) choice of Governance mode and Funding and gaps



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Introduction to DEMOS Institutional characterisation:

This report provides the results of Task 5.4: Integrated and comparative institutional analysis. This task aim is to build on the ex-ante work developed in WP3 and prepared the ground for WP4 and WP7. By looking in depth at 3 demos we characterize the main incentive frameworks that will in many ways drive or constrain the range of NBS measures to be implemented. The deliverable thus exemplifies by application to three different demos how to characterize the institutional framework that underpins the incentives driving many of the stakeholders. It is a descriptive analysis, which will be used in other deliverables.

Thus, the steps to do this characterization follow the same steps: first we define the geographical scope of the demo. Second, we define the problem that is being addressed and the level of service that would be required, in this case normally we refer to addressing floods and droughts as the main problem, and level of service of nature-based solutions to address floods and droughts. We compare what is required (e.g. by regulation) versus what is desired (e.g. by different stakeholders) to mark a difference between formal norms and regulations versus normative values. For example, in Spain there is an expected level of service from reservoirs in terms of guarantee for drought and water scarcity, how would this in turn translate to our NBS measures also addressing drought and water scarcity of managed aquifer recharge, soil conservation, etc.?. We then outline the range of measures that these demos have identified bottom up as best suited to address the defined problem. We map the stakeholders and also who “owns the problem” i.e. Who is the main responsible authority or agent who is expected to lead the design, implementation, monitoring and evaluation of the chosen measures? We however frame this “key agent” as influenced and constrained by a set of stakeholders, who have different interests and power dynamics, and thus can influence the process with their different interests. This in turn helps us identify the incentives gap for the different actors and thus the best suited choice of governance mode to align the incentives of the different actors and deliver the measures identified, for the problem defined, in the demarcated geographical scope.

TEN STEPS TO DEMO INSTITUTIONAL CHARACTERISATION ON INCENTIVE FRAMEWORKS FOR NBS ADOPTION AND IMPLEMENTATION

- Step 1: Geographical scope (demo)
- Step 2: Problem definition (gap: current level of service versus required/desired)
- Step 3: Range of measures being considered- From grey to green – key options proposed by actors (not researchers)
- Step 4: Mapping of Stakeholders - Typology
- Step 5: Stakeholder analysis- Identifying the main problem owner i.e. Responsible authority for solving the gap identified
- Step 6: NBS Measures and Stakeholders
- Step 7: Influence/Interest stakeholder matrix
- Step 8: Institutional Context and incentives gap
- Step 9: Choice of Governance mode and Funding and gaps
- Step 10: Summary of Institutional characterization and implications for incentive framework for NBS adoption

Thus, the deliverable identifies and exemplifies a series of analytical tools and methods to frame the institutional and incentive framework for the implementation of nature-based solutions. This will heavily influence the feasibility of different Nature Based strategies according to different incentives and disincentives provided at different institutional layers. Ultimately this analysis looks at the identification, prioritization and understanding of key stakeholder; identification of sources of power (money, authority, networks and relevant expertise); and per actor identify problem perception, resources, values and needs (market analysis) in relation to the different NBS strategies, what will give us an answer to the potential distribution of cost and benefits of their implementation.

Medina Institutional characterisation

Step 1: Geographical scope (demo)

The Spanish DEMO site is the Medina del Campo groundwater body 400047 located in the Duero River Basin, NW central Spain. With 3700 km², it has been identified by the Duero Water District's Water Plan for the 2006-2012 period (DWDWP) as not going to achieve good quantitative and qualitative status. The aquifer mainly covers the provinces of Valladolid and Avila, also reaching the provinces of Zamora, Salamanca and Segovia (see **Figure 1**).

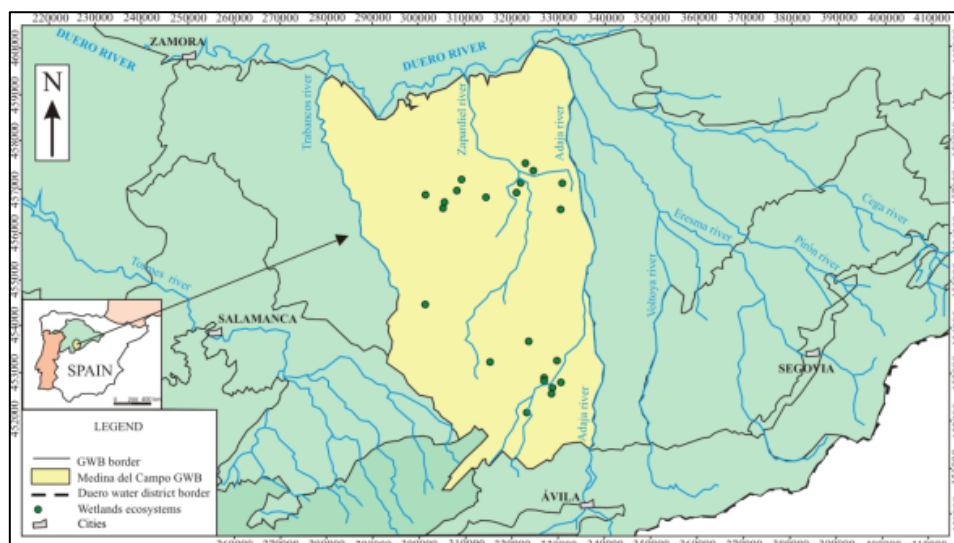


Figure 1. Duero demo site, Medina del Campo Groundwater Body (GWB) (yellow), in the Duero River basin.

Step 2: Problem definition (gap: current level of service versus required/desired)

The main hydrological risks in MCGB (Medina del Campo Groundwater Body) DEMO are water scarcity (induced by groundwater overexploitation and exacerbated by periodic droughts) and increasing deterioration of groundwater quality due to agricultural pollution and by natural contamination from arsenic, which also results in decreased water availability. The starting hypothesis of the MCGB Demo is that NBS can help increase the provision level of many critical ecosystem services provided by



groundwater, thus reducing disasters associated to these risks and strengthen the resilience of the socio-ecological system.

Water quantity

Main negative effects of groundwater levels drawdown because of intensive groundwater exploitation:

- Reduction of groundwater resources available;
- Increase of groundwater abstraction costs;
- Need to look for other more expensive water sources for agriculture (main economic activity);
- Deterioration and loss of rivers, riverine vegetation and wetlands, due to the lowering water tables.
- Increased arsenic release to groundwater due to oxidation of formerly arsenic-bearing saturated layers.

Water quality

Main negative effects of inadequate agricultural fertilization practices:

- Spread of nitrate pollution in the aquifer and affection to domestic supply wells, which would eventually have to be abandoned.
- Need to look for other more expensive water sources for domestic use.

Risks from implemented measures (analysed if possible as cascade or risks)

Main forecasted negative effects of the planned artificial recharge activities:

- Inundation of agricultural fields because of water-tables rising.
- Salinization of wetlands because of salt dissolution after recovery of groundwater discharge.
- Increase of arsenic contents in surface water (some river reaches) and groundwater (some wells) due to changing redox conditions after infiltration of oxygen-rich water.

Loss of ecosystems services

Loss of services provided by the aquifer and of the services provided by the groundwater dependent wetlands.

Floods and droughts

Increased vulnerability of human security, livelihood and wellbeing to the effects of droughts and floods due to deterioration of aquifer ability to regulate the effects of both hydrological extremes. Droughts are a recurrent phenomenon in this area with different characteristics of duration and intensity.

Step 3: Range of measures being considered- From grey to green – key options proposed by actors (not researchers)

To prevent further unsustainable aquifer exploitation the Duero River Basin Authority has proposed a series of management and mitigation measures in the Duero River basin plan, which include the artificial



recharge of aquifers and the control of extractions. Alternative management measures to combat aquifer degradation such as substituting groundwater use for surface resources or payments for reducing extractions will be proposed based on the consultation with stakeholders and the analysis of the environmental implications of all the considered measures.

In relation to droughts: if there is no surface water available, artificial groundwater recharge could provide the necessary water to ecosystems, drinking water supply and irrigation activities.

Additional or alternative management measures to address aquifer degradation could be implemented in parallel to the managed aquifer recharge, such as substituting groundwater uses by surface resources or payments for reducing extractions. These initiatives proposed are based on the consultation with stakeholders in a series of structured workshops and the analysis of the environmental/ecosystem implications of all the considered measures. The EU natural water retention measures for floods and agricultural climate adaptation measures catalogue was considered in the consultations.

In relation to floods: the only solution for the flash floods area is to increase the flood retention areas – widen the riverbed and ideally, make it greener, so increase the flowing capacity and do it by using NBS or at least a combination of green and grey.

Range of Measures:

1. Managed Aquifer recharge- groundwater reserves by artificial recharge of dam water infiltration through some rivers' bed and through irrigation infrastructure.
2. Water transfer- Substitution of groundwater by surface water
3. River Restoration and Natural Flood Management
4. Less water-demanding crops
5. Soil water conservation measures (conditionality of the CAP)
6. Reforestation

Table 1. Type of Measures considered in Medina demo (including NBS)

Type of Measure	Origin (where they are considered: plans, programs, rules, ...) develop further on the origin, describe time (task after call)	Green/Hybrid/Grey	Demand/Supply management
Managed Aquifer recharge	Duero Plan + LIFE integrated project	Hybrid	Supply management
Water transfer- Substitution of groundwater by surface water	Duero River plan	Grey	Supply management
River Restoration and Natural Flood Management	Duero River basin plan + National River Restoration Plan (TBC?) + Duero flood management Plan	Green	Supply management
Less water-demanding crops	Duero river basin plan in line with regional agricultural/territorial Plan? (TBC)	Green	Demand management



Soil water conservation measures	Duero river basin plan in line with regional agricultural/territorial Plan? (TBC) + suggested by env NGOS+ CAP	Green	Demand management
Reforestation	Reforestation Plan, Regional Government of Castille and Leon	Green	Demand management

Managed Aquifer recharge

NAIAD will help to build a resilience approach to risk management in Medina's groundwater body through Nature Based Solutions (NBS). The selected approach would reduce risk (especially to drought) through aquifer recharge with the surrounding surface water resources.

The aquifer recharge through a Managed Aquifer Recharge (MAR) could allow the introduction of water into the aquifer in Zapardiel and Trabancos rivers, assuring the availability of water resources that will result in the recovery of the endemic fauna and flora and the improvement of water quality (decreasing the salinity level). The aim of this action is to improve the general status of the aquifer of Medina del Campo and the ecosystems associated to two areas of study (Zapardiel and Trabancos) by developing artificial recharge activities.

Make use of water surpluses of the River Tormes and Adaja to recover the piezometric level of the aquifer, that will enable the recovery of the endemic Flora and Fauna associated to the rivers subject to the recharge (Ecological Restoration).

River Restoration and Natural flood plains conservation

The Medina DEMO will analyse the role of Natural flood plain conservation. There are areas that not only flood naturally but can also behave as induced floodplains in order to reduce flow downstream, hence reducing hazards to inhabitants while raising the groundwater water-table. The eventual NBS of Medina case study is the restoration of the natural environment of Zapardiel and Trabancos Rivers.



Step 4: Mapping of Stakeholders - Typology

STAKEHOLDER MAPPING SPAIN/MEDINA	
LEVEL	Organization
National public agencies	MAPAMA, Ministry of « fomento », Ministry of Economy
	CEDEX
	CHD (Duero River Basin Organization)
Insurance and re-insurance companies: re-insurance sector	Consortio Nacional de Seguros
	Agro-seguros
	Guy Carpenter
	Insurance Company (floods)
	Insurance Company (Droughts)
	Academic experts (floods)
	Academic experts (droughts)
	Asociación de mutuas de España
Infrastructure companies	Aqualia
Green Infrastructure Sector (emerging)	Asociación FIAE Castilla Leon
	ARUP Madrid
Financing bodies, investors, structural funds	Local banks
	Triodos bank
Regional	Regional government of Castile and Leon (JCyL)
	Provincial Council of Ávila
	Protección Civil
Local public	Municipal Council Valladolid
	Municipal Council Medina del Campo



STAKEHOLDER MAPPING SPAIN/MEDINA	
LEVEL	Organization
	Municipal Council Horcajo de las Torres
	Municipal Council Rágama
	Municipal council Pajares de Adaja
Farmers	Irrigation Community Río Adaja
	UPA: Association of small farmers and stockbreeders (Unión de Pequeños Agricultores y Ganaderos).
	UCCL: Unión de campesinos
	ASAJA
	Agrarian cooperatives
Public and Private Companies /SMEs	ACUAES (Aguas de las cuencas de España): Public Company in hydraulic infrastructures.
	Tragsatec (Rural development, environment and emergency)
	CEGA, Consultoria, Educación y Gestión Ambiental
Academic/Research	Water scientific research.
	Technological development Center (CIDTA) University of de Salamanca. (Centro de Investigación y Desarrollo Tecnológico del Agua).
NGO	Cultural Association: ALHONDIGA
	NGO WWF Spain
	NGO SEOBirdlife



Step 5: Stakeholder analysis- Identifying the main problem owner i.e. Responsible authority for solving the gap identified

Stakeholder	Problem perception	Values (socially accepted behavior)	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Roles and responsibilities- regulatory environment governance mode
Duero River Basin Agency	Water quantity and water quality Biodiversity Loss Climate change	General interest* (look for definition) Garantistas	Funded by the State (ministry MAPAMA) Include annual budget separate human resource from budget to implement) Main regulator (water directives) Networks with other ministries, regional government, s and water users (e.g. municipalities, irrigators) Legal, engineering and hydrology/hydrogeology, models,	Compliance with the Law	Main problem owner due to law; responsibility for taking care of national water public domain; water planning, PoM; water rights issuer; compliance with WFD, Floods Directive, water quality standards.
Regional Government	Groundwater overuse, water quality problems, biodiversity loss, lack of citizen's awareness on environmental issues	Environment protection, ecological health, territorial development, regional interest.	Funded by a national budget and tax revenues Regional authorities and administration Connected to Duero basin authority, ministries, municipalities, civil associations, farmer unions... Expertise is diverse: environment, agriculture, economy...territorial development.	Regional development and compliance with the law	Responsible for regional planning in natural areas, environmental quality, sustainable development strategies at regional level. Agricultural development, civil protection
Municipalities	Water is a limiting factor to municipal economic development, migration	To aim for local development	Limited funds Local territory authority Connected with other municipalities, provincial government, regional government, Duero, non-official organizations... Limited expertise	Economic growth, Jobs creation and wellbeing of citizens	City planning, water supply, flood management support.
Provincial Government	Water quality	General Interest for local development	Limited funds		Supports municipalities in the province of Avila in water supply



Stakeholder	Problem perception	Values (socially accepted behavior)	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Roles and responsibilities- regulatory environment governance mode
			Not a key authority		and environmental issues, technically and financially.
Irrigation communities	Water quantity and quality, drought		Limited funds, from farmer fees or from eventual subsidies/public investment on infrastructure Local networks, connected with Duero, regional government, municipalities, farming unions and cooperatives... Not an official authority, but influential.		
Farming Unions	Water quantity and quality, drought		Limited funds. Not an actor with authority, but well connected in the actor network, influential on policy level.		Farmer's Union, representing the interest of farmers in the different municipalities around Medina DEMO.
Community actors (Alhóndiga association)	Illegal water use, deforestation	Sustainable Rural development, traditions.	Limited funds, receiving subsidies for associations or from member's fees. Not an authority, but moves public opinion. Expertise on cultural and environmental concerns		Cultural and environmental association of the civil society in the municipality of Arévalo
NGOs (SEO Birdlife, ADENA)	Water quantity, quality, biodiversity loss, climate change, people awareness	Sustainable development and biodiversity conservation	Limited funds (subsidies and fees), still able to mobilize relatively large funds eventually. Not an authority, but influences public opinion, raising awareness. Connected to most actors. Expertise on ecology, economy, biology, hydrology...		Denounce lack of environmental protection compliance, creation of public awareness



Stakeholder	Problem perception	Values (socially accepted behavior)	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Roles and responsibilities- regulatory environment governance mode
Academics	Water quantity, quality, drought, policy reaction	Knowledge and innovation generation, sustainable development	Limited funds Not an authority, not much influence. Connects with local actors eventually. Expertise on technical aspects, ecology, water risks...	Needs to generate better knowledge and contribute to development	Research in the region related to water risks
Ministry of Agriculture and Environment/Ministry of « development »		General Interest	Funds available, from taxes and state budget. Actor with authority and decision-making power. Not a local actor, but connected with Duero, Regional Government, NGOs. Expertise on policy, environment, agriculture, civil protection, DRR.		Legal framework and plans for environment, agriculture, and civil protection
Agroseguro	Not aware of local problem	Provision of security to farmers	Funds available through contracts. Expertise on risk assessment	Needs to sell insurance contracts and to assess the risk exposure	Provides insurance to farmers
Public companies (Acualia, somacyl)	Water quantity, quality				They are a public company managing the dam which provides surface water to farmers in the DEMO area



Step 6: 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	Stakeholder	Managed Aquifer Recharge	Water transfer	River Restoration and Natural Flood Management	Less water-demanding crops	Soil water conservation measures	Reforestation
+ From more influential to less influential -	Duero	A, \$\$\$ (Taxes/Life), E (- for measure and monitoring)	A, \$\$\$, E	A, \$\$\$, E	A, \$\$\$, E, N	\$, E, N	E, N,
	Regional Government	A (regulates land use)	A (authorization), N	A, N	A, \$\$\$, E, N	A, \$\$\$, E, N	A, \$\$\$, E, N
	Municipalities	A (construction permit)	N	A, N	\$	N	\$, N
	Provincial Government	N	N	\$, N	E, N (Technical support)	E, N (Technical support)	E, N (Technical support)
	Irrigation communities	\$\$\$ (tariffs), * there are not yet irrigation communities for groundwater	\$\$\$ (tarifs « canon »), N,		E, N	E, N	
	Farming Unions	N (lobbying power)	N,				
	Community actors	N (could influence local support for implementation)				\$, E, N	\$, E, N
	NGOs (ADENA, SEO)	N (could influence local support for implementation), E (ecological impacts)			E, N	E, N	
	Academics (expertise or networks)	E (UdeS-ecological impacts; Politecnica-engineering)		E	E	E	



Influence/power	Stakeholder	Managed Aquifer Recharge	Water transfer	River Restoration and Natural Flood Management	Less water-demanding crops	Soil water conservation measures	Reforestation
	Ministry of Agriculture and Environment	\$ (?) , A (approval of programs)	\$,	\$\$, A, E	\$, E	\$, E	\$
	EU (Structural funds)	\$ (?)	?	?	?	?	?
	Agroseguro	Not clear role					
	Private sector (expertise or networks)	E (design of measure)	?	?	?	?	?
	Public companies : aqualia, Tragsa	E (for implementation of measures)	E	E			E

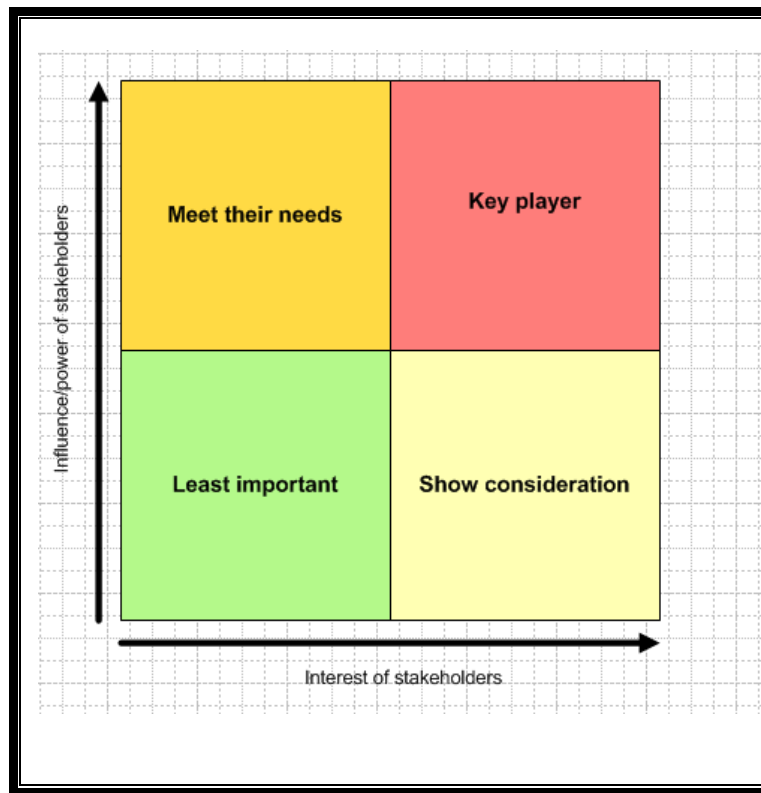
Key to symbols:

- Money (\$) - write \$ to \$\$\$\$ to indicate who should be the main contributors;
- Authority (A),
- Expertise (E)
- Networks (N)

Step 7: Influence/Interest stakeholder matrix

An important step is to locate each stakeholder on the matrix below in relation to interest versus influence. This helps to identify the stakeholders where it are more likely to drive the process of NBS adoption if the right incentives are provided.

The most important quadrant corresponds to the high interest and high influence, in the case of Medina the main stakeholder therefore are the Duero River Basin, the regional government and the irrigator communities. Thus, these would be key actors for the selection, design, implementation and monitoring and evaluation of NBS.



Step 8: 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
Layer 1: Social Embeddedness: informal institutions, culture, norms, customs, traditions, religion. 100 to 1000 years. Social theory.	DRR Grey: People perceives grey infra as more reliable solution to risks and hazards. NBS: environmental protection and climate change awareness is starting to penetrate in cultural drivers.	DRR Grey: not disincentive perceive at this level NBS: People perceives grey infra as more reliable solution
Layer 2: Institutional Environment, formal rules of the game, especially property (polity, judiciary,	Water Framework Directive (incentive to take measures in general)	DRR Grey: cost recovery of the measures



Institutional Layer	(Institutions that create) incentives for investment and successful implementation of the measure	Disincentives for investment or successful implementation
bureaucracy). 10 to 100 years. Economics of property rights/ positive political theory.	DRR Grey: water act 1985, special drought plan, floods directive NBS: Habitat Directive, water framework directive, floods management plans (floods directive), restoration plans, CAP conditionality, reforestation strategy	NBS: land property rights could be a barrier for the implementation of Natural Flood Management and other measures that require private land use
Layer 3: Governance: Play of the game, especially contracts, agreements and negotiations. 1 to 10 years. Transaction cost economics.	DRR Grey: in general, infrastructural projects are politically more visible and receive more funds NBS: Subsidies for CAP, rural development plans, territorial custody schemes, PIMA funds (Ministry level)	DRR Grey: NBS: EU procurement directive (is often a barrier for innovation update). Lack of results on NBS impact can hinder NBS investment.
Layer 4: Individual analysis, resource allocation and employment (prices and quantities, inflation, income, incentive alignment). Frequency: continuous. Neoclassical economics/ agency theory.	DRR Grey: - NBS: -	Water tariffs → DRR Grey: NBS: too high tariffs could be a barrier for the implementation of the aquifer recharge Water property schemes and tenure could influence in the type of measures implemented



Step 9: 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 (floods directive implementation inc.)	Duero RBO, Ministry of Environment, Users, Regional Authorities, municipalities	Constructors (land use in flood prone or drainage areas), urban planners (type of land use), farmers (giving more or less space for the river, groundwater levels influence), Duero RBO (problem owner),	Citizens, Farmers, environment	Farmers, citizens, ecosystems	Duero RBO, municipalities, civil protection.	Citizens, farmers
Drought (water framework directive, drought special plans implementation inc.)	Duero RBO, Ministry of Environment, Users, Regional Authorities, municipalities	Farmers, urban use, lack of monitoring and law enforcement by Duero RBO, electrical prices (pumping price), agrarian policies (type of crops promoted), market demand.	Farmers and agricultural derived economical sector, citizens, ecosystems (less availability traduces in economical loss)	Farmers, citizens	Duero RBO mainly, also Ministries and municipalities, regional government	Citizens, farmers



Glinščica institutional characterization

Step 1: Geographical scope (demo)

Glinščica catchment is situated within the borders of the Municipality of Ljubljana that spans roughly 275 km² and has a population of 284,000 inhabitants. The demo site covers 7.01% of Ljubljana's surface area, includes 5 of its districts (Dravlje, Šiška, Rožnik, Vič, Šentvid) and accounts for 8.17% (23,200) of its population, which should all be considered stakeholders in flood management. Originating at 409 m.a.s.l., the headwaters in the steep hill slopes of Toško Čelo give the Glinščica stream a torrential character which, together with climate change (less frequent, but higher intensity rainfall) and hard regulations, results in regular flooding of the Vič and Rožna dolina districts of Ljubljana.

Glinščica catchment mostly experiences moderate continental climate typical for central Slovenia, which is categorized in the Köppen's climatic classification as Cfb - temperate humid climates with warm summers. However, the proximity of bordering sub mediterranean (Cfa) region less than 20 kilometres away, influences the climate and precipitation regimes in the catchment. The average temperatures of the coldest month (January) range from -3 to 0°C, and the warmest (July/August) between 15 and 20°C. The continental precipitation regime in the catchment is characterized by the precipitation maximum in summer and minimum in winter with the secondary maximum in autumn due to the influence of the sub Mediterranean climate which also promotes persistence of higher temperatures into autumn months. The average annual rainfall is around 1300mm. (Ogrin, 1996)

Glinščica River has a Mediterranean pluvio-nival river regime characterized by two maxima, in spring and autumn and two minima, in summer and winter. The primary discharge maximum is in April due to the high amount of precipitation coupled with the snow melt occurring during this period. The primary maximum may also appear in March or May. The secondary maximum occurs in November as a result of high precipitation rates, but without the addition of snowmelt (Kolbezen, 1998).

Despite the concurrent precipitation maximum, the primary discharge minimum occurs in summer due to high temperatures and consequent loss of water through evapotranspiration. The secondary minimum in winter is greater than the primary, but it is in line with low amounts of rainfall and it does not last long. In a typical Mediterranean river regime, the high autumn rainfall rates continue throughout winter and hence the autumn and spring precipitation maxima are merged which is also reflected in the discharge rates (Kolbezen, 1998). However, Slovenia lies on the border between the continental and Mediterranean regions and so both the precipitation and discharge regimes do not follow the typical regimes described, but rather vary in between the two extremes.

As expected, the Glinščica floodplain is covered in gravel brought here by the river from its source in the hills of Polhograjsko Gorovje. The North-Western, hilly part of the catchment is made up of limestone and dolomite, soluble sedimentary rocks typical for majority of Slovenia that rose above the surrounding land and formed the Polhograjsko Gorovje during the last uplift period approximately 3 million years ago. Smaller silt and sandstone areas occur in regions where the larger Ljubljanica and Sava Rivers deposited material during extreme floods.

The Glinščica catchment is characterized by two distinct landscapes, conditioning land use. The natural headwaters, emerging in the steep Toško čelo (590m amsl) and Črni vrh (482m amsl) hills, are covered in



deciduous and mixed evergreen forest, interrupted only by sporadic lodgings and occasional pasture. Individual patches of wet forests preserved in the lower parts and unsuitable for settlement or agriculture due to huge amounts of water in the soil are protected as natural heritage. Finally, together with Rožnik and Šišenski hrib park area in the Eastern part of the catchment, the natural areas cover approximately 47 % of the catchment.

The land use changes dramatically as soon as the gradient recedes to the level suitable for agriculture and urbanization, which both compete for space throughout the rest of the catchment. While historically the agricultural land use predominated the catchment, it has been slowly giving way to urban land which now covers more than 30 % of the catchment, despite the Glinščica stream being one of the most important green wedges of the Municipality of Ljubljana.

The three city districts – Šiška in the East, Vič and Rožna dolina in the South – form the most densely populated, fully urbanized areas of the Glinščica catchment where the stream has been channelized and straightened between the years 1925 and 1970 (Šumer et al. 2004). Urban development of the upstream, suburban areas has been progressing steadily since then, but recent extreme flood events have raised concerns about appropriateness of these plans. Despite the high level of urbanization, the agricultural land, mostly on the flood plain, still covers more than 20% of the catchment area and offers opportunities for restoration and NBS implementation activities.

While natural green areas are generally believed to have the highest infiltration rates and hence, minimize the amount and speed of the runoff, the Glinščica catchment has, until now, experienced a reduction of roughly 52 % of natural or semi-natural land cover. A loss of 31 % of land cover to urbanization and 21 % to agriculture directly results in faster and higher runoff rates and consequent generation of flood waves on the one side, but also water scarcity on the other.

Step 2: Problem definition (gap: current level of service versus required/desired)

A number of initiatives have been put forward during the last 10 years to restore Glinščica to a more natural state and to secure the vulnerable districts from flooding. Together with the EU requirements from the WFD and FD, these resulted mostly in changes on strategic level. Sustainable development is one of the main targets of the 2014-2020 Strategy of the City Municipality of Ljubljana (Trajnostna..., 2015). Furthermore, restoration of natural features has been integrated in the Municipality Spatial Plan as one of the priorities in water management in the strategic part of the Plan (Odlok o občinskem prostorskem načrtu Mestne občine Ljubljana - strateški del) and as conservation of ecological status of water bodies in the implementation part (Odlok o občinskem prostorskem načrtu Mestne občine Ljubljana – izvedbeni del). Glinščica is also one of the priority streams for river restoration in the Program of Fish Management in Freshwaters of Slovenia for the period until 2021 (Program upravljanja..., 2015).

Unfortunately, these changes have thus far had little or no effect on the practical planning and implementation, which is clear from monitoring data and actual conditions in the field.

Urban watercourses in Ljubljana are an important component of urban green systems primarily as a network of natural areas which stretch into the urban structure and introduce natural landscape elements in the urban area (Mušič 1970). However, the lower reaches of Glinščica have been trapped in a concrete channel for several decades and other forms of regulations extend upstream to the mountainous



headwaters (Balant, 2006). Inappropriate regulations are reflected mainly in the high frequency of flood events and low species diversity. Straightened channel and lack of riparian vegetation have also reduced the aesthetic and educational value of the stream as well as the status of the water environment and thus the experiential value of the stream. Therefore, Glinščica ceased to constitute a basis for many of its functions as an urban green corridor; hydrological, ecological, spatio-structural, aesthetic, sports and recreational and social (Balant, 2006).

Ljubljana has several streams with high flood hazard potential of which Glinščica is the smallest and causes the least damage. Hence, Glinščica has never been seen as an important flood risk area despite its typical torrential character and the several large floods occurring in the last 10 years.

Water from an area of 17.4 km² in size naturally drains into the Glinščica streambed with an additional 1.9 km² added to this surface through the urban runoff drainage system for Šentvid district of Ljubljana, so that the overall catchment size is approximately 19.3 km². Runoff production and transport from a catchment area are mostly related to vegetation cover, soil permeability and size of paved, impermeable urban surfaces (Balant, 2006) which affect the runoff coefficient.

Steep slopes in the headwaters give rise to a fast and powerful water flow that historically dissipated in the meanders starting at the foothills and extending throughout the following forested flood plain before discharging into Gradaščica stream. Regulations on the Glinščica stream first started in 1925 and were completed through most of its course by 1970 (Šumer et al. 2004). The urban development is still claiming important flood plain areas every year. With the expansion of urban areas in the lowlands of the river basin, the hydrological regime of the river basin has changed dramatically, especially in the period of the last 20 years. By increasing the proportion of impervious surfaces (sealing, road surfaces) the rate of water runoff is increased. After the regulation and land use changes, the flood waters come rushing down straight to the confluence with Gradaščica, where the water builds up and eventually floods the surrounding areas now densely populated.

While the upper, forested part of the catchment remains largely uninhabited, rural agglomerations reach all the way to the foothills, followed by a stretch of semi-urban, densely populated areas mixed with patches of agricultural land. Extensive urban areas are spread mainly in the following districts of Ljubljana: Podutik, Dravlje, Koseze, Rožna Dolina in Brdo. Especially the Eastern part of the catchment is fully urban and the drainage from its impermeable surfaces adds considerably to flood hazard potential.

On top of that, additional 1.9 km² of urban drainage is rerouted to the Glinščica stream from the nearby areas and a meteor channel system that was designed to reduce the retention time of water in the catchment area is further pressuring the Glinščica discharge capacity (Balant, 2006). Despite the huge contribution to flood hazard, the Eastern part of the catchment is not vulnerable to flooding due to its relatively high elevation.

On the contrary, the most vulnerable part of the catchment is the area surrounding the confluence with the larger Gradaščica stream in the centre of Ljubljana. On the one hand, the flood plain has been deforested and land use management has caused the infiltration capacity to diminish which raises the hazard potential. On the other hand, urban development has spread to the banks of the Glinščica stream without consideration of vulnerability to floods. The combination of all the above-mentioned artificial



modifications throughout the catchment has resulted in high flood risk of the lower most parts of the catchment.

The two flood events of the recent years (2010 and 2014) have acted as a wake-up call to both, the residents and the responsible water management authorities. Both extreme events (September 2010 and October 2014) caused severe floods of SW part of Ljubljana when Glinščica flooded urban areas around Brdnikova cesta as well as urban districts Vič and Rožna dolina. Damage caused by floods to houses and buildings was estimated to 4.5 M€, to agriculture 33,000.00 €, to infrastructure 1.9 M€ and to watercourses 8.31 M€ (Benedičič, 2011). The City Municipality of Ljubljana allocated 5 M€ to flood protection measures after the floods (Poplave, 2014).

In 2014 flood waters of the Glinščica stream flooded Ljubljana's urban areas Vič and Rožna Dolina as well as the upstream settlement Podutik. Around 900 objects were flooded (Poplave, 2014).

The recent extreme flood events of 2010 and 2014 have proven that the current estimates of flood hazard and vulnerability in the Glinščica catchment have not considered the climate predictive changes in precipitation. Therefore, the flood risk maps underestimate the extent or/and return periods of flood waters and consequently, the required capacity of flood protection measures is underestimated.

In addition, several policy and institutional barriers prevent the planning and implementation of NBS solutions for flood prevention, thus limiting the number and efficiency of available measures. To try to understand these barriers, risk perception modelling for Glinščica catchment is being performed in the framework of NAIAD within WP3.

Ljubljana has spread extensively to the floodplains of the river Glinščica, Gradaščica and Ljubljanica during the past decades (Komac et al. 2008). Furthermore, the water management practice of leading the water out of the land as fast as possible has left no space for flood waters. Consequently, both hazard and vulnerability increased significantly, multiplying the flood risk in the catchment.

During flood events in the Glinščica catchment individual houses, apartment blocks, business facilities, other buildings, roads and railroads are affected. Approximately 8.24 km of roads, 0.47 km of railroads and 0.27 km² of houses and other buildings are affected during a Q100 event. Considering the flood maps with return period of 500 years approximately 12.40 km of roads, 0.62 km of railroads and 0.43 km² of houses and other buildings are affected.

Step 3: Range of measures being considered- From grey to green – key options proposed by actors (not researchers)

Water management on Glinščica has followed the general historical management practice, which is to get the water out of the land as fast as possible. With the occurrence of ever-increasing floods, a flood defense plan has been developed by MOL to the best of their capacity through Detailed Municipal Spatial Plan.

The first and most important measure that was already implemented in 2017 is the Brdnikova reservoir. However, the plan predicts construction of three additional dry retention areas (reservoirs Pot za Brdom (2) and Tehnološki park) and several dikes to protect from Q 100 floods. Additionally, construction of different bank protection measures is envisaged, including raising banks from Brdnikova street to Glinščica mouth to prevent flooding, bank failure and erosion. It is predicted that these measures would



together be capable to retain flood waters from Glinščica and its tributary Pržanec and thus, significantly reduce the flood risk for existing residential and other buildings downstream in the wider urbanized area of Vič and Rožna dolina (SW part of Ljubljana). (Odlok o občinskem podrobnem..., 2012).

Risk perception modelling is being performed in the framework of NAIAD, through which stakeholders are being consulted and informed about new available solutions (NBS). According to their opinion, the priorities should be given to the following five issues and goals:

The list of **5 most important issues** and **the 5 main goals** that emerged in the Glinščica catchment from the stakeholders' point of view:

- | | | |
|---------------------------|---|---|
| 1. Flood plain occupation | → | Maintain flood plain occupation (do not increase) |
| 2. State of the ecosystem | → | Improve the state of ecosystem |
| 3. Lack of public funding | → | Increase public funding |
| 4. Community safety | → | Increase community safety |
| 5. Watercourse speed | → | Decrease watercourse speed |

The report of the stakeholder WS where this information was obtained is available in the ISP:
https://naiadfsp.mare-asia.net/index.php/File:stakeholderWSreport_20180119125927.pdf



Step 4: Mapping of Stakeholders- Typology

Stakeholders mapping

In the Glinščica catchment we first performed mapping of stakeholders by identifying a number of the most important national and local institutions responsible for the different aspects of spatial planning, water management and risk management in the Glinščica catchment. Following the methodology developed in WP3 we then followed the snowball approach by including additional stakeholders that were suggested by the interviewees to the preliminary list of stakeholders.

A list of 33 stakeholders emerged that have been contacted during the last 6 months (**Table 2**), of which:

- 13 interviews were successfully performed, reports are available, and analysis has been performed,
- 1 interview was performed, and we are in the process of drafting a report,
- 10 interviews were rejected after contact,
- we received no response from 5 stakeholders even after several written and phone attempts of contact and
- we are in the process of contacting four additional stakeholders.

The first result of stakeholder mapping shows that an important proportion of stakeholders (45.45 %) were unable or unwilling to participate in the participatory modelling for the Glinščica catchment. Given the fact that the interview takes approximately 1 hour and that all stakeholders were given the freedom to choose the date and venue for the interview, we presume that most of the stakeholders were unwilling to participate. From the responses of these stakeholders, two prevailing reasons for rejection emerged:

- Firstly, several stakeholders don't perceive themselves as stakeholders.
- Secondly, many stakeholders were afraid of the consequences of the interviews despite of our guarantee to protect their privacy. This is especially important for the private companies contracted for implementation of public services and public bodies under pressure from civil societies and/or initiatives.

Of the governmental institutions, the Ministry for Environment and Spatial Planning (MOP) was identified as the most important stakeholder in NBS solution planning in Glinščica catchment, since they are responsible both for transferring Water Framework, Floods, Birds and Habitats Directives into Slovenian legislation as well as implementing them throughout Slovenia. To understand and map the many number of different functions and/or roles of MOP in the NBS solution planning in Glinščica, 12 different departments were identified within the Ministry with whom the interviews were predicted. Unfortunately, only 3 departments agreed to participate in the interviews, 5 were rejected and one never responded. In addition, the Slovenian Water Agency initially suggested we should send the questions to their PIAR service who would provide the answers in written form, but later agreed to the interview with the Sustainable River Engineering Department. We are in the process of contacting the last 3 departments of the Slovenian Water Agency.



Table 2. List of stakeholders identified in the Glinščica catchment.

n°	Institution	Department	Role	Status
1	Ministry of the environment and spatial planning - Slovenian water agency	Sustainable River Engineering Department	public water management services; restoration after flood damage	Report available
		Water Protection and Water Use Department	protection and use of water; chemical and biological pollution control/management	to be contacted
		Spatial and Environmental Document Assessment Department	assessment of spatial and environmental documentation	to be contacted
		The Middle Sava River area division	no description available	to be contacted
2	Ministry of the environment and spatial planning - Water management division	Water and Investments Directorate	Water Management Division	Rejected
			Natural Disaster Reduction Division	Report available
			Division for Decision on the Use of Water and its Protection	Report available
		Spatial Planning, Construction and Housing Directorate	Spatial Planning Division	No response
3	Ministry of the environment and spatial planning - Slovenian environment agency	Hydrology and state of Environment Office	monitoring status of all waters, surface and underground; climate change mitigation	Rejected
		Environment and Nature Conservation Office	nature protection aspects of environment	Rejected
		Office of General Affairs	coordination of the work of Slovenian Environmental Agency	Rejected
		Water Management Office	water management of all water bodies in Slovenia	Rejected
4	Administration for civil protection and disaster relief	Central or the Ljubljana Branch	administrative and professional tasks of organization, preparation and implementation of protection against natural and other disasters	Report available
5	City Municipality Of Ljubljana	Department of Urban Planning	they are responsible for spatial planning of Ljubljana	Report available
		Department of Environmental Protection	responsible for nature conservation in Ljubljana	Report available
		Department for Protection, Rescue and Civil Defense	protection against natural and other disasters for Ljubljana	Report available
		Department for Commercial Activities and Traffic	responsible for financial implementation of natural disaster measures	No response
		Office for Development Projects and Investments	responsible for projects and investments	No response
		Municipality Administration	Deputy mayor's office	Report available
6	Institute of the Republic of Slovenia for Nature Conservation	Ljubljana Regional Unit	leading nature conservation management on the national level	Report available
7	Hidrotehnik - Water management company	Water Management Public Service department – Projektiva - Ljubljana	maintenance of water infrastructure, implementation of emergency measures in times of floods and torrential outbreaks, rehabilitation work following natural disasters, investment maintenance of water infrastructure, dam operation	Rejected
8	The Chamber of Craft and Small Business of Slovenia (OZS)	Counseling services of OZS – environmental protection	consultancy relating to environmental protection for businesses	Rejected
9	Ministry of agriculture, forestry and food	Agriculture Land Management Division	management of agricultural land	Report available
		Climate Change, NGOs, Education and Accounts Division	impact of Climate Change on agriculture	Rejected
10	Chamber of Agriculture and Forestry of Slovenia	KGZS – Zavod Ljubljana	public service activities and professional tasks regarding agriculture consulting	Rejected
11	Fisheries research institute of Slovenia	Freshwater Department	fishery planning, fishing cadaster, fisheries biology, expert opinions in water management	Report available



n°	Institution	Department	Role	Status
12	Fishing club Dolomiti	Fish Manager	management of fish in the waters under jurisdiction of Fishing club Dolomiti (fishing, fish stocking, fish farming...)	Report available
13	Civil initiative for flood protection of SW part of Ljubljana	small, unstructured association	enforcing public participation in the management processes led by governmental organizations	Report available
14	Voluntary fire brigade Podutik - Glince	voluntary organization	firefighting, support and relief during extreme weather events	No response
15	The Dravlje city quarter	voluntary association of residents	enabling direct participation of residents in the management and development of their quarter.	Rejected
16	Plan B	association of the largest environmental NGOs in Slovenia	interpreting public opinion on environmental issues and suggesting policy change accordingly.	to be contacted
17	Institute for spatial policies	an independent research institution and a think tank.	to achieve synergies across a range of disciplines and practises dealing with space and place.	Drafting report
18	Slovenia Forest Service	Slovenia Forest Service	forestry management, wild animals' management	No response



Step 5: Stakeholder analysis. Identifying main problem owner- Responsible authority for solving the gap identified

Stakeholder	Problem perception	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Goals/Aims	Roles and responsibilities- regulatory environment governance mode
Slovenian water agency	Flood risk; limited enforcement of spatial planning; low community risk awareness; damages to the built environment; social vulnerability.	Funded by Ministry of the environment and spatial planning from the National Budget. Issuing Water Permits for any activities related to spaces in or around water bodies and approving Water Maintenance Plans. Cooperates with all ministries and their offices /agencies (e.g. Environmental Agency of Slovenia, Geological Survey of Slovenia), municipalities, development agencies, local communities, Fishing Association of Slovenia, angling clubs, canoeing clubs and NGOs. Hydrology, engineering.	Enhance the control of the territory for preventing unregulated settlements; increase the initiatives for raising awareness; enforce the spatial planning rules in order to control human and assets vulnerability	Provide the best expert solution available for the given challenge.	Responsible for issuing Water Permits and for the preparation of Water Maintenance Plans. Responsible to perform expert studies/basis for the preparation of the national Water Management Plan (RBMP), some parts of the Flood Risk Reduction Plan (NZPO) and some parts of the Water Rehabilitation Plan.
Ministry of the environment and spatial planning – Division for Decision on the Use of Water and its Protection		Funded from the National Budget. Setting the standards - laws, National Plans to be endorsed by the Government. Cooperates with everybody; Slovenian Water Agency, Environmental Agency of Slovenia, the Institute for forestry of Slovenia, Fisheries Research Institute, Institute for Nature Protection of Slovenia, Ministry for agriculture, forestry and food, Ministry for Infrastructure, Ministry for culture, Water Institute of Slovenia, Geological Institute of Slovenia for underground water,... International law, European Directives. Most expert support is outsourced, mostly to Slovenian Water Agency, Institute for Nature Protection or specialized private companies. NA		Good environmental status of waters in Slovenia.	Responsible for the preparation of the national Water Management Plan (RBMP) in accordance with the WFD. They cover water management, waste water treatment, drainage. The Law on Water and its subordinate acts define the process and content of the RBMPs. Coordinate with other water related administrations and plans, like the Flood Protection Plan.



Stakeholder	Problem perception	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Goals/Aims	Roles and responsibilities- regulatory environment governance mode
Ministry of the environment and spatial planning - Water and investments directorate – Sector for natural disaster rehabilitation	Unregulated settlements in the flood plain; limited cooperation among institutional actors; lack of funding for green areas maintenance; damages to the infrastructures; impacts on the community safety; unsustainability of the recovery costs.	Funded from the National Budget. Preparation of Water Rehabilitation Program (Program for elimination of consequences of concrete natural disaster) to be endorsed by the Government. Cooperates with the Slovenian Water Agency, the Directorate for spatial planning working under the same Ministry and municipalities affected. NA	Enhance the enforcement of rules and norms for the management of the territory; increase the initiatives for institutional cooperation; enforce rules for private insurance in order to reduce the recovery costs.	Elimination of consequences of natural disasters.	Responsible for preparation and implementation of the Program for elimination of the consequences of natural disasters. Ministry of the environment and spatial planning is responsible for the preparation of the Rehabilitation Program on things, buildings and land that are owned or operated by the Ministry, owned by public entities whose founder/co-founder is the municipality or owned by the municipality and intended for living, agricultural or commercial activities...
Ministry of the environment and spatial planning - Water Management Division		Funded from the National Budget. Management of watercourses in respect to flooding. NA Hydrology, Engineering.		Eliminate flood risk.	Responsible for the preparation of the Flood Risk Reduction Plan as per the Floods Directive.
Slovenian environment agency		National Budget via the Ministry of the environment and spatial planning. Monitoring and prediction. NA NA		To become a leading, effective and trustworthy environmental institution, capable of disseminating knowledge to other related institutions around the world.	Responsible for monitoring, analysing and forecasting natural phenomena and processes in the environment, and reducing natural threats to people and property. To performs expert, analytical, regulatory and administrative tasks related to the environment at the national level.
Administration for civil protection and disaster relief	Mismanagement of the territory; lack of community risk awareness; damages to the urban infrastructures; damages to the	Funded from the National Budget. Prevent damage and provide safety to people and property during disasters. Ministry of Environment and Spatial Planning, Ministry of agriculture, Forestry and food, Slovenian water agency, Slovenian Environment agency, 23	Enhance the control of the territory for preventing unregulated settlements; protecting the urban infrastructures; increase the initiatives for raising awareness.	Save lives. Coordinate and implement the most essential measures to establish normal living conditions as soon as possible and to prevent further damage and degradation during disaster.	Responsible for planning, regulating and implementing measures of large-scale flooding. The regional center provides information, coordinates and activates services for protection and Disaster Relief.



Stakeholder	Problem perception	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Goals/Aims	Roles and responsibilities- regulatory environment governance mode
	built environment; impacts on the community safety.	municipalities of Slovenia, public utility companies responsible for water management implementation,... NA		To increase population awareness.	
City Municipality of Ljubljana - Department for Urban Planning	Limited enforcement of the spatial planning; lack of community risk awareness; damages to the infrastructures; economic losses.	Funded from the National Budget via the City Municipality of Ljubljana. Defines possible land use and issues construction permits in accordance with the Spatial Plan of the city. Cooperates with other department of the municipality: for civil protection and disaster relief, for Commercial Activities and Traffic and of Environmental Protection. In addition, cooperates with civil initiatives and the Slovenian water Agency, the Institute of the Republic of Slovenia for Nature Conservation , Ministry of Agriculture, Forestry and Food; Institute for Protection of Cultural Heritage, the transport sector, the energy sector (electric company) and public company Vodovod – kanalizacija. Specialized in urban and spatial planning.	Enhance the enforcement of rules and norms for the management of the territory; protecting the urban infrastructures; increase the initiatives for raising awareness.	Enable balanced urban development considering all the different requirements of a modern city. To direct development of Ljubljana into a modern green city offering the highest quality of life.	Responsible for spatial planning of the municipality, including the phase of public participation, governing the spatial development and performing expert studies.
City Municipality of Ljubljana - Department of Environmental Protection	Unregulated settlements in the flood plain; Limited enforcement of the spatial planning; impacts on community safety; damaged to state of ecosystems.	Funded from the National Budget via the City Municipality of Ljubljana. Prepares expert opinions, suggestions, guidelines, environmental impact assessments and other public services for nature conservation within the City Municipality of Ljubljana. Mainly cooperates internally with other departments of the municipality. Biology, Ecology, Nature conservation.	Enhance the control of the territory for preventing unregulated settlements; protecting the river ecosystem.	Conserve natural environment in the municipality.	Responsible for management of public natural and semi-natural areas in the municipality.
City Municipality of Ljubljana - Department for	Unregulated settlements in the flood plain; lack of	Funded from the National Budget via the City Municipality of Ljubljana.	Enhance the control of the territory for preventing unregulated settlements;	Ensuring safety for residents and visitors.	Responsible for updating the plans and measures for flood protection. Organizing courses and training for self-assistance at times of floods.



Stakeholder	Problem perception	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Goals/Aims	Roles and responsibilities- regulatory environment governance mode
Protection, Rescue and Civil Defence	community risk awareness; damages to the built environment; damages to the infrastructures.	Prepares expert opinions and modifications for all municipal plans in relation to disaster risk reduction, guidelines for self-assistance. Coordinates and connects the other departments within the Municipality of Ljubljana, cooperates with responsible national level administrations (ministries and Slovenian Water Agency). NA	increase the initiatives for raising awareness.		Assessing the damage on buildings caused by floods. Coordinating activities with the responsible national administrations.
Institute of the Republic of Slovenia for Nature Conservation	Limited enforcement of the spatial planning; Lack of community risk awareness; impacts on the ecosystem quality; lack of maintenance of the riverbanks; damages to the infrastructures.	Funded from the National Budget. Monitoring and Management of all national protected areas, issuing binding guidelines for implementation in these areas. Cooperates with Fisheries research Institute, fishing clubs, the Slovenian Water Agency and concessionaires like Hidrotehnik, Public water utility companies around Slovenia, NGOs. All biological disciplines, ecology, nature conservation,...	Enhance the enforcement of rules and norms for the management of the territory; increase the initiatives for raising awareness; protecting the ecosystem quality.	Ensure conservation and restoration of designated natural areas and prevent degradation.	Responsible for conducting environmental impact assessment and issuing guidelines for implementation for all national plans, RBMP, FPP, Water management plans, etc.
Hidrotehnik - Water management company		Funded from the National Budget through the yearly contract system. Private company implementing water related public utility services within the concession area. Cooperates with Slovenian Water Agency. Hydrologists, engineers.			Responsible for preparation of the Water Maintenance Plans and project documentation, attaining all required permits, implementing river control service, risk reduction measures, operation of water locks, rehabilitation after floods, etc.
The Chamber of Craft and Small Business of Slovenia (OZS)		NA NA		Support and promote the traditional values of the craftsmanship: hard work, diligence, perseverance, honesty, honor, ethics,	Cooperation with the Government, ministries and the National Assembly in the creation of economic policy and the co-creation of the best legislation for crafts, micro, small and medium-sized enterprises. Connecting, educating and



Stakeholder	Problem perception	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Goals/Aims	Roles and responsibilities- regulatory environment governance mode
		It is a community with a representative body of the crafts, micro, small and medium-sized enterprises. Business, management, craftsmanship.		quality and excellence, knowledge and innovation. Advocates for the preservation of the tradition and the specific features of the craft.	informing their members. Participation in the economic and social dialogue between craftsmen and governmental institutions.
Chamber of Commerce and Industry of Slovenia		NA It is a community with a representative body of the large-sized enterprises and industry. NA Business, management, industry.		Improve the business environment and economic growth in all regions of Slovenia.	Performing strategic activities such as cooperation in the formation of the economic system and economic policies and participation in the economic and social dialogue between entrepreneurs and governmental institutions. In addition to a wide range of various business support services at home and abroad they also perform lobbying activities.
Ministry of agriculture, forestry and food	Limited enforcement of the spatial planning; damages to agricultural productivity; economic losses; impacts on the quality of green areas	From the National Budget. Issues consents or rejects applications for all national or municipal spatial plans involving agricultural land. Cooperates with all ministries, municipalities, farmers and their organizations. Agriculture, forestry, land management	Enhance the enforcement of rules and norms for the management of the territory; increase the protection of the green areas.	Ensure sustainable agricultural production.	Responsible for management of national agricultural areas, providing guidelines and standards for management of agricultural lands, providing subsidies, agricultural cadastre management, coordinating with other stakeholders.
Chamber of Agriculture and Forestry of Slovenia		NA It is a community with a representative body of the farmers and foresters, be natural or legal persons. NA		Protect and represent the interests of natural and legal persons engaged in agriculture, forestry and fisheries. Advise and promote economically and	Responsible for promoting the development of agriculture, forestry and fisheries. Improving economic conditions and performing professional services/support to natural and legal



Stakeholder	Problem perception	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Goals/Aims	Roles and responsibilities- regulatory environment governance mode
		NA		environmentally friendly agriculture, forestry and fisheries. Improve the social conditions of the rural population in Slovenia.	persons engaged in agriculture, forestry and fisheries.
Fisheries research institute of Slovenia		Partially from the National Budget via the Ministry of agriculture, Forestry and food and partially from the market. Issues non-binding expert opinions and guidelines for all national plans and any implementation projects involving fresh or marine waters. Cooperates with all ministries, fishing clubs, municipalities, public utility companies,...		Ensure sustainable exploitation and conservation of fish and their habitats.	Responsible for managing, sustainable exploitation and conservation of fish and fisheries in Slovenia. Prepares and confirms long- and short- term national and local fisheries management plans. Issues expert opinions and guidelines for any national or local implementation plans involving waters.
Fishing club Dolomiti	Lack of territorial control; Unregulated settlements in the flood plain; impacts on the ecosystem quality.	Volunteer based, membership fees, fishign permits sales. Issues permits for any and all activities in rivers and streams under their management. Cooperates with Fisheries Research Isntitute, local residents, the Veterinary Faculty, the Fisheries Inspectorate. Fishing, fish farming.	Enhance the control of the territory for preventing unregulated settlements; protecting the river ecosystem quality.	Ensure sustainable fish management within their territory.	Responsible for fish management in their territory; stocking, fish guard service, intervention fishing, etc.
Civil initiative for flood protection of SW part of Ljubljana		A civil association of local residents in the flood prone area of Ljubljana operating without a budget. Participating as stakeholder in public consultations creating pressure for change in the current water management practices. Transmitting residents' requirements to the administrations, national and local – City Municipality of		Pressure responsible authorities to ensure flood protection to residents.	Act as a liason between local residents and the authorities responsible for flood risk management.



Stakeholder	Problem perception	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Goals/Aims	Roles and responsibilities- regulatory environment governance mode
		Ljubljana, Slovenian Water Agency, Slovenian Environment Agency and some individual hydrologist. No expertise, knowledge about local conditions.			
Voluntary fire brigade		Volunteer based fire brigade receives funding from the municipality, donations, sponsorships, charity events. Providing rescue support during and after natural disasters under the National Fire Brigade Headquarters. The level of authority depends on the capacity and usposobljenost of the memberst of the brigade. May request assistance from qualified professional brigades. Direct communication with Uprava za zaščito in reševanje RS and municipalities. These two institutions are responsible to forward the communication to all utility management services, ministries and other relevant institutions. Specialized rescue expertises.		Save lives and properties. Implement the most essential measures to establish normal living conditions as soon as possible and to prevent further damage and degradation during disaster. To increase population awareness.	Responsible for rescue and protection actions between and after natural disasters. Provide safety to people, animals and property, in this order of priority.
The Dravlje city quarter		NA It is a community of Dravlje residents acting as a liaison between the City Municipality and residents in matters of public concern. NA NA		Ensure high quality living standard for the residents.	NA
Plan B		NA NA NA		NA	NA



Stakeholder	Problem perception	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Goals/Aims	Roles and responsibilities- regulatory environment governance mode
		NA			
Institute for spatial policies		NA NA NA NA		NA	NA
Slovenia Forest Service		NA NA NA NA		NA	NA
Individual spatial planning expert		Private company performing expert studies and drafting spatial plans for municipalities and national administration on contract basis. Suggesting solutions based on expert knowledge and opinion. Cooperate with all of the institutional actors: municipality and national level. Non-institutional actors are only included when necessary to avoid future conflicts. Spatial planning, landscape architecture, urban planning, geodesy.		Ensure spatially harmonized development.	Coordinating conflicting development goals and different uses during the spatial planning process. The proposed solutions must comply with all relevant legislation.

Step 6: 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	Stakeholder	Opening floodplain	Re-meandering	Urban park retention basins	Re-vegetation	Removal of crosswise barriers
+ <						



Influence/Power	Stakeholder	Opening floodplain	Re-meandering	Urban park retention basins	Re-vegetation	Removal of crosswise barriers
	Slovenian Environment Agency	E	E	E	E	E
	The Chamber of Craft and Small Business of Slovenia	N, \$	N, \$	N, \$	N, \$	N, \$
	Chamber of Commerce and Industry of Slovenia	N, \$	N, \$	N, \$	N, \$	N, \$
	Chamber of Agriculture and Forestry of Slovenia	N, \$	N, \$	N, \$	N, \$	N, \$
	Plan B	E	E	E	E	E
	Institute for spatial policies	EE	EE	EE	EE	EE
	Slovenia Forest Service	E	E	E	E	E
	Individual spatial planning expert	E	E	E	E	E

- Key to symbols:
 - o Money (\$) - write \$ to \$\$\$\$ to indicate who should be the main contributors;
 - o Authority (A),
 - o Expertise (E)
 - o Networks (N)



Step 7: Influence and Stakeholder Matrix

An important step is to locate each stakeholder on the matrix below in relation to interest versus influence. This helps to identify the stakeholders where it is more likely to drive the process of NBS adoption if the right incentives are provided.

The most important quadrant corresponds to the high interest and high influence, in the case of Glinščica the main stakeholder therefore is the Institute of the Republic of Slovenia for Nature Conservation, the City of City Municipality of Ljubljana and the Fisheries research institute of Slovenia. Other actors that have influence but low interest like the Slovenian Water Agency and the Ministry of Environment or the Slovenia Environment agency could thus be key actors to be activated for the selection, design, implementation and monitoring and evaluation of NBS.

Step 8: 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
Layer 1: Social Embeddedness: informal institutions, culture, norms, customs, traditions, religion. 100 to 1000 years. Social theory.	Water has always been a right for the people of Slovenia and has also been included in our Constitution since 1977. Therefore, all water related risks and benefits (e.g. providing flood safety, managing water bodies, waste-water treatment, drinking water supply) are considered a responsibility of governmental institutions and should be free of charge. Recent flooding events of 2010 and 2014 have been stated as the main reasons driving the need for enhanced flood risk management in the Glinščica catchment. Historically, Glinščica did not present a flood hazard.	People do not consider themselves as being co-responsible for planning and management of waters. NBS: People are not aware of NBS and so do not distinguish between green, grey and hybrid solutions. The only current measures that they know and believe are effective, is grey solutions.
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.	NBS: It will have to be integrated at least into the Ministry for environment and spatial planning and the Ministry for agriculture, forestry and fisheries. The decisions are made by the funding organizations.	NBS: NBS have not been integrated in Slovenian policy and strategic documents yet, nor the responsibilities defined.
Layer 3: Governance: Play of the game, especially contracts, agreements and negotiations. 1 to 10 years. Transaction cost economics.	Restoration of natural features has been integrated in the Municipality Spatial Plan as one of the priorities in water management in the strategic part of the Plan (Odlok o občinskem prostorskem	There is no planning or implementation of restoration activities.



Institutional Layer	(Institutions that create) incentives for investment and successful implementation of the measure	Disincentives for investment or successful implementation
	načrtu Mestne občine Ljubljana - strateški del) and as conservation of ecological status of water bodies in the implementation part (Odlok o občinskem prostorskem načrtu Mestne občine Ljubljana – izvedbeni del). Glinščica is also one of the priority streams for river restoration in the Program of Fish Management in Freshwaters of Slovenia for the period until 2021 (Program upravljanja..., 2015). Glinščica is not specifically mentioned in the RBMP. The City municipality of Ljubljana leads the commissioning of the tasks, but the Slovenian Water Agency (SWA) of the Ministry for environment and spatial planning is officially responsible to manage the stream. There is a Sava River Basin sector within the SWA that is responsible for coordinate actors in the area. SWA subcontracts the water maintenance works through a system of concessionaires via a 7-year contract, based on a sectoral maintenance plan, further detailed each year for the consecutive year.	
Layer 4: Individual analysis, resource allocation and employment (prices and quantities, inflation, income, incentive alignment). Frequency: continuous. Neoclassical economics/agency theory.	Grey: Landowners are mostly farmers, who are difficult to negotiate with, due to past cases of high collar crime with land acquisition among the municipality/governmental officials. NBS: During the NAIAD public participation process, different options have been discussed with farmers, who were generally inclined towards mutually beneficial solutions.	NBS: NBS is not a generally recognized concept in Slovenia.

Step 9: 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 (floods directive)	There's a difference between who invests and who is responsible. In SLO, the Ministry is responsible and should invest, but is not fulfilling their obligations, so municipalities do what they can	Everybody. The state should not give permissions to build on flood prone areas and people shouldn't try to build on flood prone areas and then require the state to protect them.	Local citizens - housing, insurance companies – all insured assets, municipalities – housing, municipality owned infrastructure, government – national infrastructure and in case of natural catastrophe - housing.	Everybody.	Civil protection headquarters of each municipality and the firefighters. Coordination on national level managed by The civil protection agency. Restoration of nationally owned infrastructure is managed by the Ministry of Environment and individual citizens manage their won recovery. National funds are only available for natural catastrophes, otherwise Ministry for Environment provides funds for recovery. Individual properties either cover their own costs or are co-financed by the insurance if they were insured.	Those that were affected by the flood. Don't know.

Brague institutional characterisation

Step 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 urbanized 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).

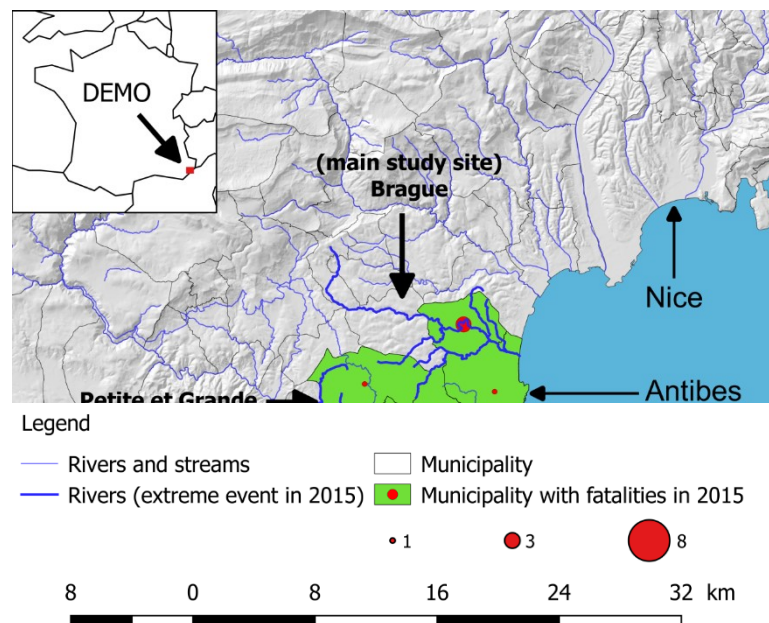


Figure 2. Brague catchment demo site.

Step 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. The figure 2 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).

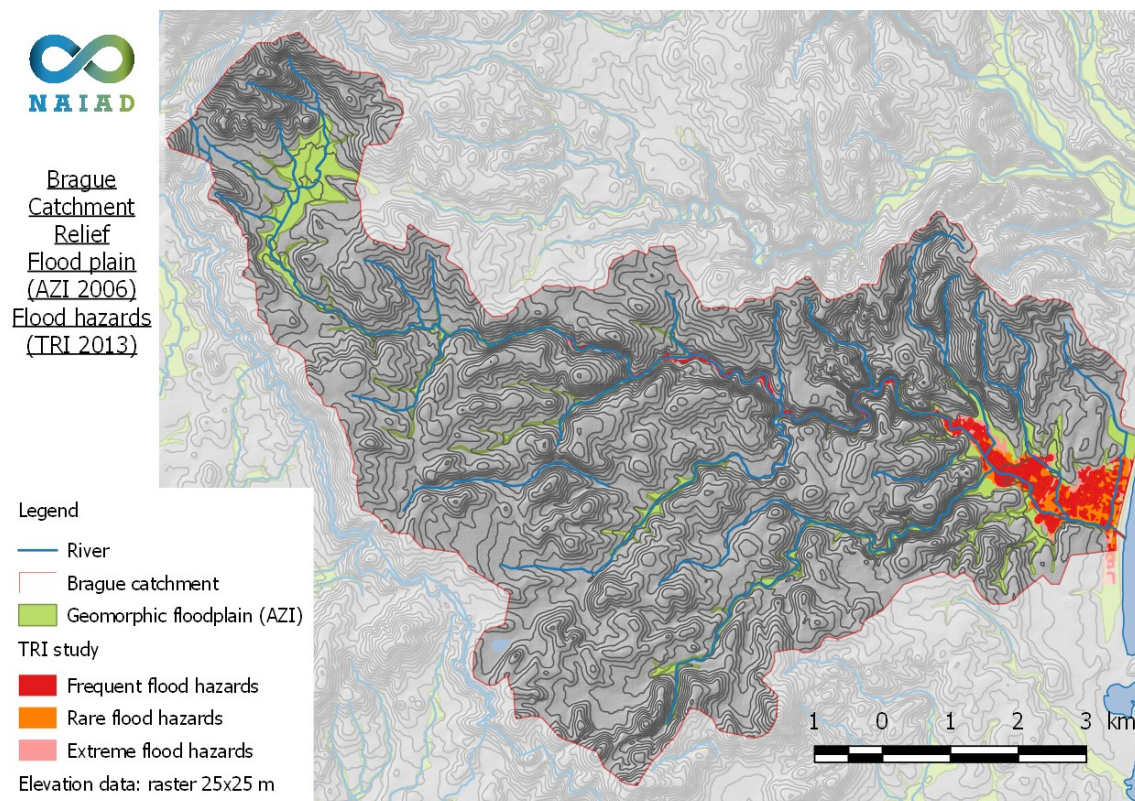


Figure 3. Elevation and flood hazard in the Bague catchment.

Since the early 2000's, the catchment has experimented different flood episodes (**Table 3**). 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 Bague 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 3. Flood experiences in the Bague 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 Bague 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)

Step 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.¹ 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 uses reconversion. To further reduce damages from flood risk in the Bague catchment, the urban community of Sophia Antipolis² (CASA) has planned to secure the banks and widen the minor bed of the Bague 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 4**.

¹ 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)

² This community includes among other, all municipalities in the Bague catchment.



Table 4. 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



Step 4: Mapping of Stakeholder- Typology

This section maps a key stakeholder identified to participate in the first and the second round of interviews.

Table 5. 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
Local public	Conservatoire du littoral
	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
	ESCOTA: highway company
Public and Private Companies /SMEs	Cabinet MERLIN
	CEREMA (Centre d'Etudes et d'expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement)
	IFSTTAR (Institut français des sciences et technologies des transports, de l'aménagement et des réseaux)
NGO	CYPRES
	ASEB-AM
	ORRM-PACA (Observatoire Régional des Risques Majeurs en Provence-Alpes-Côte d'Azur)



Step 5: Stakeholder analysis. Identifying main problem owner- Responsible authority for solving the gap identified

This analysis concerns stakeholders from **table 5** that participated at the first-round interviews.

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 advises 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



Stakeholder	Problem perception	Values (socially accepted behavior)	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Roles and responsibilities- regulatory environment governance mode
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 and Corsica Water Agency)	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 associations including those concerned by water issues); Expertise on ecology, biology and hydrology (Impacts studies, applied and experimental studies, projects funding)	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 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.);	-	Produce information about industrial, technical and natural risks, public authority awareness on risk prevention and preparedness on crisis.



Stakeholder	Problem perception	Values (socially accepted behavior)	Resources/ sources of power Money Authority Networks Relevant expertise	Needs	Roles and responsibilities- regulatory environment governance mode
			Expertise on training, risk diagnostic, risk awareness.		
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 expertise	-	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 sea (Antibes)
CEN-PACA	Flooding/torrential floods, because PPRI (prevention planning of flood risk) are not complied with concerning urban planning	Protection of natural heritage, regional interest.	Funded by public subsidies, donations and income from its activities. Not an authority but influences public opinion; Antibes municipality, Urban community of Sophia Antipolis, ONF RTM, SIAQUEBA Scientific and technic expertise on ecological studies, maintenance et protection of natural habitats, population information and awareness	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 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.

Step 6: 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



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
	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:
 - o Money (\$) - write \$ to \$\$\$\$ to indicate who should be the main contributors;
 - o Authority (A),
 - o Expertise (E)
 - o 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.



Step 7: Influence and Stakeholder Matrix

Step 8: 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
Layer 1: Social Embeddedness: informal institutions, culture, norms, customs, traditions, religion. 100 to 1000 years. Social theory.	DRR Grey: The social belief that Grey infrastructures are the unique solution to flood risk reduction. NBS: Environmental protection and climate change awareness is starting to penetrate in cultural drivers.	DRR Grey: NBS: Low social awareness and acceptance of flood risk; strong social perception of the effectiveness of grey infrastructures
Layer 2: Institutional Environment, formal rules of the game, especially property (polity, judiciary, bureaucracy). 10 to 100 years. Economics of property rights/ positive political theory.	The Water Framework Directive incentive to take preventive measures in general DRR Grey: National solidarity in the financing of DRR management, purely technical approach of the flood risk (vs <i>ecological approach</i>); centralization of flood risk management and limited room for local participation. Existence of explicit incentive mechanisms for the development of DRR Grey (fond Barnier) 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).	DRR Grey: NBS: Standardization of flood preventive measures; criteria of the Barnier fund are too restrictive and hinder the innovative update (table 6 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
Layer 3: Governance: Play of the game, especially contracts, agreements and negotiations. 1 to 10 years. Transaction cost economics.	DRR Grey: In general, Grey infrastructures are more politically persuasive, visible and have immediate efficiency; electoral pressure for urbanization; taxes on touristic activities NBS:	DRR Grey: - NBS: High opportunity costs of land reconversion (the loss local election and taxes revenues); lack of empirical effectiveness of NBS;
Layer 4: Individual analysis, resource allocation and employment (prices and quantities, inflation, income, incentive alignment). Frequency: continuous. Neoclassical economics/ agency theory.	DRR Grey: Believing in the power and efficiency of grey infrastructure; land price and land speculation; revenues from tourism activities including local taxes abatement. - NBS: -	DRR Grey:- NBS: High opportunity costs of land reconversion, no believing in the efficiency of NBS.



Step 9: Choice of Governance mode and Funding and gaps

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 with urban planning rules.	Citizens (victims of flooding) Businesses (commerce tourism, transport) Département des Alpes Maritimes	Citizens (victims of flooding) Businesses (commerce tourism, transport) Département des Alpes Maritimes	DDTM-AM Force 06 ONF RTM (national Forest Office - Torrent control service) SIAQUEBA/Urban community (CASA) Municipalities, etc.	Citizens (victims of flooding) Businesses (commerce tourism, transport) Département des Alpes Maritimes

Conclusion and next steps

This deliverable has provided a methodology applied to three of our nine demos on how to undertake an integrated institutional analysis which will then be further developed and used in the development of the Handbook for Financing framework and the Natural Assurance canvas in WP7.

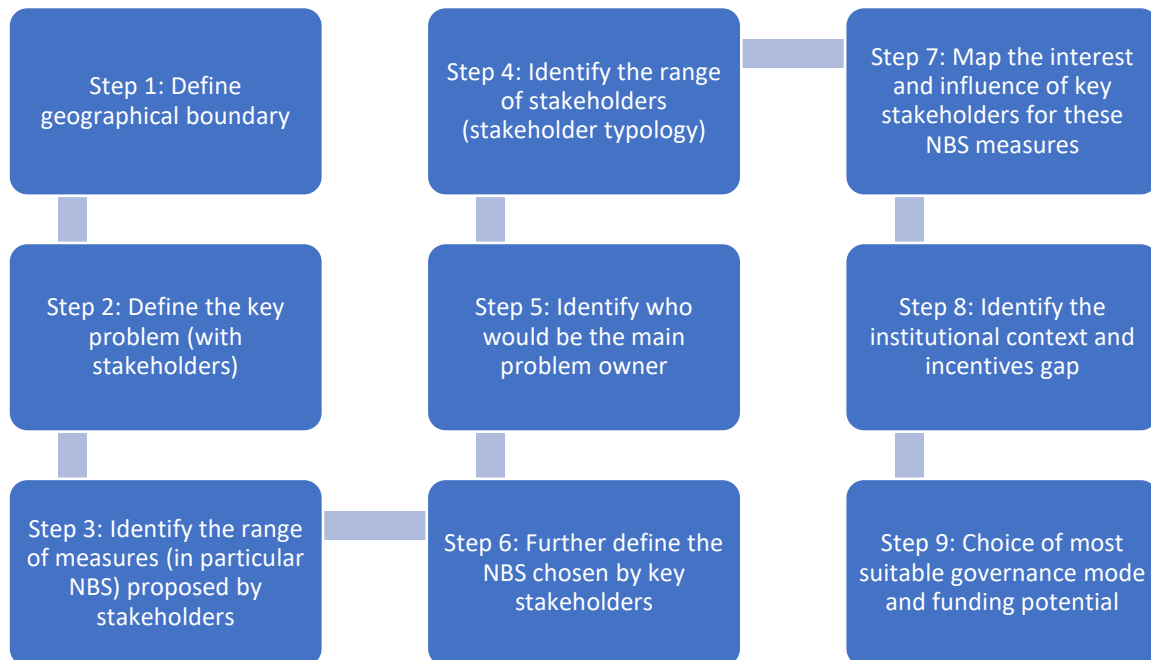


Figure 4. Summary of Institutional characterization and implications for incentive framework for NBS adoption.

This analysis prepares the ground on the underpinning institutional incentives to the cost benefit analysis undertaken in WP4 on who carries the costs of the problem and who would benefit from the action, and the quantification of costs and benefits (D4.4. and D6.3). Thus, this institutional mapping -who is in the best position to act from a power and interest point of view- can then help identify potential institutional arrangements and bundled incentives schemes for the implementation of the NBS (who can or would implement).

The methodology laid out in this deliverable will be further developed in the Handbook for financing which sets the basis for the analysis of potential financing for these implementation arrangements (D7.3). Also for the value capture identified in the natural assurance schemes on the demand and the supply for the adoption of NBS for our specific demo and their institutional contexts D7.2 and D7.4.



Annex: additional information on Institutional context

Table 6. Subsidies from the Barnier Fund to implement RPP's vulnerability reduction measures

For whom? The beneficiaries		Local authorities		Natural or legal person (Individual or companies with less than 20 employees)		
For what? The studies, works and subsidized acquisitions	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? Variable rates 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? Depending on the nature of the risks	Serious threat to human lives Acquisition expenses of properties, lower than the average cost of safeguarding and population protection Property covered by a “multi-risk home insurance” including the “natural catastrophe” guarantee	Assets covered by an insurance contract including the guarantee against the 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	Communities covered by a prescribed or approved PPR Assets covered by a “multi-risk home insurance” if the envisaged operations concern directly the property exposed to natural hazards	Reconnaissance operation: proven dangers for buildings and human lives Filling operation: serious threat to human lives and cost of works less than the cost of expropriation compensation	Assets covered by a “multi-risk home insurance” and existing at the date of approval of the PPR if the envisaged operations concern directly the property exposed to natural hazards.	
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 recommendations.