Vipava River Basin Adaptation Plan

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Part I & II

BeWater

Society Adapting to Global Change

Vipava River Basin Adaptation Plan

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Preface

Climate change projections for the Mediterranean region estimate an increase in water scarcity and drought episodes, as well as more frequent floods and other extreme weather events . There is a high likelihood that these events will evoke substantial socio-economic losses and negative environmental impacts if no action is taken to support territories' adaptation efforts. Furthermore, changes in population and land use, such as urban expansion or the abandonment or intensification of agriculture, also affect the response of territories to these events. In this context, sustainable water management strategies are urgently needed as they will enhance the resilience of socio-ecological systems, referring both to society and the environment.

Current water management practices focus on the river basin level as the natural geographical and hydrological unit. Resilient water management strategies focusing on the river basin can respond to pressures within this unit in an appropriate way, while trying to minimize disruptions to the socio-ecological systems.

'Making Society an Active Participant in Water Adaptation to Global Change' (BeWater) is an EU-funded project which responds to the above challenges by promoting dialogue and collaboration between science and society for sustainable water management and adaptation to the impacts of global change. The BeWater project, taking place from 2013 to 2017, focuses on the design of adaptive water management approaches at a river basin scale in the Mediterranean region. More specifically, the project aimed to develop a river basin adaptation plan for each of four pilot case studies, namely for the Tordera (Spain), Pedieos (Cyprus), Rmel (Tunisia) and Vipava (Slovenia) River Basins. These basins are representative of various Mediterranean conditions with regards to climate, topography, environment, socio-economic and political conditions, land use and water demands.

The adaptation plans were developed in a collaborative process according to a common methodology developed within BeWater, and utilising existing information on the local dynamics of global change. Over the course of the three and a half-year project, the subsequent plan and the plans of the other three pilot cases were co-produced by experts and stakeholders in the respective river basins as well as with scientists and experts from within the BeWater consortium, with guidance from the project's advisory board.

The four river basin adaptation plans (RBAPs) aim at fostering adaptation to global change within the four basins, and serve as a reference for other basins within the Mediterranean region and beyond, that wish to increase their resilience and undertake such a participatory development process. To facilitate the transferability potential, the BeWater project is also producing a handbook presenting lessons learned from throughout the development process.

The present plan is a document designed by the Slovene partners and stakeholders. It outlines the adaptation action for the Vipava river basin.

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Executive Summary

Within the BeWater project (funded by the European Union through the 7th Framework Programme), a River Basin Adaptation Plan was developed for the Vipava river basin to integrate global changes in river basin management. The plan is a guiding document for stakeholders in water use sectors and affiliated policy areas acting in the river basin. The specific aim of this river basin adaptation plan is to increase the resilience of the social and ecological system of the Vipava river basin and to facilitate a proactive response to emerging global changes and related challenges. Therefore, the objective of the adaptation plan is the delineation of water management options that aim to implement sustainable water management in the Vipava river basin for the period until 2030.

In the Vipava river basin, citizens have little awareness of the challenges that they and the environment are facing due to global changes. To start the awareness raising process, stakeholders from the Vipava river basin determined appropriate strategies for management of the Vipava river basin guided by local and international experts. The plan is thus the result of a bottom-up approach in which researchers interacted with stakeholders to identify how pressures from climate change, land use, and elsewhere could be tackled best. During the development process 114 stakeholders provided concrete input regarding the process of formulating and evaluating water management options, as well as identification of adaptation strategies in several stages of a participatory process that included (a) three professionally facilitated workshops, (b) follow-up interviews, (c) individual and group sessions, and (d) an additional open consultation.

Based on stakeholder knowledge and scientific information, three water-related challenges and 20 water management options that would tackle these challenges and support the adaptation process were identified. The majority of options (16) were identified to cope with the challenge of water availability during droughts in the growing season (challenge A), followed by 13 options coping with the appropriate water quality (challenge C). Half of the options (ten out of 20) were identified to address the challenge of reducing flood risks (challenge B); however several options are addressing more than one challenge. To maximise the synergistic benefits among the individual options and to increase their effectiveness, seven different complementary sector-based bundles of options were defined. Within the bundles, stakeholders indicated also the optimal timing for implementing the options over the short, medium and long-term.

According to stakeholders' preferences, implementation-oriented factors such as multi-criteria analysis, the implementation of options regarding the challenges, feasibility, acceptability, and policy synergies, five water management options were assigned the highest priority for the implementation process: a) *Establishment of an inter-municipal expert working group*, b) *An awareness campaign for the local public*, c) *Construction of water reservoirs*, d) *An awareness campaign for water management experts*, and e) *Improving the financing system for water infrastructure*. These options should therefore be highlighted when considering adaptation actions in the Vipava river basin. The majority of recommended options represent a soft approach to adaptation, which achieved the highest preference of stakeholders, having low implementation and operational costs and the best outcome for all three identified challenges of the Vipava river basin. Although the option *Construction of water reservoirs* has the best evaluation outcome for the two identified challenges of the Vipava river basin, the option is a technical solution (grey approach to adaptation) with high implementation costs. As such it is also involved with low feasibility or even conflicts with the objectives of Water Framework Directive.

To assure the successful implementation of individual water management options or bundles of options, the development and execution of a monitoring plan including sound indicators is crucial. Hence the alignment of existing monitoring plans with the objective to monitor the implementation of water management options should be considered.

Povzetek

V okviru projekta BeWater (ki ga financira Evropska unija v okviru 7. okvirnega programa) je bil razvit načrt prilagajanja porečja reke Vipave z namenom vključitve globalnih sprememb pri upravljanju porečij. Načrt je ključni dokument namenjen zainteresiranim deležnikom na strani uporabnikov vode in povezanih področij politike, ki delujejo v porečju reke Vipave. Poseben cilj tega načrta je povečanje prilagodljivosti socialnega in ekološkega sistema porečja reke Vipave ter omogočanje proaktivnega odziva na nastajajoče globalne spremembe in s tem povezane izzive. Med drugim je cilj načrta prilagajanja predstavitev možnosti upravljanja voda, ki so namenjene izvajanju trajnostnega upravljanja voda v porečju reke Vipave za obdobje do leta 2030.

V porečju reke Vipave se prebivalci premalo zavedajo izzivov globalnih sprememb, s katerimi se soočajo tako oni sami kot njihovo okolje. Da bi pospešili proces ozaveščanja, so zainteresirani lokalni deležniki s pomočjo domačih in tujih strokovnjakov določili ustrezne strategije za upravljanje porečja reke Vipave. Načrt prilagajanja je torej rezultat pristopa od spodaj navzgor, v katerem so raziskovalci sodelovali z zainteresiranimi deležniki, da bi skupaj ugotovili, kako bi na najboljši način reševali pritiske zaradi podnebnih sprememb, rabe zemljišč in ostalih dejavnikov. Tekom postopka je skupno 114 deležnikov podalo konkretne prispevke k procesu oblikovanja in vrednotenja možnosti upravljanja voda, kot tudi k opredelitvi strategij prilagajanja na različne načine in v več korakih, vključno z: (a) tremi strokovno vodenimi delavnicami, (b) naknadnimi intervjuji, (c) individualnimi in skupinskimi sestanki ter (d) dodatnim javnim posvetom.

Temelječ na poznavanju problematike s strani zainteresiranih deležnikov ter znanstvenih dognanj so bili prepoznani trije glavni izzivi in 20 možnosti upravljanja voda, ki bi reševale te izzive in podpirale proces prilagajanja. Večina možnosti (16) je bilo prepoznanih na področju spopadanja z izzivom razpoložljivosti vode med sušnimi obdobji v rastni dobi (izziv A), ki mu sledi 13 možnosti spopadanja z ustrezno kakovostjo vode (izziv C). Polovica možnosti (10 od 20) je bilo opredeljenih na področju zmanjševanja poplavne ogroženosti (izziv B). Vsekakor pa več možnosti obravnava več kot en izziv. Z namenom povečanja skupnih koristi posameznih možnosti upravljanja in povečanja njihove učinkovitosti, je bilo opredeljenih sedem različnih sektorskih svežnjev. V okviru teh svežnjev so zainteresirani deležniki nakazali tudi optimalni časovni okvir za izvedbo posameznih možnosti v kratkoročnem, srednjeročnem in dolgoročnem časovnem obdobju.

Glede na večjo naklonjenost deležnikov in dejavnikov glede uvajanja možnosti kot so npr. analiza več meril, učinek možnosti na prepoznane izzive, izvedljivost, sprejemljivost in sinergije politik, je bilo petim možnosti upravljanja voda dodeljena najvišja prioriteta pri samem postopku uvedbe in sicer: a) *Oblikovanje medobčinske strokovne delovne skupine za porečje reke Vipave*, b) *Kampanja ozaveščanja lokalne javnosti*, c) *Izgradnja vodnih zadrževalnikov*, d) *Kampanja ozaveščanja o trajnostnem upravljanju voda, namenjena strokovnjakom s področja upravljanja površinskih voda* in e) *Izboljšanje sistema financiranja vodne infrastrukture*. Posledično je potrebno poudariti te možnosti pri obravnavi ukrepov prilagajanja v porečju reke Vipave. Večina priporočenih možnosti predstavlja mehak pristop k prilagajanju, katerim so zainteresirani deležniki dali najvišjo prioriteto, povzročajo nizke stroške uvedbe in obratovanja in imajo najboljši izid za vse tri prepoznane izzive porečja reke Vipave. Čeprav je možnost gradnje vodnih zadrževalnikov dosegla najboljši ocenjeni rezultat za dva ugotovljena izziva, pa ta možnost predstavlja tehnično rešitev (sivi pristop k prilagajanju) z visokimi stroški izvedbe. Kot taka, je tudi slabše izvedljiva ali celo v nasprotju s cilji okvirne Vodne direktive.

Za zagotovitev uspešnega izvajanja posameznih možnosti upravljanja voda ali svežnjev možnosti, je ključnega pomena razvoj in izvedba načrta spremljanja ter vključitev smiselnih kazalnikov. Zato je treba razmisliti o uskladitvi obstoječih načrtov spremljanja s ciljem spremljanja izvajanja možnosti upravljanja voda.

Glossary of key terms

- **Acceptability (as criteria for water management options) -** an option is considered as acceptable if there is not significant reason a priori for actors in the basin to reject the option, e.g. because of its design [1]
- **Adaptation pathway -** portrays a sequence of actions and their implementation prioritisation over the short, medium and long-term, with regards to achieving a set of pre-specified objectives under uncertain changing conditions [2]
- **Adaptive management -** an approach to reduce ecological uncertainty and increase resilience by emphasising that management regimes should be regularly adjusted to changes in the ecological system being managed and to managers' evolving understanding of this system
- **Bottom-up approach -** entails the participation of local actors in decision-making about the selection of the priorities and actions to be pursued in their local area; the approach can interact and be combined with top-down approaches from national and/or regional authorities in order to achieve better overall results [3]
- **Challenge -** something that by its nature or character serves as a call to a special effort; the RBAP focuses on the challenges related to the impacts of global change in the river basin - now and in the years to come
- **Climate change -** any long-term change in climate over time, whether due to natural processes or as a result of human activity [4]
- **Climate change adaptation -** appropriate action to prevent or minimise the damage that climate change impacts can cause, or taking advantage of opportunities that may arise due to climate change [5]
- **Climate change scenario -** the difference between a climate scenario (i.e. a plausible and often simplified representation of the future climate) and the current climate [6]
- **Co-benefits (as criteria for water management options) –** options are considered to have co-benefits when their combined implementation amplifies the total impact-related benefits, as compared to the benefits which would arise from implementing each option individually
- **Environmental flow regime** - describes the amount of water that is needed by the river ecosystem to sustain its natural functioning
- **Extreme weather event** - an average of a number of weather events over a certain period of time, an average which is itself extreme (e.g. rainfall over a season) [7]
- **Feasibility (as criteria for water management options) -** an option is considered as feasible if physical, technical, regulatory or organizational obstacles are not existing or can be easily overcome during option's implementation [1]
- **Flexibility (as criteria for water management options) -** an option is considered flexible when it can be adjusted/ complemented or reversed when it turns out to be inadequate or inappropriate in practice [1]
- **Fuzzy cognitive map -** a tool to graphically represent the knowledge about or the perception of a given system; can be converted into simple mathematical models to run simulations and calculate outcomes of possible scenarios to facilitate the discussion and exploration of complex issues [8]
- **Global change** - changes in the global environment that may alter the capacity of the Earth to sustain life, encompassing climate change as well as other critical drivers of environmental change that may interact with climate change, such as land use change, population trends, the alteration of the water cycle and changes in ecosystem functionality [9]
- **Good status (of a water body)** – a term to describe a condition under which water bodies have the biological and chemical characteristics expected under sustainable conditions [10]

- **Governance -** the way rules, norms and actions are produced, sustained, regulated and held accountable; it refers to the processes of interaction and decision-making among the actors involved in a collective problem that lead to the creation, reinforcement, or reproduction of social norms and institutions [11]
- **Green measures -** ecosystem-based approaches that are using green infrastructure to address three identified challenges. Four options in the RBAP fit in green measures category
- **Grey measures –** measures related to the tehnological and engeniring solutions that include improvements in water availability, water quality or flood risk reduction. Seven options in Vipava River Basin Adaptation Plan fit in grey measures category
- **(Invasive) alien species –** plants, animals, pathogens and other organisms that are non-native to an ecosystem, and which may cause economic or environmental harm or adversely affect human health [12]
- **Impact assessment –** a method to identify the environmental, social and economic impacts of an action or project prior to decision-making
- **Implementation barrier or opportunity -** elements deriving from the implementation context influencing the foreseen or ideal development of an action
- **Integrated River Basin Management -** Integrated river basin management (IRBM) is the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximise the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems
- **Karst -** a special type of landscape formed by the dissolution of soluble rocks, including limestone, dolomite and gypsum; it is characterised by underground drainage systems with sinkholes and caves; Karst regions contain aquifers that are capable of providing large supplies of water [13]; subterranean drainage may limit surface water with few to no rivers or lakes
- **Knowledge transfer –** the process of engaging with researchers, decision-makers or the community and decision-makers to generate, acquire, apply and make accessible the knowledge necessary to successfully develop and enhance evidence-based initiatives which enhance human, material, social and/or environmental wellbeing [14]
- **Meander -** a bend in a watercourse or river formed by erosion on the outer banks due to the flow of moving water and resulting in a winding watercourse; when a meander gets cut off from the main stream, an oxbow lake forms
- **Multi-criteria analysis -** a tool for supporting complex decision-making situations with multiple and often conflicting objectives (e.g. economic, ecological and social) that stakeholder groups and/or decision-makers value differently [15]
- **Mutual learning -** a learning process experienced and shared by different actors developed through direct interactions; the process is conducive to adaptive water management and includes the exchange of information on technical features of river basin management, scientific findings, as well as political aspects, so as to arrive at a shared understanding of issues and possible solutions
- **Oxbow lake -** a crescent shaped body of water lying alongside a winding river; formed when a wide meander from the main stem of a river is cut off [16]
- **Participatory co-creation -** an approach which integrates all stakeholders in the entire design process of an action, i.e. problem definition, solution generation, evaluation of proposed solutions during development, and implementation of solutions, to help ensure the result meets user needs and increase acceptability
- **Policy framework -** a broad set of laws, regulations, or processes that structure political, social, cultural or economic activities in a society; these policies form an interacting web and therewith

impact the functioning of exiting policies as well as new policy developments and policy amendments [17]

- **Pressure -** anthropogenic factors inducing environmental change (impacts), including for example the release of substances (emissions), physical and biological agents, the use of resources and the use of land by human activities [18]
- **Resilience -** the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change [19]
- **River basin -** the area of land from which all surface water runs off through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta; it is a natural geographical and hydrological unit that is used e.g. by the European legislation to manage a single drainage area [20]
- **River Basin Adaptation Plan -** management plans containing a series of basin-specific options for enhancing the resilience of the basin's water resources as well as societal resilience in the face of global change. They include an analysis of the options' implementation over time and present a range of further aspects relating to these options, such as implementation opportunities and co-benefits between the options.
- **River Basin Management Plan -** document including the objectives for a given river basin district and the programme of actions required to meet these objectives; the aim is to protect, improve and sustainably use the water environment; these plans are a requirement of the European Water Framework Directive
- **River Basin District** - the area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters [21]
- **Robustness (as criteria for water management options) -** an option is considered robust to uncertainties if it can maintain its effectiveness under different climatic and socio**-**economic development scenarios [1]
- **Sediment management -** organized and coordinated actions to reduce the impact of human activities or natural changes on the quantity and quality conditions of solid material that is or can be transported by or deposited from the river's water [22]
- **Shelterbelts -** a row of trees planted across the direction of wind to deflect and reduce wind speed without causing turbulence; generally, provide protection from desiccating winds to the extent of 5 to 10 times their height on windward side and up to 30 times on leeward side, thus reducing evaporation losses and wind erosion [23]
- **Socio-ecological system –** consists of 'a bio-geophysical' unit and its associated social actors and institutions; delimited by spatial or functional boundaries surrounding particular ecosystems and their problem context [24]
- **Soft measures –** measures related to governance changes and are including policy approaches, raising awareness, monitoring systems and other "soft" approaches. Nine water management options in the river basin adaptation plan fit in green measures category
- **Stakeholder** - any person, group or organisation with an interest or "stake" in an issue, either because they will be affected or because they may have some influence on its outcome; the term is usually reserved for well-organised and active groups and organisations, thus making a distinction from the general public
- **Water management option –** activity developed within the scope of the BeWater project which aims to impact the interactions between water uses and the water body; can be characterised as nature-based approaches (enhancing natural regulation of ecosystem functionality), soft approaches (acting on management or policy norms and regulations) or technical approaches (developed through engineering)

- **Water scarcity –** a lack of sufficient available or safe water resources to meet water needs within a region; this can involve water stress, water shortage or deficits, and water crisis as a result of climate change, increased pollution, or increased human demand and overuse of water [25]
- **Watershed -** the area of land that catches rain and snow and drains or seeps into a marsh, stream, river, lake or groundwater; this area is typically smaller than a river basin, meaning that several watersheds may comprise a single river basin [26]

List of acronyms

ARSO	Agencija Republike Slovenije za okolje (Slovenian Environmental Agency)
CAP	Common Agricultural Policy
CS	Case Study
DRSV	Direkcija Republike Slovenije za vode (Slovenian Water Agency)
EIA	Environmental Impact Assessment supported by Environmental Protection Act (Official Gazette of RS, no. 39/06 - consolidated text, 49/06 - ZMetD 66/06 - dec. U.S. 33/07 - ZPNačrt, 57/08 - ZFO-1A, 70/08, 108/09, 108/09 - ZPNačrt-A, 48/12, 57/12, 92/13 and 56/15) and with Decree on the activities (interventions) for which an environmental impact assessment is mandatory (Official Gazette of RS, no. 51/41)
FCM	Fuzzy Cognitive Map
FFP	Fisheries and Farming Management Plan
FRMP	Flood Risk Management Plan 2015-2021 (FRMP) and Programme of Measures (in preparation)
GeoZS	Geological Survey of Slovenia, Ljubljana
HQ	The higherst discharge observed – extreme; an example of HQ 50 - the flood extent is given for return period of 50 years, extreme weather event
IzVRS	Inštitut za vode Republike Slovenije (Instutute for Water of the Republic of Slovenia)
MCA	Multi-criteria Analysis
MKGP	Ministrstvo za kmetijstvo, gozdarstvo in prehrano (Ministry of Agriculture, Forestry and Food)
MOP	Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning)
PMFIWRS	Programme for the Management of Fish in Inland Waters of the Republic of Slovenia
RB	River Basin
RBAP	River Basin Adaptation Plan
RBMP	River Basin Management Plan for period 2015 - 2021 (slo: “NUV II” implementation of the WFD) – in preparation
RDP	Rural Development Programme
SEA	Strategic Environmental Assessment also known as comprehensive environmental impact assessment supported by Environmental Protection Act (Official Gazette of RS, no. 39/06 - consolidated text, 49/06 - ZMetD 66/06 - dec. U.S. 33/07 - ZPNačrt, 57/08 - ZFO-1A, 70/08, 108/09, 108/09 - ZPNačrt-A, 48/12, 57/12, 92/13 and 56/15) and with Decree laying down the content of environmental report and on detailed procedure for the assessment of the effects on certain plans and programmes on the environment (Official Gazette of RS, no. 73/05)
WFD	Water Framework Directive; Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy
WMO	Water Management Option
WWTP	Wastewater Treatment Plant

PART 1

1 Introduction

1.1 Introduction

The Vipava river basin is a part of the Soča river basin and belongs to the Adriatic sea basin district. The climate of the Vipava river basin is a sub-Mediterranean type, with mild winters and hot summers. The Vipava river basin is constantly influenced by a warm and humid southwestern wind and by the cold and gusty northeastern bora wind, especially in the cold half of the year. According to the trends in the discharges for the Vipava river basin, a decrease in low and mean annual discharge has been observed [27]. Climate change projections show an increase in average annual temperatures and decrease in precipitation. Hence, an additional decrease in low and mean discharges are expected with high probability.

The Vipava river basin as well as other river basins in Slovenia are managed at the national level with the River Basin Management Plan (2009 - 2015) [28] and its Program of Measures in force [29], according to the Water Framework Directive [21]. Nevertheless, the Program of Measures is addressing adaptation to climate change at too general and declarative level so as to support the development of concrete water management strategies and actions. These strategies and actions are needed to increase the resilience of the socio-ecological system of river basins.

Beside the River Basin Management Plan, there are also other sectoral strategic plans related to water management, like for example the flood risk management plan, Natura 2000 Management Programme, and other sectoral documents in agriculture and forestry. As such, these plans should be harmonized with the River Basin Management Plan. Therefore, in the process of developing the Vipava river basin adaptation plan, existing water related sectoral strategic plans must be considered in order to help all the river basin authorities and other relevant actors develop adaptive and harmonized strategies, plans and actions.

To maximise the effectiveness of these sectoral strategies, regional and local characteristics must be considered and local communities must be engaged in developing these strategies. Profund participatory approaches are often missing in policy making (e.g. for designing river basin management plans). Furthermore, many institutions act behind closed doors, making it impossible for the local society (e.g. via NGOs) to participate and discuss already in the early phases of planning and designing of measures.

To begin the integration of global change in the river basin's management at the local level, innovative bottom-up approaches have been tested. By promoting an iterative dialogue and mutually educational collaboration processes between science and society, the process of river basin adaptation plan (RBAP) development is moving away from expert-dominated adaptation planning towards a process that will support the co-design of adaptation responses by stakeholders and scientists. The specific aim of this river basin adaptation plan is to increase the resilience of social and ecological systems linked to the Vipava river basin and to allow a proactive response to emerging global changes and related challenges. There are many initiatives across the world that have started to integrate global change in water management planning at multiple levels. Nevertheless few attempts have been made to integrate global change in river basin management as proposed by the present document.

Text box 1: Definition of RBAP

The BeWater River Basin Adaptation Plan (RBAP) is a management plan containing a series of basin-specific options for increasing the resilience of the basin's water resources as well as societal resilience in the face of global change. It includes an analysis of the options' implementation over time and presents a range of further aspects relating to these options, such as implementation opportunities and co-benefits between the options.

1.2 Objectives and vision

Future climate change projections for the Euro-Mediterranean region estimate an increase in water scarcity and droughts, causing substantial socio-economic losses and environmental impacts. Foreseen global change and recognized existing conflicts among water-related objectives (e.g. improving flood/erosion risk protection, optimizing water use, improving ecological status) are a challenge for developing an integrated and sustainable water management.

The vision for the river basin adaptation plan is to strenghten the resilience of the river basin against the impacts of global changes and to better manage conflicts between sectors. In accordance with the so-called Integrated River Basin Management [30], a long-term inter-sectoral cooperation at the river basin level must be established. Such cooperation can provide a framework for harmonized and feasible strategic planning not only at the national level but also regional and local levels. Long-term inter-sectoral cooperation on adaptation should also:

- assure participation of all river basin authorities and other relevant actors on the basis of equal inter-sectoral partnership;
- assure good knowledge of the socio-ecological systems in and around the basin, especially through iterative dialogue and mutual learning processes between scientific disciplines and society;
- develop all relevant documents (e.g. policies, strategies, projects) in an integrated manner;
- incorporate communities and stakeholder participation into the planning and management processes;
- improve awareness and shared responsibility;
- establish a system to assess whether or not the river basin is being managed sustainably.

In order to make adaptation strategies credible, informed and achievable, they need to be developed in close and continuous consultation with a diversity of stakeholders, sectors and policy areas in the river basin. Within such a long-term cooperation framework, global change impacts can be managed in a more efficient and sustainable way together with prioritizing concrete adaptation actions that can give inter-sectoral synergic benefits.

According to the statement above, the main objectives for the Vipava River Basin Adaptation Plan are:

- to raise public awareness on the importance of sustainable water management, considering the expected impacts of global change at the river basin scale;
- to promote the importance of the involvement of the local stakeholders from various disciplines and levels of practical involvement;
- to identify current water uses, related problems, and potential solutions through the involvement of the communities within the Vipava river basin;

- to prepare, analyse and assess adaptation options which can increase the capacity of the Vipava river basin to adapt to the impacts of global change and other pressures on water resources;
- to support sustainable water management in the long-term by providing recommendations for strengthening the resilience of the river basin's society to global change and improving governance for adaptation.

To address these objectives, the Vipava River Basin Adaptation Plan was developed through an iterative process of mutual learning, participatory techniques, and a bottom-up approach to ensure that stakeholders play an active role in developing appropriate strategies for the management of the Vipava river basin. During this process a total number of 114 stakeholders participated in workshops, consultations, and interviews to express their interest in and views on managing water-related challenges in the Vipava river basin. The participatory workshops led to the identification of three water-related challenges and 20 water management options that would tackle these challenges and support the adaptation process.

1.3 Overview of content

Following the introductory section, chapter 2 presents details on current and possible future state development of the main socio-ecological systems (land, climate and water, biodiversity, and people) in the Vipava river basin and the context for policy context. The main challenges identified throughout the participatory approach are included in this chapter. Chapter 3 provides a short overview of the methods used to identify, formulate and evaluate water management options with a graphical component, a list of water management options and a more detailed description of the river basin adaptation plan planning process with information on the stakeholder engagement process. Chapter 4 presents the adaptation actions prepared for the Vipava river basin in a form of seven sector specific bundles together with monitoring and evaluation. Chapter 5 concludes with the recommendations for policy/decision makers on priority water management options. Part 2 of the river basin adaptation plan includes a detailed description of the 20 Water Management Options. Engagement and dissemination activities taking place in the Vipava river basin are presented in Annexes I and II.

2 Vipava River Basin

After a short introduction to the Vipava river basin, this chapter provides an overview of the current state and expected future state of Vipava's land use and industry activity, climate and water, people, and water uses. The expected future state or so called dynamics are presented mainly for the climate of the Vipava river basin and for resulting water availability. This chapter also includes an overview of the main flood areas in the Vipava river basin that were identified in the transposition of the Floods Directive [31] into Slovenian legislation. In addition, relevant legislation and policies are listed and described. This chapter concludes with an overview of the main challenges identified for tackling global change in the Vipava river basin.

2.1 Current status and dynamics

2.1.1 Geography and geology

The Vipava river basin is located in south-west Slovenia covering an area of 589 km2. The upper part of the Vipava river basin includes the Vipava River spring and the catchment area of its main tributaries Močilnik, Bela, Hubelj, and Lokavšček. The lower part of the Vipava river basin starts where the Branica River flows into the Vipava River and it includes the Vipava River and the catchment area of its main tributaries Lijak, Vrtojbica, and Branica (see Figure 1). Just after the Vrtojbica River flows into the Vipava River (near the town Miren), the Italian state border forms a virtual boundary around the Vipava river basin. Soon after the state border the Vipava River flows into the Soča River.

Geologically, the Vipava Valley is composed of tertiary and quaternary alluvial sediments where the soil is quite fertile. The mountain range that envelops the valley in the north is a massive Mesozoic limestone accretion, covered by a thin and unstable layer of flysch. For this reason, landslides are common on the steep slopes during heavy rainfall events. The elevated but much lower plateau to the south is largely of more or less pure limestone from the Mesozoic era [32]. Both limestone plateaus lack surface water and all the water sinks into ground creeks and canyons, only to emerge again just above the impermeable valley bottom.

In general, water management in such karstic regions is difficult, as the groundwater behaves similar to surface water streams and may be affected by sources of pollution that are distant and difficult to locate. Moreover, the water's self-purification capabilities in comparison to non-karstic regions are extremely limited due to the lack of proper natural filters (e.g. lush vegetation, a thick layer of soil, layers of sand and gravel underneath, etc.).

Due to the fact that the Vipava river basin hinterland is sparsely populated and with the exception of a small number of pastures (the Trnovo Forest and the Nanos and Hrušica Plateaus), the waters in the surrounding karstic regions of the Vipava river basin do not experience large-scale pressure. However, a noticeable number of vineyards in the karst region could to some extent exert environmental pressure.

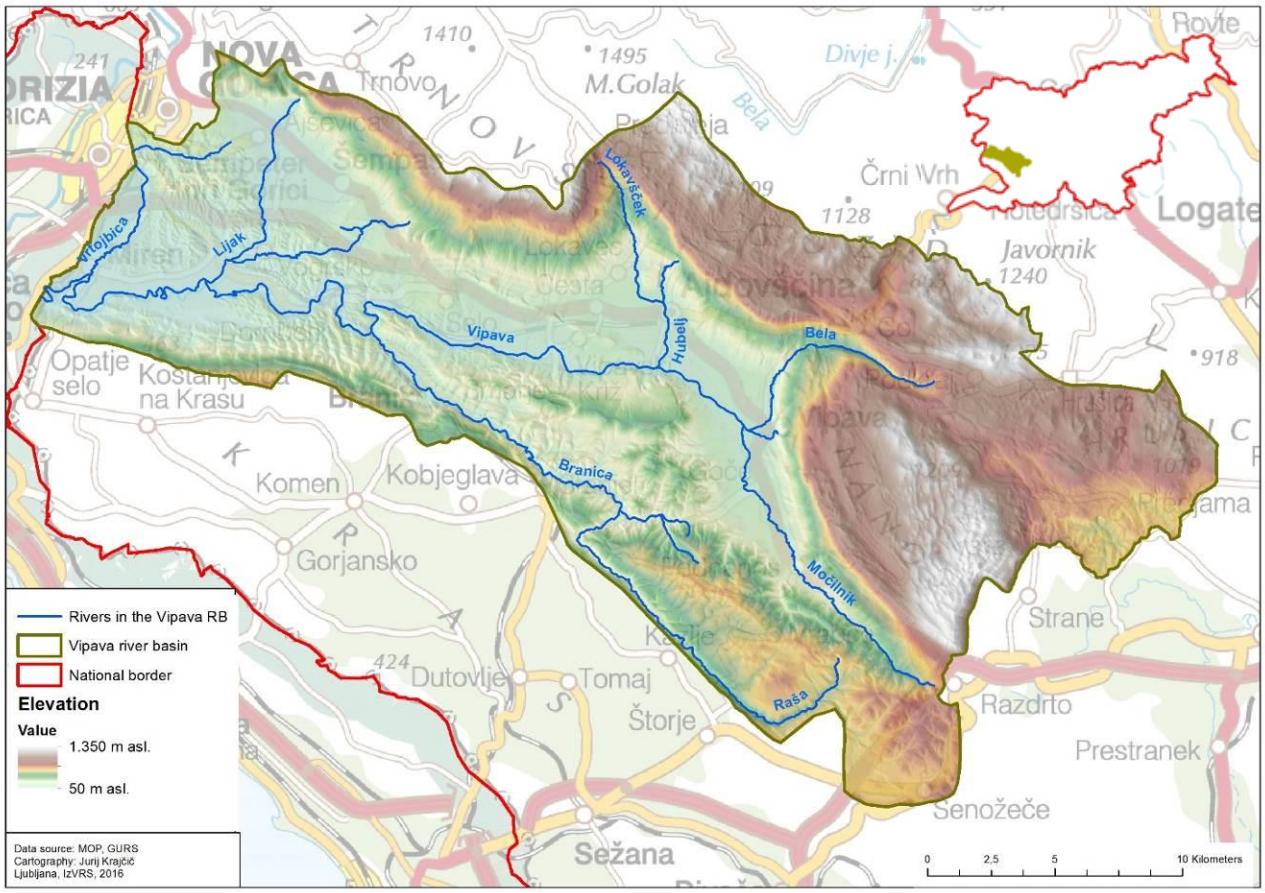


Figure 1: *Overview of the Vipava River Basin with its main watercourses and elevation, and its location within Slovenia*

2.1.2 Land use [33] and industrial activity

A large part of the Vipava river basin is covered by forest (61%), mostly on the slopes and higher altitudes around the main valley, and in the north and south periphery of the lower part of the basin. The second main land use in the Vipava river basin is agriculture (33%), mostly in the flatland around the Vipava River and its tributaries.

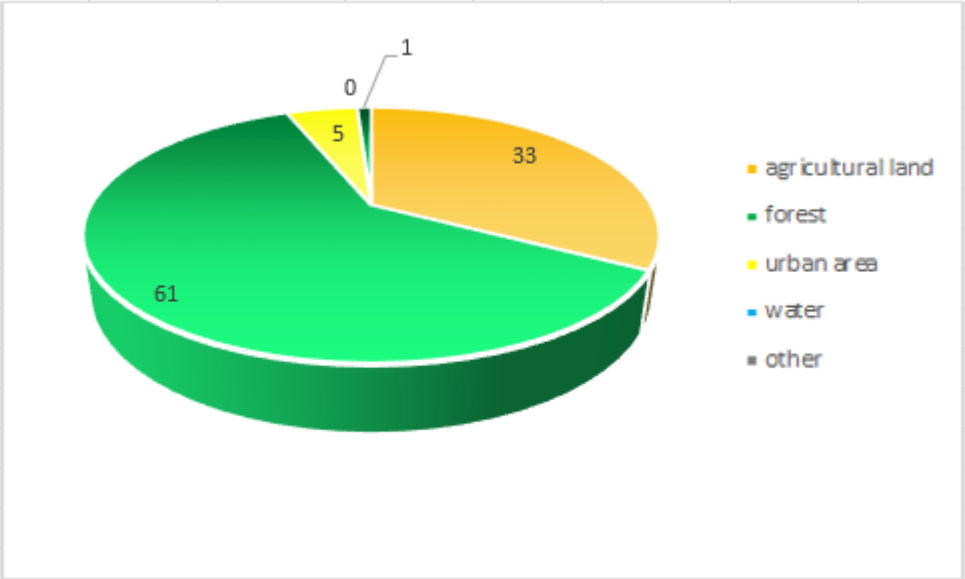


Figure 2: *Percentage of land use in the Vipava River Basin*

A comparison between land use in 2002 and 2015 shows noticeable changes. In this time, 2.1% of the river basin area were transformed from arable land to grassland and urban area and 3.5% of the area that formaly was geassland developed into forest and shrubland [33] [34]. Due to the specific geology and morphology of the area, the Vipava RB has a large number of nature conservation areas (e.g. valuable natural features, protected areas), protected at the national level by the Nature Conservation Act [35].

The most important agricultural products in the valley are fruits (especially peaches) and grapes for wine production. Other important agricultural products are early vegetables (lettuce, potato, cabbage, carrot, onion, garlic, and strawberries) due to favorable climate conditions and a vegetation period that is significantly longer compared to the continental parts of Slovenia [36].

Besides agriculture, industry is also an important sector in the Vipava RB (31% of the total GDP in the Goriška region). Industry is present in all major cities of the Vipava Valley (e.g. Ajdovščina, Vipava, Šempeter, Nova Gorica), although it is more condensed in the lower part of the basin. The town of Ajdovščina developed along the Hubelj watercourse (see Figure 1). In Ajdovščina, there are two important food processing factories. Other important industrial sectors in the valley are electronics, construction, and transport services. The number of newly established micro-, small-, and medium-sized companies during the past decade is increasing as people are developing new income opportunities, following the abandonment of agricultural activities and decreasing employment opportunities in large industry complexes.

With its rich natural and cultural heritage, the Vipava Valley (especially in the upper part) has great potential for developing ecotourism. Besides beautiful landscape, the Vipava wine road is a good starting point for countryside ecotourism. The importance of tourism for the local economy has been increasing. The number of visitors is rising every year, reaching 176,000 in 2014, the main attractions being the landscape, wine tasting, and gastronomy [36].

2.1.3 Climate and water

Being open to the west towards the Adriatic Sea, the Vipava river basin is subject to a strong Mediterranean climate interplaying with continental climate conditions. The sub-Mediterranean climate is moderated by occasional influxes of continental air masses from the north-east across the mountain barrier. Summers are hot and dry with occasional droughts, while winters tend to be mild and rainy with frequent bora winds, a prominent local wind which is dry, cold, and often comes in gusts with well over 100 km/h and can occasionally exceed 200 km/h, causing damage to crops and buildings, and causing problems in traffic. The section most affected by bora wind is usually the upper part of the Vipava Valley, stretching from Ajdovščina to Podnanos.

The bottom of the valley rarely sees freezing temperatures and snow is a rare occurrence as well. The average annual temperature for the reference period 1981 – 2010 at the bottom of the valley is 12-13 °C. The hottest month is July with an average temperature (1981 – 2010) of 22 °C, and the coldest month is January with an average of 3 °C. Temperatures drop with altitude; at the annual level, they are 2 °C lower on the Karst plateau and 6 °C lower in the highlands of the Trnovo Forest mountain range. The average annual precipitation in the upper part of the Vipava Valley is around 2,000 mm per year, and in the lower part and the Vipava Hills around 1,500 mm per year. For example, Figure 3 shows average monthly air temperature and precipitation for the reference period 1981 – 2010 for Bilje Meteorological Station, located at the bottom of the valley in the north-west of the basin [37].

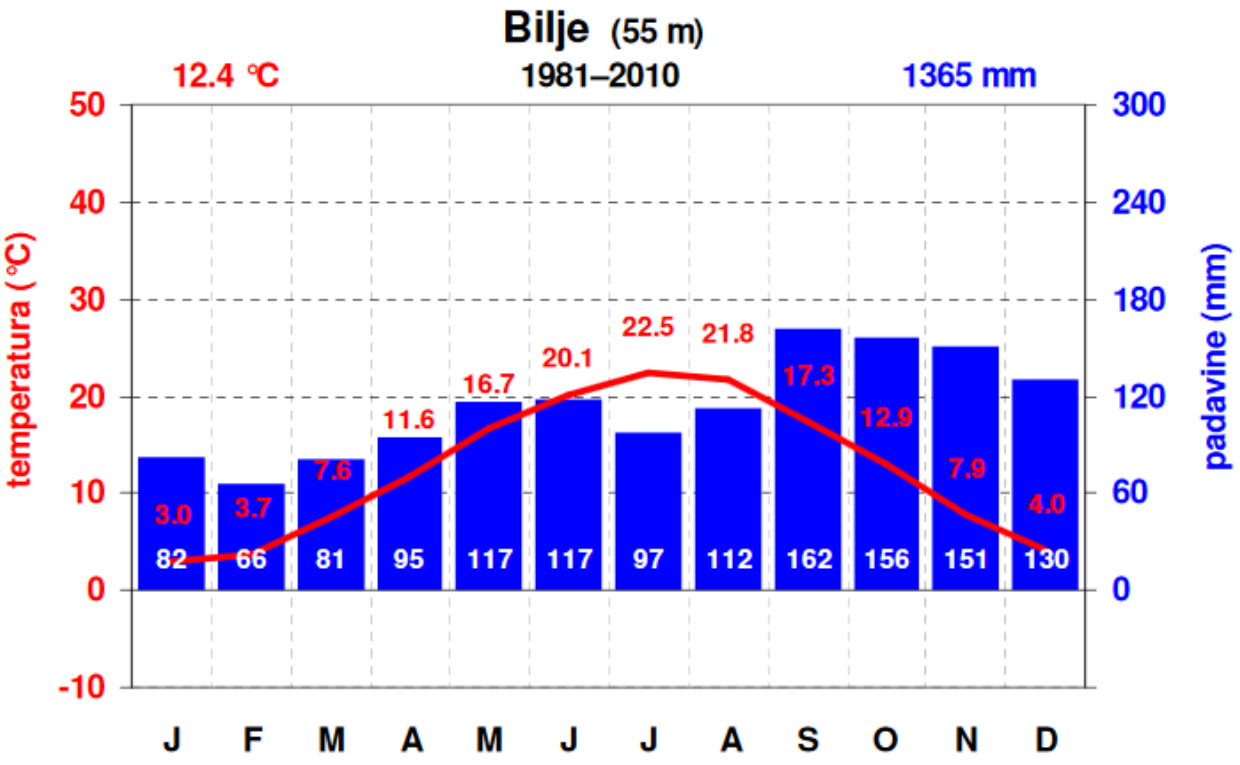


Figure 3: *Diagram for the Bilje Meteorological Station, located in north-west of the Vipava river basin, with average monthly air temperature (red numbers) and precipitation (blue numbers) for the reference period of 1981-2010*

The main water body, the Vipava River, with a length of 47 km and a mean yearly discharge of 17.3 m3/s (the 1971 – 2000 period), has a pluvial or pluvio-nival flow regime. From its right river bank it is fed by several tributaries with strong karstic springs (e.g. Lijak, Hubelj), which are fed from the wet Trnovo Forest mountain range. The Vipava River has a short but noticeable low flow in late winter

due to snowfall in the mountains, a long and persistent low flow during the summer, and two high flows, one in early spring and one in late autumn. Low-scale floods are frequent in the lower part of the valley during late autumn and larger-scale floods occur every couple of years [38].

According to national legislation by the rules on determing and classification for water bodies [39] the Vipava river basin comprises three surface water-bodies (Hubelj, Vipava Brje – Miren, and the Vipava povirje – Brje) and one heavily modified water-body (zadrževalnik Vogršček) according to the EU Water Frame Directive [21].

According to data from the river basin management plan (2015 – 2021) of Slovenia (in preparation) [27], the chemical status of surface waters in the basin is good, whereas the ecological status or ecological potential of the Vipava River is moderate in the lower part and good in the upper part. Ecological conditions of the lower part of the Vipava River are deteriorated due to high levels of nutrients and presence of specific pollutants. The chemical status of three groundwater bodies in the Vipava river basin (Obala in Kras z Brkini, Kraška Ljubljanica, and Goriška Brda in Trnovsko Banjška planota) is good [40]. However, the chemical status of groundwater aquifer system “Vrtojbensko polje” is questionable due to high levels of nitrates [41], which was confirmed also by the ASTIS project [42]. In addition to nitrates, the project’s results also showed increased levels of specific pollutants such as chlorides and sulphates which are of anthropogenic origin in the groundwater aquifer system “Vrtojbensko polje”.

For the implementation of the Floods Directive [31], a total of 56 potentially significant flood risks areas were demarcated in 2012 across Slovenia with regard to human health, environment, cultural heritage, and economic activity [43]. In the Vipava river basin there are five such areas (see Figure 4). According to the preliminary hazard indication map, there is the likelihood of very rare floods1 (estimated in the Vipava river basin in total area of 19.21 km2 (3.3% of the total river basin area) (see Figure 4).

[1] HQ 50 and more means the highest discharge observed – the flood extent is given for return period of 50 years, for extreme weather event [43].

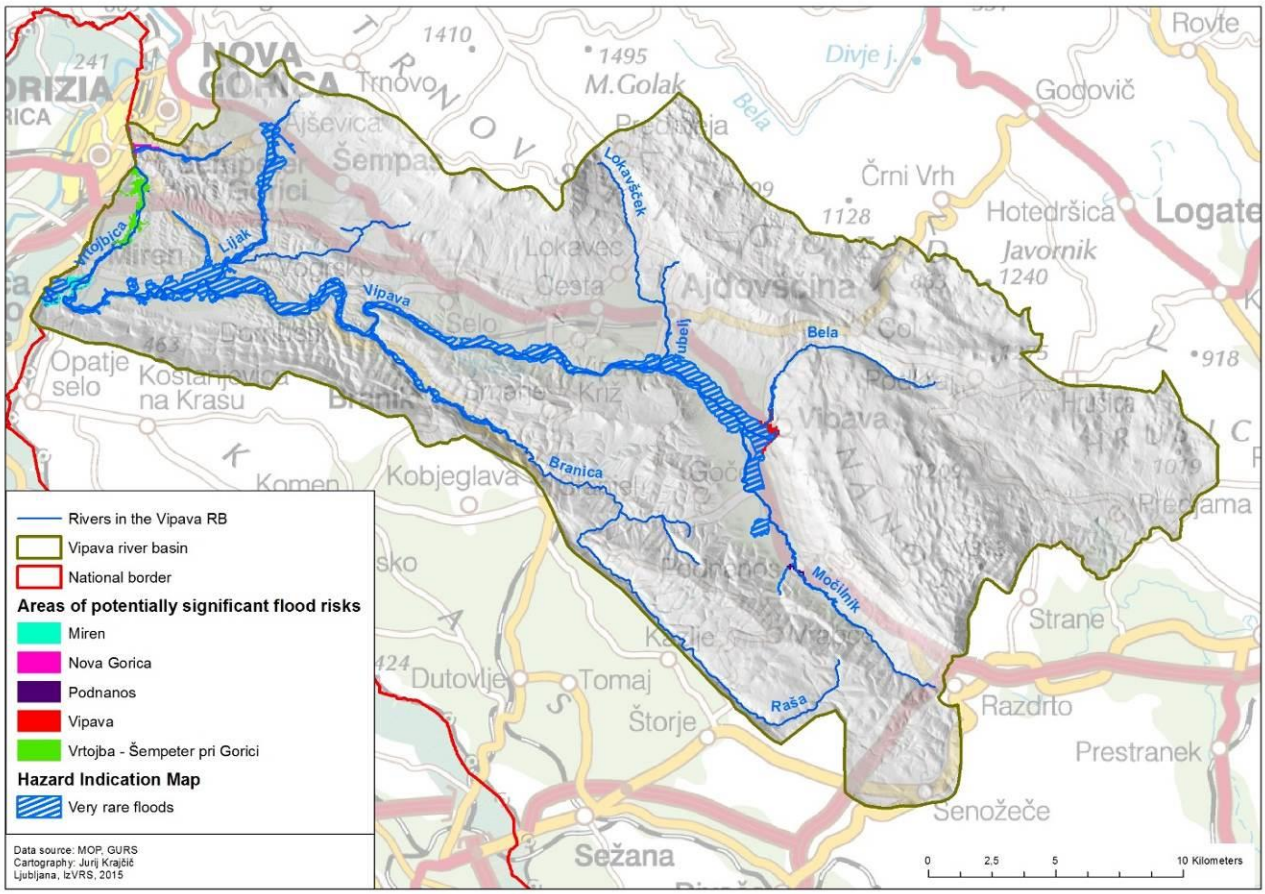


Figure 4: *Areas of potentially significant flood risks and very rare floods (HQ50 and more, marked in blue) in the Vipava River Basin*

The Vipava river basin is one of the areas most profoundly influenced by human activity in Slovenia. The upper stream of the Vipava River and its tributaries were technically regulated in the past because of floods and to increase the area of arable land. With regulation of the Vipava River, flood protection in the upper part of the basin has improved. However due to a quicker run-off towards the lower part of the basin, floods have become more frequent [45] and several catastrophic floods occurred in past years which resulted from changes in the precipitation regime, one of the consequences of climate change. There is one large Vogršček water reservoir, built on a rather weak watercourse with the same name. The total designed volume (both lower and upper reservoir) of Vogršček is 8.5 million m3 of water. Vogršček has been designed to provide water for the irrigation of the lower Vipava Valley, amounting 84.5% of the total usable volume (6.8 million m3). 15.5% of the total usable volume is intended to prevent hydropeaking and flooding during high flows [46]. Although planned (Republic Green plan, 1970-1980) not all the corresponding irrigation systems were constructed. Today's capacity of Vogršček is only 1.8 million m3 per year, which corresponds to possible irrigation of 1,400 ha of agricultural land. Due to Vogršček's sub-optimal functioning (leakage of the barrier, low water level resulting in low pressure for optimal irrigation) only approximately 1.3 million m3 of water per year (1,000 ha of agricultural land) is used for irrigation.

Slovenia is one of the eight Member States that have failed to comply with their obligations under the Urban Waste Water Treatment Directive [47]. The main reason is that municipal wastewater treatment in the basin is not sufficient, which is reflected in poorer ecological status, especially during extreme low flows. Buildings in most of the smaller settlements still have (permeable) septic tanks instead of sewerage systems or small wastewater treatment plants. However, two municipal wastewater treatment plants (WWTP) with total capacity of 56,500 population equivalents together

with sewerage systems were constructed most recently in the basin (1) WWTP Vipava in the upper part of the basin and (2) WWTP Nova Gorica (Vrtojba) in the lower part of the basin. Surface water quality is expected to improve. Nevertheless, more WWTPs are needed in the basin, mostly on a smaller scale.

2.1.4 People and water uses

Urbanisation in the Vipava river basin is moderate. There is only one town, Ajdovščina, with more than 5,000 residents. The population density is quite high at the bottom of the valley and lower on the slopes that enclose the valley. The area of the Vipava river basin is divided among eleven municipalities with a total of 172 settlements [48] and a population of approximately 52,000 inhabitants. Three of the municipalities, Vipava, Renče – Vogrsko, and Šempeter – Vrtojba, are located entirely in the area of the Vipava river basin, while most of them are located partly in the Vipava river basin and partly in other river basins (Ajdovščina, Nova Gorica, Miren – Kostanjevica, Postojna, Divača, Sežana, Komen, and Idrija).

Data from water balance in the 1971–2000 period show that the overall water supply is relatively stable and secure. However, there are shortages of surface water during the summer months. Occasional droughts result in damage on crops and in yield loss, but underground aquifers, which make up the vast majority of potable water resources, are rarely notably affected [49].

The total annual runoff of the basin is approximately 545 million m3. Regarding authorized water withdrawals (or abstractions) we distinguish between two terms:

1) water use that describes the total amount of water withdrawn from its source to be used. Uses of surface water include small hydropower plants, aquaculture, fisheries, saw/mill, water used by technological plants, and individual water supply [50].

2) water consumption as the portion of water use that is not returned to the original water source after being withdrawn [51]. In 2013, the total granted water consumption from surface waters through granted water permits amounted around 33.5 million m3, around 6% of all water available from surface waters. Almost all of this quantity was allocated to irrigation (and mostly from the Vipava River).

Drinking water for households is provided by mandatory municipal public utility services (Komunala Nova Gorica d.d. in municipalities Nova Gorica, Šempeter-Vrtojba, Miren-Kostanjevica and Renče-Vogrsko and Komunalno stanovanjska družba d. o. o. Ajdovščina in municipalities Vipava and Ajdovščina) and is obtained from springs (e.g. Hubelj). The total granted withdrawal in the Vipava river basin in 2013 amounted around 6.2 million m3 through water permits. Additional 0.08 million m3 were allocated to individual water supplies. The two uses combined presents more than 99% of all water consumption from springs. An additional granted amount of 3.9 million m3 was allocated to aquaculture [51].

Water use from groundwater sources others than springs is low. In 2013 only 7,000 m3 of withdrawal was granted through water permits for individual water supplies, and additional 64,000 m3 for technological purposes. There were no concessions awarded for use of ground water in 2013 [51].

The importance of hydropower is small. There are nine small hydropower plants in the basin; most of them are on the Vipava River [51].

2.1.5 Climate change and expected impacts

In Slovenia, temperature measurements clearly show that the climate is warming [52]. According to the analysis presented by dr. Kajfež-Bogataj in 2005, “in the period 1951-2000, the average annual air temperature increased by 1.1 °C, and during the last 30 years, warming exceeded the limit of 1.5 °C” [53]. Analysis of water balances in Slovenia for the period 1971–2000 [54] show changes in precipitation levels in the last few years, with an increasingly pronounced autumn peak of precipitation and decreased amounts in other seasons. On average, snow cover has become rarer and the snow line has been occurring on higher altitudes, decreasing the amount of water to be retained until spring. Thus, low flows or occasional water shortages in surface waters to the start of the vegetative season have become more common, jeopardising crop yields. Even though the annual precipitation levels do not show any trend, it tends to be ever less equally distributed throughout the year; winters have been getting wetter and summers drier [38] [55] [56]. Evaporation is increasing in comparison to the 1961-1990 period [54]. As a consequence, water flow regimes are changing, with diminishing differences in river water flow regime at regional levels. Water flow trends are generally declining. A comparison of water balance elements in the period from 1971–2000 with those in the 1961–1990 period [54] also indicates an increase in evaporation and a reduction in surface water runoff. The above-listed climate changes on a regional level have not yet caused water shortages in the short term at the regional level, the risks of water provision are increasing locally. Namely, in the last years the Vipava river basin has been experiencing persistent extreme low-flow events during the summer months as well as relatively short but extreme peak discharges during heavy rainfall, causing sometimes devastating torrential floods [38] [56].

Climate change projections for Slovenia published by the Slovenian Environment Agency in 2008 [57] suggest that the average annual temperature in the Vipava Valley could increase by around 1.3 °C under the scenario A1B (Special Report on Emissions Scenarios (SRES)) by 2030 (see Figure 5 also for other scenarios). It should be noted that this increase differs between various models used to make these projections. The biggest positive trend in temperature is seen during the summer months [58]. The increase in temperature is accompanied by a reduction of precipitation in the summer and increases in the winter. Under the scenario A1B approximately a 2% rise in precipitation for winter months and a 4% reduction for summer months until 2030 is projected (see Figure 5) [58]. Moreover, summer precipitation tends to decrease with shorter but more intense rainfall with storms and torrential downpours, causing rapid surface run off of precipitation water with little infiltration into the soil.

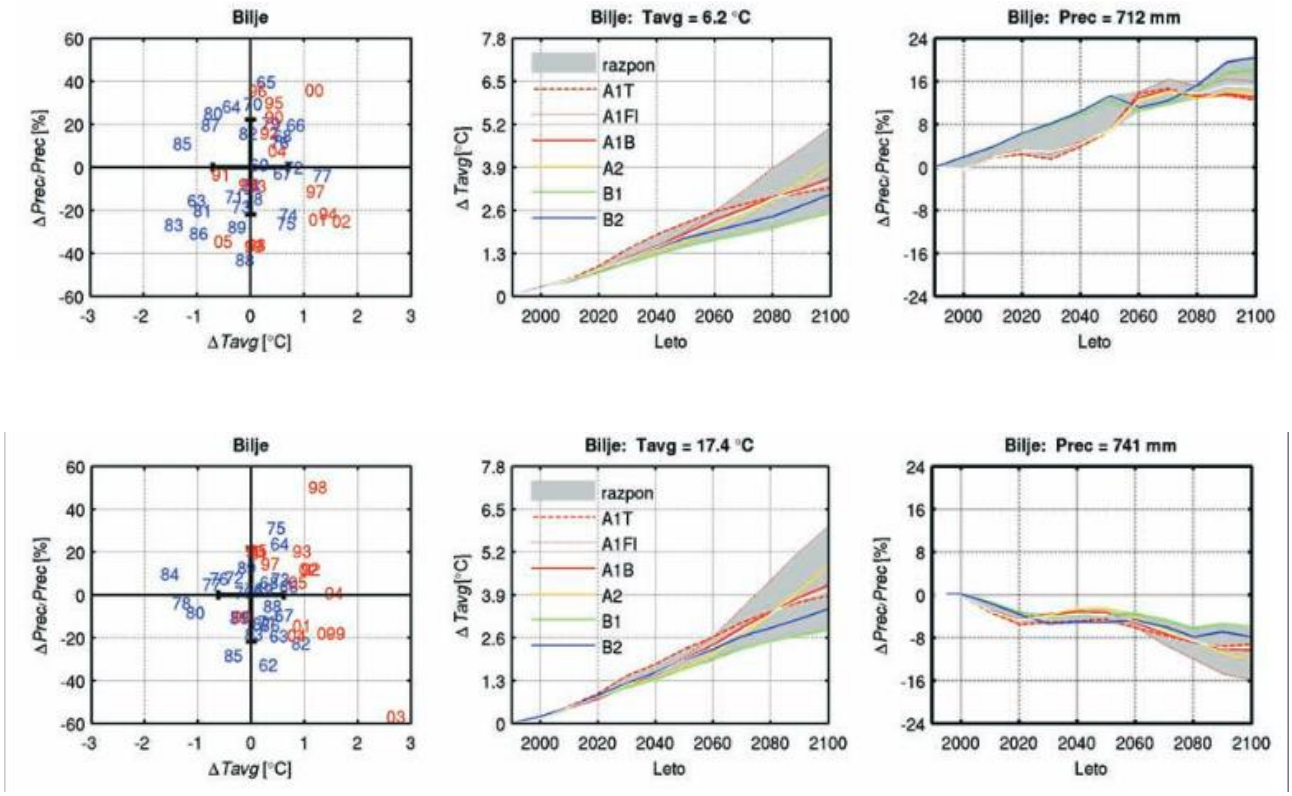


Figure 5: *Distribution of years in the period 1961-2005 according to the variations in average air temperatures (Tavg) and precipitation (Prec), in the cold (October-March) and warm (April-September) halves of the year. Cold half of year is shown above and warm half of year is shown below.*

Average in the 1961-1990 period for Bilje Meteorological Station (located 7 km south from Nova Gorica) together with the indicative projections of changes in air temperature (Tavg: middle) and precipitation (Prec: right) through the end of the 21st century, according to different scenarios of greenhouse gas emissions (SRES A1B, A1T, A1FI, A2, B1, B2).

2.2 Policy Context

The existing policy framework is an important starting point for river basin adaptation planning. It directs the actors' existing efforts in solving the issues at stake by complying with set objectives. Hence, the existing policies can present synergies for the implementation of further actions that are aligned with the policies' objectives and support the implementation of proposed adaptation options. This support can be based on regulatory, financial, or information-based mechanisms and instruments. Identified opportunities and barriers for the implementation of individual adaptation options prepared for the Vipava River Basin Adaptation Plan are outlined in chapter 4 and Part 2.

The main water management policy in the EU is the Water Framework Directive [21]. The Republic of Slovenia has completely integrated the Water Framework Directive into national legislation through the Waters Act [59]. Besides the Water Framework Directive, other directives such as the Bathing Water Directive [60], Floods Directive [31], and Marine Strategy Framework Directive [61] have been transposed in the national Waters Act [59].

Ministrstvo za okolje in prostor (The Slovenian Ministry of the Environment and Spatial Planning) is the country's main institution in water management and is responsible for preparing and implementing environmental policies and legislation. This Ministry is responsible for implementing

the Water Framework Directive and preparing the river basin management plan. Adopted in 2011, the river basin management plan (2009–2015) [28] together with the programme of measures [29] is a national strategic planning document for water management. The river basin management plan specifies the mechanisms for carrying out policies by which the good status of water bodies will be achieved. Based on the determination of characteristics and status of river basin districts, and on management objectives in water protection, water management and water use are defined. In Slovenia there are two basin districts: the Danube basin district and the Adriatic sea basin district. The Vipava river basin as part of the Soča river basin belongs to the Adriatic sea basin district [28].

There are four institutions affiliated to the Ministrstvo za okolje in prostor [62]; the Direkcija za vode Republike Slovenije (Slovenian Water Agency), the Agencija Republike Slovenije za okolje (Slovenian Environmental Agency), the Geološki zavod Slovenije (Geological Survey of Slovenia) and the Inštitut za vode Republike Slovenije (Institute for Water of the Republic of Slovenia) that was in charge of the development of this plan. The Direkcija za vode Republike Slovenije and the Agencija Republike Slovenije za okolje are actively involved in drafting the next river basin management plan for the period 2016-2021 by providing the requisite expert bases. The Geološki zavod Slovenije provides support in data analysis and expert knowledge on groundwater. The Inštitut za vode Republike Slovenije is preparing methodologies related to the development of a river basin management plan. A new river basin management plan for the period 2016-2021 is in preparation and is planned to be finished and adopted in 2016.

The Direkcija za vode Republike Slovenije performs administrative, expert and developmental tasks in water management, in accordance with the regulations governing water. It performs tasks as a spatial planning authority in water management, as a consent authority, and other tasks within the context of spatial planning procedures, building construction, and environmental impact and other assessments. The Direkcija za vode Republike Slovenije, together with a concessionaire selected on the basis of a public tender, provides the water management public service. The Agencija Republike Slovenije za okolje conducts expert, analytical, regulatory, and administrative tasks related to the environment at the national level, except for tasks that are in the responsibility of the Direkcija za vode Republike Slovenije.

The Ministrstvo za okolje in prostor is responsible also for the preparation and implementation of flood risk management plan 2015-2021 (in preparation) [63]. The Flood risk management plan is a separate document from the river basin management plan and is expected to be adopted in 2016.

Apart from the Waters Act, other policies are related for water management.

The Decree on the protection of waters against pollution caused by nitrates from agricultural sources [64], which is an executive act of the Environmental Protection Act [65], and in accordance with EU Nitrates Directive [66]. It sets threshold values for nitrogen input from agricultural sources into agricultural soils and includes measures to reduce and prevent water pollution caused by nitrates from agricultural sources. In accordance with the Nitrates Directive [66], the entire territory of the Republic of Slovenia is designated as a Nitrate Vulnerable Zone.

The Decree on groundwater status [67], is another executive act of Environmental Protection Act, and is in accordance with EU Groundwater Directive [68]. It sets among other parameters the chemical and quantitative status and groundwater quality standards.

The operational program of discharge and municipal wastewater treatment for the period 2005-2017 [69] was prepared in accordance with Urban Waste Water Treatment Directive [47]. The Direkcija za vode Republike Slovenije is currently preparing a new operational programme.

Another important plan, affecting management also in the Vipava river basin, is the Natura 2000 Management programme for Slovenia for the period 2015-2020 [70], adopted in April 2015 and

prepared by the Ministrstvo za okolje in prostor. Expert input was provided by the Zavod za varstvo narave Republike Slovenije (Institute for Nature Conservation of the Republic of Slovenia). The Natura 2000 Management programme is important for water management as many species and habitats are dependent on water. The framework for this programme is made up by the Birds Directive [71] and Habitats Directive [72], which are transposed in the national Nature Conservation Act [34].

Since 2008 the Slovenian agriculture and forestry strategy of adaptation to climate change and its implementation document (Action plan, 2011) [73] have been in force. Primarily it is focusing on building capacity to manage the adaptation of agriculture and forestry, education, raising awareness, consulting to farmers, and the maintenance and acquisition of new knowledge on adapting to climate changes. The strategy outlines, technological measures to reduce the vulnerability of agricultural production to drought (2008) and to reduce the impact of drought in cultivation of maize. It contains a map of agricultural land (cultivation of maize) in risk of drought, that was prepared in 2014. Nevertheless, an overall national strategy including all sectors and policies is still missing. The current practice in the occurrence of drought as a natural disaster is mainly targeted at mitigating the impacts (economic loss/economic drought). To overcome this gap, Slovenia prepared in 2014 a draft assessment of climate change risks and opportunities as a basis for the climate change adaptation action plan. This assessment will, based on climate scenarios, serve as a basic document for drafting action plans (period 2020 - 2030) and guidelines for administrators involved in water management at local, regional, and national levels.

Besides the Ministrstvo za okolje in prostor also the Ministrstvo za kmetijstvo, gozdarstvo in prehrano (the Slovenian Ministry of Agriculture, Forestry and Food of the Republic of Slovenia) is relevant for water management. The Ministrstvo za kmetijstvo, gozdarstvo in prehrano performs inter alia tasks in the areas of agriculture, rural development, plant protection, forestry, hunting and fisheries. The Ministrstvo za kmetijstvo, gozdarstvo in prehrano is also responsible for the implementation of the EU common agricultural policy. The current rural development programme 2014-2020 focuses on two main areas: i) improvement of biodiversity, and ii) improvement of water status and soil quality [74].

The Ministrstvo za kmetijstvo, gozdarstvo in prehrano has on the basis of the Freshwater Fisheries Act [75] adopted the programme for the management of fish in inland waters of the Republic of Slovenia in 2015 [76]. This programme is the basis for the fisheries and farming management plans [77], which are prepared by the Zavod za ribištvo Republike Slovenije (the Fisheries Research Institute of Slovenia) with the help of local fishing clubs. The fisheries and farming management plans, still in preparation, form the basis for the annual programs [78]. Expert bases for the programme for the management of fish in inland waters of the Republic of Slovenia are provided by the Zavod za ribištvo Republike Slovenije.

Representatives of the Ministrstvo za okolje in prostor, the Agencija Republike Slovenije za okolje and the Ministrstvo za kmetijstvo, gozdarstvo in prehrano have been directly or indirectly involved in the preparation of the Vipava river basin adaptation plan by providing relevant information on water use conflicts and the desired state for the Vipava river basin. Policy-makers within the Ministrstvo za okolje in prostor and the Ministrstvo za kmetijstvo, gozdarstvo in prehrano have also provided information on the current situation of adaptation to global change at national and river basin level. They also provided their experience with public participation in the design of policies and potential conflicts that may appear.

2.3 Main Challenges

The challenges identified by stakeholders during the first stakeholder workshop were analysed and consolidated by the BeWater project team into three overarching challenges that the Vipava river basin is facing: (a) Water availability during droughts in growing season, (b) Flood risk reduction, (c) Appropriate water quality.

➢ Challenge A: Water availability during droughts in the growing season

The main challenge indicated by stakeholders is water availability in irrigation networks and rivers during drought occurrences, especially in the growing season. In the Vipava river basin meteorological, agrometeorological and hydrological droughts are present, each having a specific impact on the environment. The adverse climate conditions (higher temperatures and reduction of precipitation in in the warmer part of the year) will aggravate risks of water shortage in the future even more.

When droughts occur, a variety of activities, sectors (water users) and ecosystems can be severely impacted by water shortage, especially agriculture. When farmers can no longer use water to irrigate their crops from the two main water sources, the Vipava River and Vogršček water reservoir, they potentially use potable water, which can cause some problems with the drinking water supply, especially in the summer months. Furthermore, when droughts occur, they can also cause damages to water distribution systems infrastructure – damaged, broken water pipes, causing unavailability of drinking water in some areas of the Vipava river basin.

Although the water demand for households is expected to stay at approximately the same level, water demand for agriculture, especially irrigation, is expected to rise in the years to come because of expected drier summers and due to plans encouraging irrigation and consequently decreasing the vulnerability of crops to droughts [79].

The main reasons why water is unavailable during droughts in growing season are listed below:

I. Droughts have been always present in the Vipava river basin in the past. Due to the impacts of climate changes they have been occurring more frequently in the last few years, thus affecting larger areas. Beside climate changes, the changed water cycle in the river basin is also a result of extensive regulations of watercourses (Vipava, Hubelj, Lijak) in 1980s and earlier, and amelioration works that drain excess water the from soil. The consequences are more rapid surface water runoff from the basin, increased flow velocity, the decreased retention functions of the riverbed and soil, and reduced water infiltration, causing a lower groundwater level.

II. Although several water reservoirs and irrigation systems were planned to be constructed in the Vipava Valley (e.g. Branica, Pasji rep, Močilnik, Malenšček-Kamenski potok, Vrtovinšček, Lokavšček, Košivec) in the 70s, due to a program to increase the level of self-sufficiency in food (called Republic Green plan, 1970-1980) only the Vogršček water reservoir with corresponding irrigation systems for the lower part of the valley were actually constructed. The reasons were the changed priorities of the Republic of Slovenia and thus the available funds at that time were transferred into the construction of highways. After that, several plans of different water reservoirs were discussed, but not yet realized.

III. The Vogršček water reservoir was a major intervention in the valley's water cycle, yet with undesirable results, attracting political and professional criticism for many years. The main problem is unclarified ownership of the reservoir and its infrastructure between government and the private sector, which, in the past 20 years, has resulted in poor management, improper functioning, lack of

operation and maintenance funding. The result is (for details see sub-chapter 2.1.2) lower capacity compared to planned volume for irrigation. Together with illegal connections to irrigation system there is less water available for proper management of the irrigation system. According to stakeholders there are many challenges that need attention regarding Vogršček among which the most important are (a) better understanding of the system functioning, (b) more transparent functioning of the system (with no illegal connections), (c) better cooperation among users (16 irrigation communities), (d) organization of optimal irrigation (irrigation time plan), and (e) technological renovation and modernization of the reservoir and connected irrigation systems.

IV. The Vipava River, as the only water source for irrigation in the upper Vipava river basin, is dependent on rainfall (flow is directly dependent on the precipitation regime in the catchment area). In dry periods, when water is needed for agriculture, there are restrictions for water abstraction from the river due to maintenance of the ecological flow (Water Framework Directive). Nevertheless, illegal water abstraction from the Vipava River occurs even during low flows, thus exacerbating the negative impacts of drought on aquatic, riparian, and wetland ecosystems (reduced water flow, flow cessation, eventually complete desiccation; resulting in not achieving good ecological status of surface waters according to Water Framework Directive). Already, some experts have claimed that the irrigation needs in the Vipava Valley are greater than the available water quantities and other water sources besides the Vogršček water reservoir would be needed.

In the framework of the Republic Green plan (1970-1980), shelterbelts (wind barriers) were planted to minimize the impact of wind on agriculture by reducing evaporation and the impact of summer winds on soils (drying, loss of water in soil). Due to the illegal removal of already planted shelterbelts by farmers (lack of awareness) and improper agricultural practice, the deflationary effects of the bora wind are even stronger, especially in winter.

➢ Challenge B: Flood risk reduction

Floods have always occurred in the Vipava river basin and pose a bigger problem in the lower part of the river basin. Due to impacts of global change, changes in the river regime as a result of regulations of the watercourses in 1980s and building of settlements too close to the watercourses (deprivation of riparian area), severe floods are occurring more frequently and at a larger scale.

Trapped and rigidly regulated watercourses (concrete banks) in the upper valley lack the needed space (floodplains) and the ability to reduce the flow velocity; hence water rapidly drains downstream causing severe floods in the lower valley.

One of the main challenges identified by stakeholders regarding flood risk management is the lack of competences between local and national authorities mostly due to unclear legislation. Most problematic are smaller watercourses not recorded in the water cadaster or the water cadaster is not properly managed at all. Additionally, municipal spatial planning and its effect on flood occurrence must be mentioned in any discussion of flood risks in the Vipava river basin. In the Vipava river basin there are eleven municipalities, but not all of them are affected by floods. Each municipality manages its own area without considering the impacts of their measures upstream or/and downstream of the watercourses and thus increasing flood risks outside their area.

Landslides, which occur everywhere in the Vipava Valley on a sloped terrain, have also an impact on floods occurrence although indirectly. The biggest and most dangerous areas for landslides occurrence are on the northern slope of the valley that descend from the Trnovo Forest (Trnovski gozd) into the valley. The landslides and also many other slope-movement phenomena originate in

the current geological structure of the valley and in the formation of the terrain. However, most landslides are triggered by heavy rainfall.

Due to inappropriate spatial planning in the Vipava river basin, urbanisation of the valley slopes has increased the possibility of triggering landslides mostly due to the inappropriate regulation of storm water and hinterland water drainage. Also poor maintenance of the drainage system built more than 30 (or 50) years ago, like regulations of torrents and inadequate drainage of storm waters, contribute to triggering landslides more often. Landslides do not only threaten buildings and infrastructure, but also cause morphological changes of the terrain. Landslides often move large amounts of sediments, which does not only stay on the slopes, but also reach the fluvial network. Under extreme weather conditions, landslides may lead to torrential outbursts, debris flows or dam-break waves after a dam-breach of natural dams. As a result, floods of larger scope can occur.

➢ Challenge C: Appropriate water quality

The ecological status of the Vipava River is moderate due to high levels of nutrients and presence of specific pollutants (insufficient municipal wastewater treatment and agriculture).

One of the main reasons for the unsuitable water quality in the Vipava river basin is insufficient municipal wastewater treatment. To solve the current situation and most importantly due to compliance with legislative requirements, two waste water treatment plants (WWTPs) were constructed recently, in the upper valley WWTP Vipava (at the stage of trial operation) and in the lower valley WWTP Nova Gorica (Vrtojba). However, there is still unsolved problems of insufficient municipal wastewater treatment in small and dispersed settlements. This problem is evident in the catchment area of the Vogršček reservoir where monitoring of water quality confirmed presence of faecal coliforms [80]. The source of contamination are most probably septic tanks overflows in the catchment area. Since water in the Vogršček water reservoir occasionally contains too many coliforms, the use of water for irrigation purposes is limited. In the case of the Vogršček reservoir stakeholders have also highlighted the improper connection of the irrigation system to the floor outlet, resulting in (a) exceptionally cold water unsuitable for irrigation, and (b) water full of sediments unsuitable for irrigation (fruits like peaches and vegetables must be cleaned constantly) [81] [82]. These issues add to the challenge of water availability (challenge A).

When Vipava River and its tributaries (Lijak, Hubelj, etc.) were regulated and canalized in 1980s in order to increase area of arable land, the length of the Vipava River was shortened from 50 to 47.7 kilometres mostly due to the elimination of meanders. With regulations, many habitats for aquatic and riparian plants and animals disappear. The result is lower self-cleaning ability of watercourses resulting also in moderate ecological status.

In connection with the already mentioned excessive water abstraction from the Vipava River for irrigation, problems with maintaining ecologically acceptable flows and in this context achieving a good ecological status become an issue when droughts occur.

A pre-condition for water ecotourism development like natural bathing sites on the Vipava River is appropriate bathing water quality. With bathing waters on the Vipava River microbiologically unsuitable, the desired ecotourism cannot develop.

3 Participatory development of the River Basin Adaptation Plan

3.1 Development process

The development of the river basin adaptation plan for the Vipava river basin is the result of an intensive stakeholder engagement process. The participation and integration of a wide group of stakeholders from various sectors throughout the whole development process has had a crucial role in the identification and evaluation of water management options and all the necessary preparatory steps which took place in an iterative way.

Due to inherent project limitations [83] together with challenges with different levels of knowledge, and differing values, assumptions and terminologies among experts, scientists and stakeholders, a methodology for identification and selection of stakeholders was developed [83] with the help of the Stakeholder Integrated Research (STIR) approach [84]. As such a supporting management tool in the form of a stakeholder database was created [83] and used for the identification of all relevant stakeholders depending on the objective of the stakeholder engagement process.

A wide range of stakeholders were part of process, actively participated and provided concrete input to the identification, formulation and evaluation processes of water management options in several stages of the participatory co-creation process that included three professionally facilitated workshops, follow-up interviews, individual and group sessions, and an additional open consultation. Parallel to the stakeholder engagement, an awareness campaign in the form of tailor-made mobile exhibition took place in the Vipava river basin with the aim of raising social awareness and to encourage capacity building, empowerment, and social formation in water management challenges and adaptation (see Annex I and II for details). A detailed methodological overview with a graphical representation and detailed description is given in chapter 3.2.


Development of river basin
2014
January–March
April–June
1st general project meeting in Barcelona
Identification and mapping of river basin stakeholders and key actors
1st stakeholder workshop on identifying the current and desired status of the river basin
Review and analysis of river basin adaptation plans and strategies from around the world
2015
January–March
April–June
Stakeholder consultation on draft narratives and the basin's graphical representation (fuzzy cognitive map)
Finalisation of river basin narrative, fuzzy cognitive map, and main challenges
Formulation of water management options to tackle challenges
2nd stakeholder workshop on evaluating water management options
2016
January–March
April–June
Characterisation of policy and stakeholder basis of water management options
Assessment of water management option synergies and co-benefits
Design of draft bundles of water management options
3rd stakeholder workshop on desired content and implementation of the River Basin Adaptation Plan
Finalisation of adaptation pathways and bundles of water management options

adaptation plan

July–September

Stakeholder interviews on the river basin context and challenges

October–December

2nd general project meeting in Nicosia

July–September

Finalisation of water management options

Impact assessment, multi-criteria analysis and economic assessment of water management options

October–December

Stakeholder consultation event to present and gather opinions on final water management options

3rd general project meeting in Barcelona

Finalisation of impact assessment, multi-criteria analysis and economic assessment

July–September

Completion of River Basin Adaptation Plan

Next steps

Development of policy recommendations to support river basin adaptation

Compilation of lessons learned during the River Basin Adaptation Plan development process

Local policy forum to present river basin adaptation plan and highlight potential paths forward

European policy workshop in Brussels to highlight BeWater outcomes and key messages for policy makers

River basin adaptation conference and final project meeting in Nova Gorica, Slovenia

3.2 Methodological steps followed


BeWater
Society Adapting to Global Change
EVALUATING OPTIONS
To evaluate the water management options, the stakeholders select the criteria on which the options will be evaluated, as well as the relative weight of each criterion. The information from the multi-criteria analysis is combined by scientific experts with the outcome of the options' impact assessment and results in the identification of options that have a desirable impact on the river basin, according to the local stakeholders.
Which options have desirable impacts on the river basin?
Assess the impacts of the options through the qualitative model
REVIEWING THE POLICY FRAMEWORK
Policies and programmes on the local, national and EU level can hinder or support the implementation of the options. Their potential role is determined by a scientific expert evaluation of whether the policy objectives, targets and timescales are in line with those of the options, what funding is available, and if eligibility or selection criteria create barriers to adopting the options.
How do the options fit within the relevant policy and decision-making frameworks?
Evaluate the options based on multiple decision criteria
IDENTIFYING POLICY ACTORS
As local stakeholders and policy actors will be directly involved in or affected by the implementation and maintenance of the options, their willingness and capabilities to support the implementation of the options are important to inform the selection and design of options. They are validated via interactive exercises with them.
How could stakeholders be involved in the implementation of the options?
Evaluate the role of existing policies in the implementation of the options
BUNDLING OPTIONS
Implementing multiple options together can result in different impacts than the individual options would produce on their own. These potential interactions are assessed using scientific expert judgment and validated via interactive exercises with the local stakeholders. Using these outcomes, previously determined basin challenges and main sectors affected by these challenges, the options are grouped into bundles.
Which synergies or conflicts arise between the options and how can they be grouped together?
Identify key stakeholders and their potential roles in implementing the options
DEVELOPING AN IMPLEMENTATION TIMELINE
The timeline for implementing each of the options within a bundle is based on their effectiveness over time, local stakeholder preferences and the policy framework. Developing the timeline for implementation takes into account factors such as feasibility, acceptability, Multi-Criteria Analysis results, costs, policy synergies. The initial scientific expert assessments were verified by the local stakeholders.
When should the options be implemented?
Assess co-benefits and conflicts arising between options in order to group them in bundles
FINALIZING THE ADAPTATION PLAN
Based on existing examples of adaptation plans in other river basins and an open dialogue between stakeholders and academics, the content and design most relevant to the local reality in the river basin are determined and integrated into a tailored river basin adaptation plan.
How can all this information be integrated and presented in the most effective way?
Assess the optimal timing for implementing the options
River Basin Adaptation Plan

The first step of the stakeholder engagement process was to identify relevant stakeholders in the Vipava river basin. With the selection criteria (e.g. gender, age, organizational affiliation and sector) stakeholders from national to local level, including civil society, scientists, public administrators (policy makers and implementers, institutional administrations and local governments), water sector actors (e.g. service providers) and other related sectors (e.g. agriculture, tourism, energy) were identified [83]. Afterwards, direct contact through e-mail, phone, and meetings was established.

Further information on the methodology and results introduced within this adaptation plan, as well as the BeWater project more generally, can be found on the project website (www.bewaterproject.eu).

Within the project three stakeholder workshops were organized. Objectives, outcomes, and other details are summarized in table 4.1.

Table 4.1: *Table of conducted workshops*

Date and title of workshop	No. of participants and sectors	Objectives	Outcomes
10th June, 2014 **1st Stakeholders Workshop**	32 a) water management, b) agriculture, c) public administration, d) infrastructure, e) energy, f) nature conservation, g) tourism, h) fishery, i) health, j) business and economy, k) civil society, l) municipalities.	a) Inform stakeholders about the BeWater objectives and expected results b) inform stakeholders on what is known about the current status of the Vipava river basin and expected impacts of global change c) gather information on stakeholder perspective of the issues and challenges in Vipava river basin in the medium-long term d) to clarify objectives (vision) for the Vipava river basin for 2030 e) to discuss on water management options aimed at achieving those objectives in the Vipava river basin by 2030	Three main challenges were identified: a) water availability during droughts in growing season; b) flood risk reduction; c) appropriate water quality.
27th May, 2015 **2nd Stakeholders Workshop**	12 a) agriculture, b) public administration, c) water management, d) municipalities.	a) To discuss the progress of the Bewater since the first workshop (June 2014); b) To collect stakeholders' comments on the formulated water management options based on the input of the first workshop; c) For stakeholders to evaluate the options through a social evaluation in a form of an on-the-spot multi-criteria analysis.	a) Selection of 13 criteria for assessing MCA; b) determination of relative importance of selected criteria; c) on-the-spot multi-criteria analysis was performed and results were discussed.
23th March, 2016 **3rd Stakeholders Workshop**	21 a) nature conservation, b) regional development, c) municipalities, d) education, e) agriculture, f) water management.	a) Identification of potential synergies and conflicts between water management options; b) Revision of prepared bundles by stakeholders; c) To discuss potential implementation barriers and opportunities.	a) Determination of synergies and conflicts between water management options; b) final selection of water management options in bundles; c) final timeline for implementing individual water management options.

At the first workshop experts provided participants information on the status of Vipava river basin and results of scientific research on the impacts of global change in the basin, with a 2030 horizon. Afterwards participants were asked to identify a medium-to-long term challenges for the Vipava river basin and their vision on its future status. In addition, participants proposed several preliminary options to address these challenges. Analysis of the first workshop showed some informational gaps, which were tackled by 14 additional interviews in October and November 2014 with policy representatives and key stakeholders that were not able to attend the first workshop. The objective of the interviews was to gain information about the current situation of adaptation in the region, personal experience with public participation in the design and especially the implementation of policies/natural resources management, and potential challenges that may appear.

The information collected on the current state and the future expectation regarding water management (according to the stakeholders) in the Vipava river basin was organized and synthesized by building a narrative of the Vipava river basin. This narrative was complemented with a graphical representation in the form of a fuzzy cognitive map (see [85] for details).

Text box 2: Description of the fuzzy cognitive mapping method

To evaluate the water management options against the three challenges expressed by the stakeholders, a method called Fuzzy Cognitive Mapping was applied. A Fuzzy Cognitive Map is a graphical representation of a system - in this case the Vipava river basin - where the components (factors) are represented as boxes and relationships as arrows. The arrows reflect the sign and strength of the relationships between the factors. The map is cognitive because it represents the dynamics in the system based on the understanding of individuals. Fuzzy cognitive maps allow all the information available on the basin to be organized in a clear way to illustrate the current status in the basin: main challenges at stake, drivers that influence them and their relationships in the system. The maps were constructed with inputs from stakeholders from different backgrounds. Besides clearly describing the river basin, the map was used to assess the impacts of the water management options on the river basin. In this way, the BeWater Project team was able to estimate of the impacts of the water management options and their effectiveness towards each of the three challenges.

The initial map prepared was consulted with the stakeholders (February 2015). Overall 19 stakeholders, also present at the first workshop or included in the additional interviews that followed, commented and suggested improvements of the map which resulted in factors and relationships being added or modified. After that a final map was produced (see Figure 5).

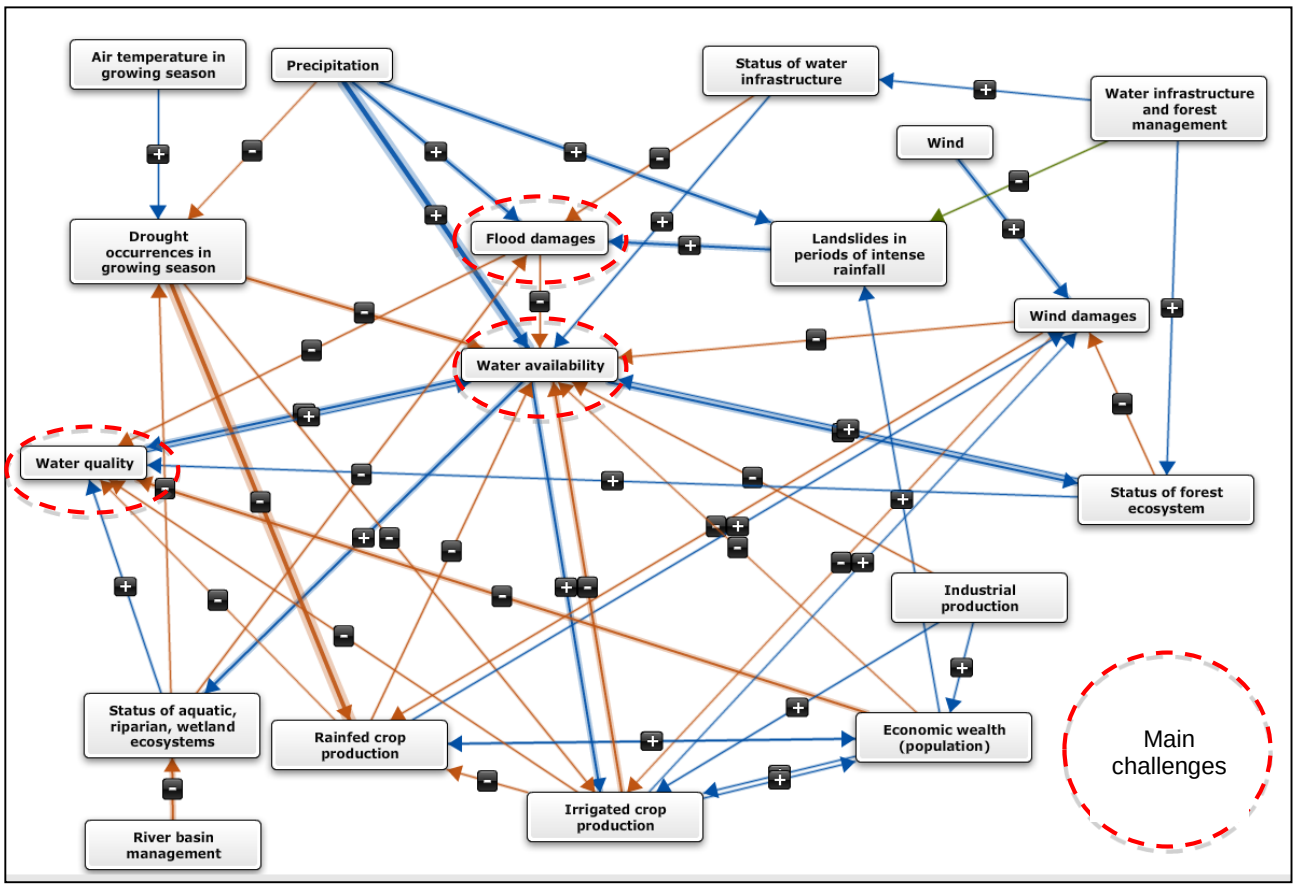


***Figure 5**: Fuzzy Cognitive Map of the Vipava river basin with identified three overarching challenges*

Next, water management options suggested by stakeholders during the first workshop were characterised using a fixed set of descriptors that mainly refer to the implementation of water management options (the parts of the RB, the sectors and land uses concerned, time frame, costs, type of approach, feasibility, acceptability, the relation to global change and to extreme weather events). This format allowed to cluster long list of options, based on the similarity of descriptors and challenges that they address in a refining process. By clustering water management options, based on the similarity of descriptors and challenges that they address and refining process, 21 options were developed to the point that allowed further analysis. A so-called impact analysis of individual options was conducted by experts using a fuzzy cognitive map (see Text box 2).

In the second workshop the 21 formulated water management options were presented to the participants. In order to evaluate and rank the formulated options from most to least preferred, participants selected 13 criteria and determined their relative importance by assigning points from one (1) to ten (10), with ten (10) representing the greatest importance and zero (0) if a criterion was not considered important. Once the stakeholders had selected and weighted the criteria, they were asked to review scoring functions for the criteria [83]. Afterwards an on-the-spot multi-criteria analysis was performed and discussed.

Text box 3: Description of multi-criteria analysis

Water management options have quite different characteristics and impacts on the water basin and local communities. Selecting the specific options that should be included in the river basin adaptation plan is a complex endeavour. To support this process, a participatory multi-criteria analysis was conducted. During a workshop, stakeholders were asked to select the evaluation criteria to decide how well options perform, as well as the importance of each of these criteria in relation to each other. Criteria referred to both the design of the water management options and their expected impacts on the river basin, as estimated with the fuzzy cognitive map. The scores and weights of the criteria given by the stakeholders were combined with the characterization of the water management option and the outcomes of the impact assessment to evaluate the water management options prepared by experts and the research team. The evaluation results are presented on a scale of 0-100 with a 0 indicating the least preferred evaluation outcome and a value of 100 as the most preferred evaluation outcome.

After performing the analysis, the outcomes of the multicriteria analysis were discussed, allowing for the integration of participants' perspectives for interpreting the final prioritization of options. The main comments of the stakeholders were that some individual water management options were ranked as high or low, depending on which of the three challenges they address. Experts reviewed all the comments carefully and where needed changes in impact assessment were made. As for the comments on the list of water management options, participants expressed some doubts about one particular option, which was later deleted, and a list of 20 water management options remained. The overall results of the multi-criteria analysis are shown in the figure below. For each option, evaluation results are presented as described in the description of Multi-criteria Analysis (see Text box 3).

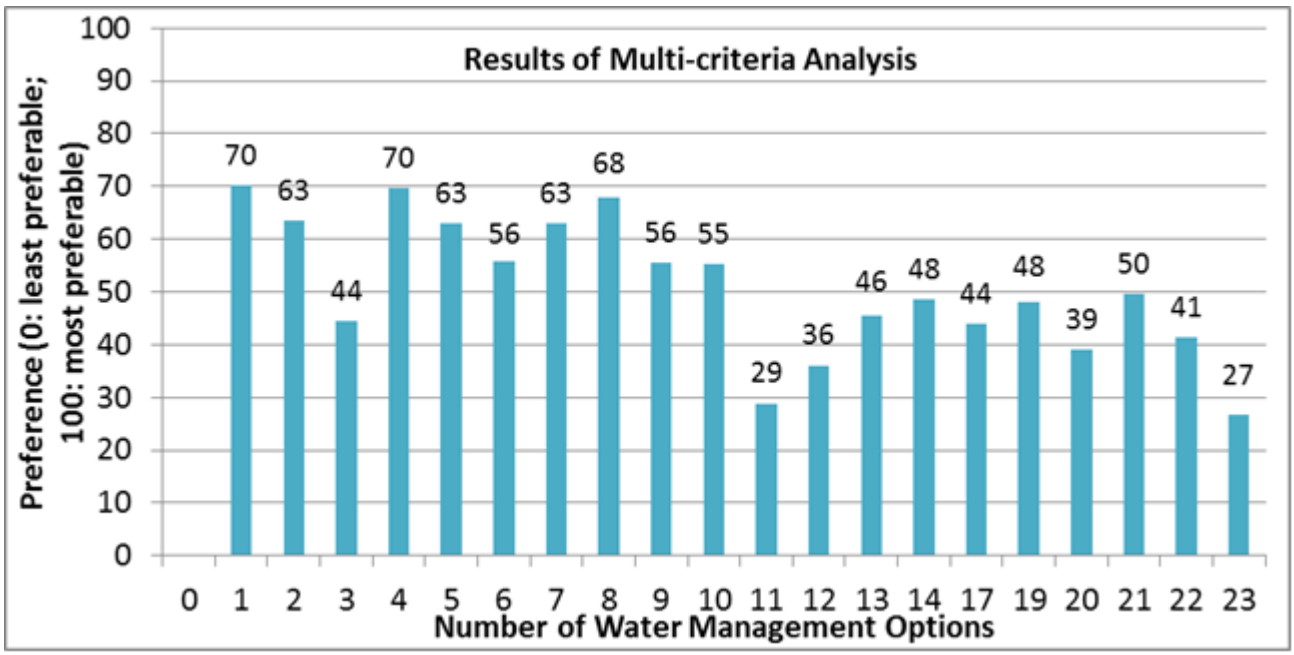


***Figure 6**: Results of Multi-criteria analysis based on criteria (and their changes) derived from the Fuzzy Cognitive Map and the impact assessment. Numbers refer to the water management options in Table 4.2*

In the process of characterisation of water management options, a more detailed description on the steps or actions was developed by experts. This was the basis for an economic analysis or so called cost assessment from the beginning of their implementation plan (2018) towards 2030, i.e. a 13-year

time horizon, which was the same for all water management options and could correspond to the project's objectives. The information on steps and costs for each water management option can be found in Part 2. The results of this assessment are considered to be indicative only, because a detailed assessment for 20 options was not feasible with the given project resources. Hence, the results of the cost assessment must be interpreted with care. A more detailed assessment of costs and benefits is recommended before these options could be implemented.

The objectives of the open stakeholder consultation (October 2015) was to present the latest version of the water management options; to receive feedback and collect input for further substance to options with an eye on validation and implementation, to sequence options (in the years from 2018 to 2030), and to disseminate current outcomes of the BeWater project. There were 16 participants actively attending the event, representing public administration, forestry, nature conservation, industry, and agriculture. The participants suggested some improvements for implementations steps that were considered in the descriptions of the water management options and additional or different implementation bodies. Some participants have already indicated various combinations of options. At the end, participants had the opportunity to indicate a timeline for the implementation of the individual water management options.

Afterwards, experts identified potential co-benefits between the individual options. Co-benefits were identified if the combined implementation of options amplified the total impact-related benefits, compared to the benefits gained from implementing each option individually. Based on the co-benefits, seven bundles were formulated. With the help of a methodology developed among the experts, optimal timing for implementing individual water management options within each bundle was prepared. The so called ‘‘adaptation pathway’’ is a combination of options and their implementation prioritisation over the short, medium, and long-term, with regards to achieving a set of pre-specified objectives under uncertain changing conditions [86]. The ‘‘adaptation pathway’’ takes into account factors like policy synergies, co-benefits or conflicts between the options, acceptability, feasibility, results from multi-criteria analysis (second workshop), and associated costs (see Table 4.2).

In the third workshop participants identified potential synergies and conflicts between the water management options that were combined by experts into seven sector- or challenge-specific bundles. Bundles contain individual interlinked options each other with the “adaptation pathways”. Participants also commented on prepared bundles of water management options and the proposed implementation timeline of individual options within the bundles. The aim was to increase the effectiveness of implementing bundles of options compared to implementing individual water management options. All suggestions given by participants that showed no discrepancy with the results of experts were taken into account in the subsequent steps. If the comparison showed a two- or more-degree difference (e.g. low conflict vs. low co-benefit or high conflict vs. no interlinkage), this was counted as a discrepancy and hence a detailed revision followed. For the final results please see chapter 4. Comments given on the content of the water management options (e.g. suggesting improvements toward better definition of the options) were not taken into account if there was a possibility of altering the results of the analysis conducted in previous steps.

With the help of stakeholders thoughts and ideas on the desired content and implementation of the adaptation plan for the Vipava river basin were gathered. There were some suggestions to include new water management options as well as to amend the content of existing options to an extent that would alter the social and economic assessment done in previous steps. Such comments could not be added at this stage of the project but are mentioned in chapter 3.3. Relevant comments given to the content of the River Basin Adaptation Plan are already incorporated in the structure of this document. Suggestions on stakeholder interest in taking forward water management options or even the individual bundles given by participants are included in chapter 4.3.

3.3 Further considerations

As described above in chapter 3, the formulation and detailed analysis of the options consisted of a particular set of steps based on the participatory approach. After the formulation of options, their detailed description allowed for the social and economic assessment. The final list of options was presented to the broader public (October 2015) and additionally to the Agencija Republike Slovenije za okolje (Slovenian Environmental Agency) at an informal meeting in Nova Gorica in January 2016. In March 2016 also the third workshop followed based on the final list of options. As some new stakeholders attended the events and the meeting, some new insights were shared with the experts. Due to the methodology prepared within the BeWater project, new ideas like for e.g. the extension of the options or adding new options, that could alter the results of previous analysis, could not be integrated in the Vipava River Basin Adaptation Plan. Therefore we mention the main ideas or new options within this chapter and give the base for improvements of the content of the River Basin Adaptation Plan in the near future.

Although it was pointed out at the first workshop (June 2014) that there were no problems with drinking water supply, one of the stakeholders participating the third workshop pointed out the problem of using drinking water also for irrigation and for technological purposes. This becomes an issue mostly during drier periods (summer) when the water consumption is at highest and people use drinking water also for other uses (irrigation, watering the garden, washing the car, etc.). This issue should be addressed in a way that basic supply should not be threatened by means of prohibiting the use of drinking water for irrigation. Also water saving techniques could be applied at the household level (e.g. turn off the tap when brushing teeth, invest in water-efficient household products, …) and in industry (e.g. closed water circuit). By doing so, the economical efficiency of the operation of the Ultraviolet Water Purification Plant at the Hubelj water spring would increased.

Regarding flood risk reduction the main comment was that integrated options for reducing floods are missing. At the first workshop the preparation of a harmonised flood risk study was proposed, and would contain a number of measures to govern the long-term flood protection for the whole Vipava river basin, not just its parts. Due to limited resources (lack of detailed data) it was not possible to develop this proposal to such an extent that the social and economic analysis could be possible. Still, as mentioned in chapter 2.2, the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) is preparing flood risk management plan 2015-2021 (in preparation) [63] and programme of measures that will include also Vipava river basin where problems of floods were recognized also at the national level. The flood risk management plan is expected to be adopted in 2016. Within the draft flood risk management plan five areas with significant impact of floods have been identified in the Vipava river basin (see chapter 2.1.2). In 2014, already three of five flood hazard maps and flood risk maps have been prepared for the Vipava river basin [87].

4 Adaptation actions

4.1 Adaptation actions

Table 4.2 below lists 20 water management options (WMOs) developed for the Vipava river basin and presents a selection of additional information associated with each option. While the options are grouped together in bundles in chapter 4 according to their synergistic interactions with one another and the common objective they contribute to, this table provides an overview of information that is specific to individual options in the columns. This information can be used by decision-makers when determining which single option(s) would be most appropriate to achieve their targeted objectives.

More specifically, table 4.2 associates each option with one or more of the challenges identified for the Vipava basin (see also chapter 2.3) and a score from the multi-criteria analysis. This score is based on the characterization of the option, the result of an assessment of the option's impact when applied in the river basin, and stakeholder evaluations ('weights') of the importance of the various possibilities for option features and impacts. A higher score from the multi-criteria analysis (ranging from 0 to 100) represents a stronger overall performance in coparison with alternative options in view of the criteria important to local stakeholders (see Text box 3 for more information about the multi-criteria analysis).

Each option is further characterized by a set of additional implementation-oriented factors, such as its feasibility, acceptability, and policy synergies. These factors help to determine whether there will be barriers to the option's implementation or, conversely, if there may already be elements in place that facilitate its implementation. Costs represent an indicative estimate of the full cost of implementing the water management option and can be used to determine which options fall within a given allocated budget. The co-benefit gives the score of combined implementation of options amplifies the total impact-related benefits, as compared to the benefits which would arise from implementing each option individually. Finally, the priority associated with each option is a combination of how an option performs according to stakeholder preferences and implementation-oriented factors evaluated through expert opinion.

The information presented below also enables stakeholders to compare the various options and identify individual ones that fulfill desired expectations, such as selecting an option which addresses a specific challenge within certain cost limitations, while meeting an individual criterion such as having high "acceptability". Based on the value of each criteria:

- The majority of options (16) were identified to cope with the challenge of water availability during droughts in the growing season (challenge A), followed by 13 options coping with the appropriate water quality (challenge C). Half of the options (ten out of 20) were identified to cope with the challenge of reducing flood risks (challenge B); however several options are addressing more than one challenge.
- Option 1, 4, and 8 performed particularly well in the multi-criteria analysis and are therefore presented mostly with high priorities. Nevertheless, option 8 is involved with high costs and low feasibility and is therefore presented with medium priority.
- Option 11 and 23 performed relatively poor in the multi-criteria analysis and are therefore presented with low or medium priorities. Both options are involved with high costs and low co-benefit with other options.

A detailed description of all 20 options is provided in the Part 2 of the document.

Table 4.2: *Overview of the identified water management options for Vipava river basin*

#	Name of Water Management Option	Challenges (A-Water availability during droughts in growing season; B-Flood risk reduction; C-Appropriate water quality)	MCA results (0: least preferable; 100: most preferable)	Feasibility (0: serious obstacles, 1: no major obstacles, 2: minor obstacles)	Acceptability (1<: low, 1: medium, >1: high)	Policy synergies (0: none, 1: medium, 2: high)	Costs (€: low (<200,000 eur), €€: medium (200,000-1,000,000 eur), €€€: high >1,000,000 eur))*	Co-benefit (>1: high, 1: medium, <1: none or conflicts)	Phasing Priority level
1	Establish an inter-municipal expert working group for the Vipava river basin	A, B, C	70	1	2	2	€	1.29	High
2	Awareness campaign focused on educating experts involved in surface water management for sustainable water management	A, B, C	63	1	2	2	€€	1.40	High
3	Awareness campaign focused on optimizing water use for farmers, for proper irrigation and minimize impacts on water quality through proper agricultural practices	A, C	44	1	2	2	€€	1.30	High
4	Awareness campaign for local public on impact of their activities on the river	A, B, C	70	1	2	2	€	1.50	High
5	Improve the financing system for water infrastructure	A, B	63	1	1	2	€	1.67	High
6	Upgrade and update the existing network for monitoring the status of water environment	A, B, C	56	1	1.5	2	€€	0.77	High
7	Setting up monitoring to reduce pressures on aquatic ecosystems resulting from water abstraction and water storage	A, C	63	1	1	2	€	1.11	High
8	Construction of water reservoirs on the watercourses in the upper part of the river basin	A, B	68	0	1	1	€€€	0.73	Medium

#		Name of Water Management Option	Challenges (A-Water availability during droughts in growing season; B-Flood risk reduction; C-Appropriate water quality)	MCA results (0: least preferable; 100: most preferable)	Feasibility (0: serious obstacles, 1: no major obstacles, 2: minor obstacles)	Acceptability (1<: low, 1: medium, >1: high)	Policy synergies (0: none, 1: medium, 2: high)	Costs (€: low (<200,000 eur), €€: medium (200,000-1,000,000 eur), €€€: high >1,000,000 eur))*	Co-benefit (>1: high, 1: medium, <1: none or conflicts)	Phasing Priority level
9		Construction of dry reservoirs	B	56	1	1	1	€€€	1.60	High
10		Reconstruction of existing water reservoir Vogršček	A	55	1	1.5	2	€€€	1.22	High
11		Development of new irrigation systems	A	29	0	1	1	€€€	0.45	Low
12		Reconstruction of existing irrigation system	A	36	1	2	2	€€€	0.50	High
13		Restoration of Vipava river and its tributaries	A, B, C	46	1	1	2	€€€	0.82	High
14		Restoration of old meanders and oxbows of Vipava river and its tributaries	A, B, C	48	1	2	2	€€€	0.67	Medium
17		Reconstruction of stabilizing and transverse constructions from natural stone in the smaller tributaries of Vipava river	B	44	2	2	2	€	0.67	High
19		Improving the system of payment for water used for irrigation	A, C	48	1	1	1	€	1.17	High
20		Preservation of existing and introduction of new shelterbelts	A, C	39	1	2	2	€€€	1.14	High

#		Name of Water Management Option	Challenges (A-Water availability during droughts in growing season; B-Flood risk reduction; C-Appropriate water quality)	MCA results (0: least preferable; 100: most preferable)	Feasibility (0: serious obstacles, 1: no major obstacles, 2: minor obstacles)	Acceptability (1<: low, 1: medium, >1: high)	Policy synergies (0: none, 1: medium, 2: high)	Costs (€: low (<200,000 eur), €€: medium (200,000-1,000,000 eur), €€€: high >1,000,000 eur))*	Co-benefit (>1: high, 1: medium, <1: none or conflicts)	Phasing Priority level
21		Removal of invasive non-native species	C	50	1	1.5	1	€	1.20	High
22		Construction of municipal wastewater treatment plants and sewage systems	C	41	1	2	2	€€€	1.33	High
23		The cultivation of crops that are resistant to climate changes (drought, pests and diseases)	A, C	27	2	0.5	2	€€€	0.13	Medium

*Remarks: €: low costs mean under EUR 200,000.00, €€: medium costs mean between EUR 200,000.00 and EUR 1,000,000.00, €€€: high costs mean above EUR 1,000,000.00.

4.2 Political context

All 20 options were cross-checked with five relevant sectoral programmes related to water management in Table 4.3. Some programmes are already adopted and some are still in preparation. Among the sectoral programmes, drafts of river basin management plans for the Danube and the Adriatic Sea Basins (2015 – 2021) [29] and a flood risk management plan [63] are still in preparation. It is expected that both key plans, prepared by the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) will be adopted by Vlada Republike Slovenije (The Government of the Republic of Slovenia) by the end of 2016. The Natura 2000 Management Programme [70] and Programme for the Management of Fish in Inland Waters of the Republic of Slovenia (Inland Fisheries Programme) [76] were adopted in 2015 for the periods until 2020 and 2021, respectively. A Draft Plan for Development of Irrigation until 2020 (Irrigation Plan) [79] is still considered among the sectors.

As expected, more than half of the options show synergies with the objectives of draft river basin management plan or even overlap with some of the proposed measures [29]. There are also two options (no. 8 and 11) in conflict with the objectives of draft river basin management plan. Reasons behind such conflicts are due to differing views of the stakeholders and opinions on how best to adapt to the impacts of global change. As mentioned already in chapter 1, existing conflicts among water related objectives (e.g. improving flood/erosion risk protection, optimizing water use, improving ecological status) have been recognized. These conflicts pose a challenge for development of an integrated and sustainable water management.

If options already show synergies with the objectives of cross-checked sectoral plans, support for the actual implementation exists. This support can be based on regulatory, financial, or information-based mechanisms and instruments. For options lacking such synergies, more effort and additional support from relevant actors would be needed.

Table 4.3: *Cross check of the identified water management options for Vipava River Basin with relevant sectoral programmes*

No.	Short name of water management options (WMO)	Draft river basin management plan	Draft flood risk management plan	The Natura 2000 Management Programme	Inland Fisheries Programme	Irrigation plan
WMO 1	Establish an inter-municipal expert working group	**1**	**0**	**0**	**0**	**1**
WMO 2	Awareness campaign for water management experts	**1**	**0**	**0**	**0**	**0**
WMO 3	Awareness campaign for farmers	**1**	**0**	**1**	**0**	**0**
WMO 4	Awareness campaign for local public	**1**	**0**	**1**	**0**	**0**
WMO 5	Improve the financing system for water infrastructure	**1**	**1**	**0**	**0**	**0**
WMO 6	Upgrade and update the monitoring network	**1**	**0**	**1**	**0**	**0**
WMO 7	Setting up monitoring for water abstractions	**1**	**0**	**0**	**0**	**0**
WMO 8	Construction of water reservoirs	**-1**	**1**	**1**	**0**	**1**
WMO 9	Construction of dry reservoirs	**0**	**1**	**0**	**0**	**0**
WMO 10	Reconstruction of water reservoir Vogršček	**0**	**1**	**1**	**0**	**1**
WMO 11	New irrigation systems	**-1**	**0**	**0**	**0**	**1**
WMO 12	Reconstruction of existing irrigation system	**0**	**0**	**0**	**0**	**1**
WMO 13	Restoration of Vipava river and its tributaries	**1**	**1**	**1**	**1**	**0**

No.	Short name of water management options (WMO)	Draft river basin management plan	Draft flood risk management plan	The Natura 2000 Management Programme	Inland Fisheries Programme	Irrigation plan
WMO 14	Restoration of Vipava river and its tributaries	**1**	**1**	**1**	**0**	**0**
WMO 17	Reconstruction of stabilizing and transverse constructions	**0**	**1**	**1**	**0**	**0**
WMO 19	Improve the system of payment for water use	**1**	**0**	**0**	**0**	**0**
WMO 20	Preservation and introduction of shelterbelts	**0**	**0**	**1**	**0**	**0**
WMO 21	Removal of invasive non-native species	**1**	**0**	**1**	**1**	**0**
WMO 22	Construction of municipal wastewater treatment plants	**0**	**0**	**0**	**0**	**0**
WMO 23	Cultivation of climate change resistant crops	**0**	**1**	**1**	**0**	**0**

Legend:

1	**synergy with sectoral plan**
-1	**conflict with sectoral plan**
0	**no synergy with sectoral plan**

4.3 Presentation of bundle factsheets

The aim of the bundling of the individual options was to increase the effectiveness of implementing bundles of options compared to implementing individual options. Namely, the evidence from studies of adaptation to past and current climate variability indicates that adaptation measures are rarely adopted singly [88]. Instead, bundles of adaptation options are adopted together, in an attempt to address the multiple impacts of global change on the socio-ecological systems of the river basin. Although many of the options could be implemented individually to achieve the addressed objectives, some of the options are missing complementary options to give the desired results. This was also noticed by stakeholders within the participatory process. However, not all adaptation options are necessarily compatible with one another [88].

The identified adaptation options for the Vipava River Basin Adaptation Plan were bundled with one another based on: 1) options addressing water management relevant sectors (water management, agriculture, tourism and nature conservation) and 2) their co-benefits and conflicts. Experts assessed the impact of different combinations of adaptation options in relation to the implementation of individual options. Based on this co-benefits analysis, groups of adaptation options with high or low co-benefits were grouped together.

Implementation timeline of the bundled adaptation options was assessed, based on their effectiveness over time and local preferences. This assessment aimed to identify when each option would best be implemented within each bundle.

For individual water management options, information about synergies with other policies and suggestions on stakeholder involvement was specified in Part 2.

The seven bundles, developed within this process, address sectors that were recognized by experts and stakeholders as relevant for the uptake in the adaptation plan:

1. Organisation of Sustainable Water Management
2. Implementation of Sustainable Water Management
3. Flood Risk Reduction
4. Improving Conditions for Agriculture Taking Climate Change Impacts into Account
5. Adaptation of Agriculture to Climate Change Impacts
6. Development of Sustainable Tourism
7. Implementation of Nature Protection Management

Factsheets of the bundles of adaptation options are presented below and provide summarised information for each bundle, including:

- the focus of the bundle
- the proposed combination of adaptation options per bundle
- the “adaptation pathway”, representing the implementation of the options in short-term (2018), mid-term (2021), and long-term (2025), and
- the way forward, i.e., implementation avenues.

4.3.1 Organisation of sustainable water management

Focus of the bundle

Organisation of sustainable water management is the precondition for implementation phase of sustainable water management. This bundle aims to prepare currently missing integrated plans that are applicable for an individual river basin. Spatial planning and raising awareness among water management experts are crucial options for the preparation of those plans. Other options provide needed information about the scope and intensity for water management options that are directly addressing implementation phase of sustainable water management. The bundle addresses all three identified challenges: water availability, flood risk reduction, and appropriate water quality.

Proposed combination of options

Context		
Water management options included in this bundle have in common that they all aim to establish the organization of sustainable water management at the river basin level. The water management options present all co-benefits, with the WMO 1 to 5 and WMO 6 and 7 scored with high co-benefit and others as low co-benefit. The WMOs 1, 5, 6, and 7 are providing information for preparation of integrated plans at the river basin level. Hence spatial planning, improvement of expert knowledge, financing of options and monitoring of water status and water abstractions are covered.		
Water Management Options		
1	Establish an intermunicipal expert working group	The task of the inter-municipal working group is to direct spatial planning considering water management in the river basin. Representatives of each local authority with external help of requisite expert knowledge will be included in working group. The position would last through the financial cycle of river basin management plan.
2	Awareness campaign for water management experts	The objective of the awareness campaign for water management experts in the first place is to educate them on impacts of their work on hydromorphological pressures. The second objective is to educate them about more sustainable techniques in designing interventions on watercourses. The last objective is to collect existing good practices with suggestions for improvements and a complementing database of good practices.
5	Improve the financing system for water infrastructure	The objective is to determinate a contribution key and to set legal bases for the eligible use of funds for financing water infrastructure. The objective is also to improve system of financing water infrastructure in a way so as to help achieve the objectives of sustainable water management and of the river basin management plan.
6	Upgrade and update the monitoring network	The objective is to review all of existing monitoring stations and their status and in the second phase to upgrade the network system with new stations where needed.
7	Setting up monitoring for water abstractions	The objective is to verify existing water rights in Vipava river basin and to verify actual water consumption. This is precondition for monitoring illegal water abstractions.

'adaptation pathway'

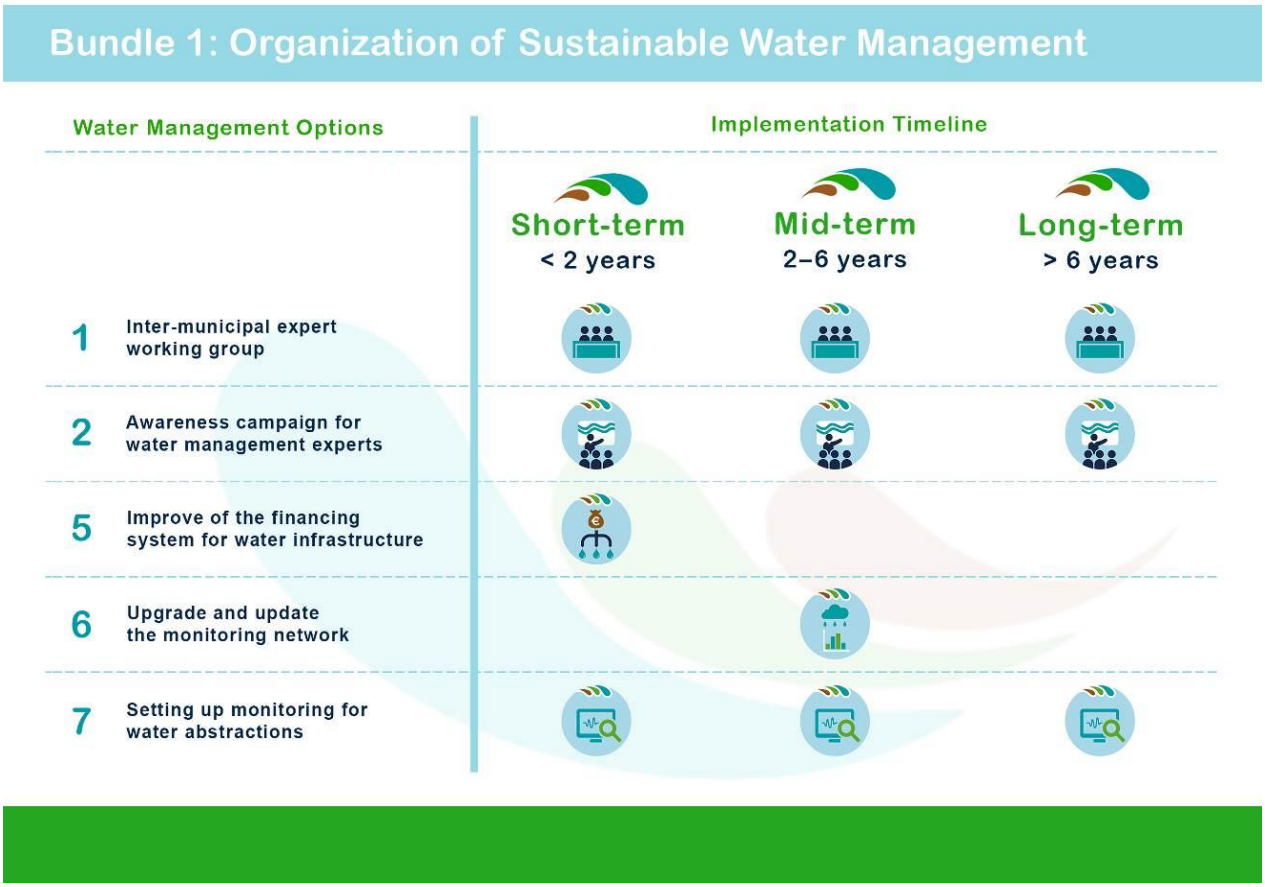
With the creation of an inter-municipal expert working group (WMO 1), the much needed cooperation between municipalities and experts and the main objectives are first set. Together with WMO 2, an awareness campaign focused on educating experts, and WMO 5, the improvement of the financing system, they should be implemented first, in the first year (short term). Despite minor barriers due to limited financial capacities or the varying levels of acceptability according to stakeholders, they show many policy synergies. They form the basis for the organisation of an integrated and sustainable water management plan addressing the whole Vipava river basin.

For monitoring of actual water consumption at holders of water rights (WMO 7) minor barriers due to possible restriction of water use and medium acceptability by stakeholders exist. Still due to the lowest costs, this option (WMO 7) should be implemented next, especially during a period of low natural flows, and repeated every 5 years.

When the facts regarding water consumption are identified, the upgrade of the existing monitoring network (WMO 6) should be implemented in the mid-term due to limited financial capacities. With both options (WMO 7 and 6), more representative data can help to better understand the current situation in the Vipava River Basin as the basis for improvement of river basin management.

The upgrade and update of the existing monitoring network for assessing the status of the water environment (WMO 6) should be implemented after WMO 5. WMO 5, the improvement of the financing system, will make the implementation of the rather costly option WMO 6 feasible, as it reduces the highest implementation barrier, the costs of WMO6.

Therefore, the acceptability of WMO 6 for stakeholders will probably improve over time, once the funding sources are secured.



Way forward/implementation avenues

The bundle is showing an overall policy synergy with draft river basin management plan. There are also some synergies with the Natura 2000 management programme [70] and also the flood risk management plan [63]. The resolution on the national environmental action programme (2005–2012) [89], and others (e.g.: local self-government act [90]) allow for the establishment of groups of stakeholders (WMO 1) to help achieve the objectives of the regional development programme of Northern Primorska (Goriška development region) 2014-2020 [91] in planning a comprehensive spatial development of the region.

Many of the water management options included in the bundle could be funded through different financial mechanisms such as Horizon 2020, The INTERREG MED Programme 2014-2020, depending on the priorities and challenges they address.

The main identified actors that need to be involved in the implementation of this bundle can be divided into national and local actors. National actors that are most important for this bundle are the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) with its bodies, especially the Direkcija Republike Slovenije za vode (Slovenian Water Agency) and the Agencija Republike Slovenije za okolje (Slovenian Environmental Agency). At the local level active involvement of municipalities together with regional development agencies and users of water infrastructure must be assured.

During the third workshop (March, 2016) the municipalities, the Water Management Company with state concession to provide the water management public service, and the health sector through the Nacionalni laboratorij za zdravje, okolje in hrano (National Laboratory of Health, Environment and Food) and Nacionalni inštitut za javno zdravje (National institute of public health) indicated their willingness to take up the bundle or individual water management options with differing roles in the implementation process.

4.3.2 Implementation of sustainable water management

Focus of the bundle

In the past, the water management sector had the main objective to provide flood safety of people and their property. After the adoption of the Water Framework Directive in 2006 the component of ecological status was legally included in water management. The bundle addresses the physical part of sustainable water management. Each individual water management option included has beside the regulatory part, also the part which addresses the ecological status of water management. The bundle addresses all three identified challenges: water availability, flood risk reduction, and appropriate water quality.

Proposed combination of options

Context		
Water management options included in this bundle present concrete options where actual improvements of water management status can be made. The majority of options are complement with each other and have scored co-benefit, only a few scored no interlinkage and few scored low conflict. Pairs WMO 13 and 17 and WMO 14 and 17 have scored as low conflict due to possible prevention of sediment transport as a crucial element of natural hydromorphology		
Water Management Options		
13	Restoration of Vipava river and its tributaries	The objective is to establish the original state of the Vipava river and its tributaries with removal of transversal and longitudinal protection objects. It proposes 16 potential locations for the restoration of the Vipava river and seven locations of its tributaries in total length of 21,926 m.
14	Restoration of old meanders and oxbows	The objective is to establish the original state of old meanders and oxbows with restoration of the former connection of the main watercourse with its old meander and oxbow. It proposes restoration of old meanders on nine potential locations in total length of 2,721 m.
17	Reconstruction of stabilizing and transverse constructions	The objective is to locate existing transversal and stabilizing construction in the tributaries of Vipava river and set a priority for their reconstruction. Their function is to stabilize the water bed and prevent erosion. Reconstruction is conceived with the use of all known sustainable techniques.
20	Preservation and introduction of shelterbelts	The objective is to preserve existing and introduce new shelterbelts. Implementation of shelterbelts includes trees seedlings (four seedlings per meter of approx. 50 cm high), with their marking and protection with poles.
22	Construction of municipal wastewater treatment plants	Agglomerations under 2,000 population equivalent (PE) – overall 21,225.44 PE is without the existing public sewage system, 21.137,05 PE is without the existing WWTP. Agglomerations above 2,000 PE – overall 4,767.36 PE is without the existing public sewage system, 5,207.80 PE is without existing WWTP.

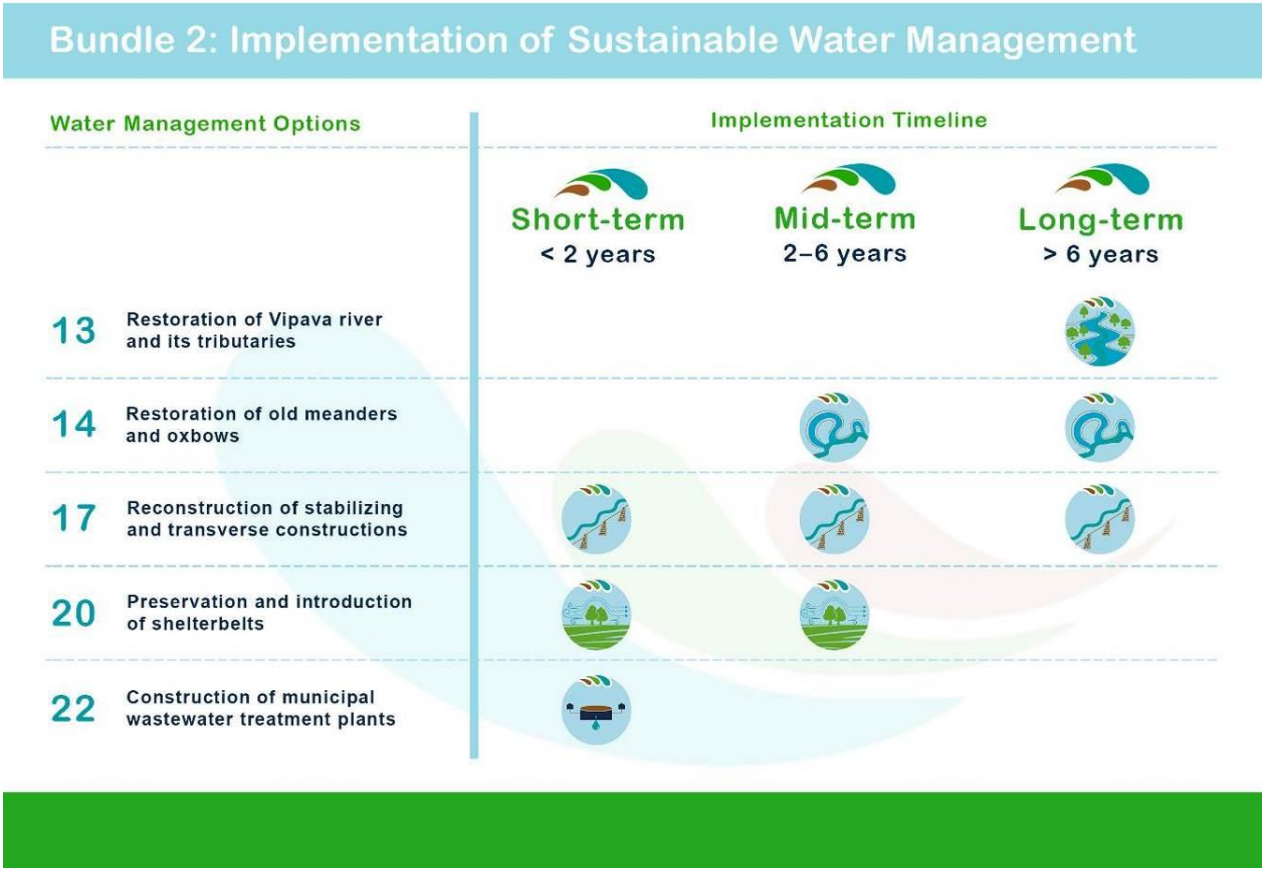
'adaptation pathway'

The reconstruction of stabilizing and transverse constructions in the Vipava's tributaries (WMO 17) and construction of missing sewage and municipal wastewater treatment plants across the river basin (WMO 22) should be implemented or be begun in the first year, respectively. Although there are barriers due to high costs, constructing sewage and municipal wastewater treatment plants across the river basin (WMO 22) shows high policy synergies. WMO 22 can reduce water pollution (organic, nutrients, pathogens) and result in better water quality. At the same time (in parallel), reconstruction of stabilizing and transverse constructions in the Vipava's tributaries (WMO 17) should be implemented. WMO 17, concentrated to specific areas in Vipava river basin, result in low costs, with no major barriers for implementation and showing many policy synergies. As maintenance works must be continuously conducted, the phasing is adapted accordingly.

With minor barriers due to low awareness of farmers, and also limited financial capacities, the option of preserving existing and introducing new shelterbelts (WMO 20) should be implemented next. As more time is needed for trees to function as shelter and wind breakers, the option should be implemented in first potential location (proposal of four potential locations is prepared, see description of WMO in Part 2) in the second year, followed by the third, fourth, and fifth year for the remaining three proposed locations.

Minor barriers due to high costs and varying acceptability of stakeholders also accompany next two proposed options, restoration of old meanders and oxbows (WMO 14) and restoration of Vipava river and its tributaries (WMO 13). Although in low conflict with WMO 17, as sediment transport is prevented downstream, both options show low co-benefits with WMO 20, as shelterbelts can be also part of riparian vegetation. They would improve the ecosystem

services of the river and riparian zones (including sediment and nutrient filtering, water storage, bank stabilization, and provision of habitat for biodiversity).



Way forward/implementation avenues

Options no. 13 and 14 showing synergies with the river basin management plan [29], flood risk management plan [63] and the Natura 2000 management programme [70]. Option no. 13 shows synergies with the programme for the management of fish in inland waters [76]. Option no. 20 shows synergies with the Natura 2000 management programme [70]. Construction of municipal wastewater treatment plants (WMO 22) follows the requirements of the operational program of discharge and municipal wastewater treatment [69].

Option no. 17 could be financed through the Vodni sklad (Water fund). Other options could be covered through other mechanisms such as INTERREG MED Programme 2014-2020, funding via the Common Agricultural Policy, European Regional Development Fund, and the Cohesion Fund.

The main actor identified for the implementation of this bundle is the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) and its bodies the Direkcija Republike Slovenije za vode (Slovenian Water Agency) and the Agencija Republike Slovenije za okolje (Slovenian Environmental Agency). Beside options directly connected to the water sector there is option no. 20, where the Ministrstvo za kmetijstvo gozdarstvo in prehrano (Ministry of Agriculture, Forestry and Food) and the Zavod za gozdove Slovenije (Slovenia forest service) should actively cooperate and support its implementation. As in practice municipalities play a main role in implementation of option no. 22.

During the third workshop (March, 2016) the municipalities, the water management company, the Služba vlade RS za razvoj in evropsko kohezijsko politico (Government office for development and European cohesion policy), and the health sector representatives the Nacionalni laboratorij za zdravje, okolje in hrano (National Laboratory of Health, Environment and Food) and the Nacionalni inštitut za javno zdravje (National institute of public health) indicated their willingness to take up the bundle or individual water management options with differing roles in the implementation process.

4.3.3 Flood Risk Reduction

Focus of the bundle

With settlement expansion (urbanization) and the need for increasing farmland in the past took Vipava river and its tributaries the needed space that was used as natural inundation area. In the lower parts of Vipava river basin there are flood areas practically all through the valley. The bundle includes water management options addressing flood protection and so coinciding with a challenge of flood risk reduction. This bundle works in a curative way of past interventions and in preventive way to avoid new mistakes.

Proposed combination of options

Context		
Water management options included in this bundle have the objective of reducing flood risks and the majority of them are complementary with each other and have a scored co-benefit. Due to the high number of WMOs included it is undersandable that not all included WMOs have a scored co-benefit. Low conflicts are shown for pairs WMO 8 and 13, WMO 8 and 14, WMO 13 and 17, and WMO 14 and 17. The reason for this is that WMOs 8 and 17 can have a negative effect on the ecological state of water. This is in contradiction to the objectives of WMOs 13 and 14 of restoring natural hydromorphology. Ten pairs out of 45 combinations of water management options have scored no interlinkage as no co-benefit or conflict was assessed between them.		
Water Management Options		
1	Establish an intermunicipal expert working group	The task of the inter-municipal working group is to direct spatial planning, considering water management in the river basin. Representatives of each local authority with external help of requisite expert knowledge will be included in working group. The position would last through the financial cycle of river basin management plan.
2	Awareness campaign for water management experts	The objective of the awareness campaign for water management experts in the first place is to educate them on the impacts of their work on hydromorphological pressures. The second objective is to educate them about more sustainable techniques in designing interventions on watercourses. The last objective is to collect existing good practices with suggestions for improvements and a complementing database of good practices.
5	Improve the financing system for water infrastructure	The objective is to determinate the contribution key and to set legal bases for the eligible use of funds for financing water infrastructure. The objective is also to improve the system of financing water infrastructure in a way so as to help achieve the objectives of sustainable water management and of the river basin management plan.
6	Upgrade and update the monitoring network	The objective is to review all of existing monitoring stations and their status and in the second phase to upgrade the network system with new stations where needed.
8	Construction of water reservoirs	The objective is to construct water reservoirs that are already part of the “Development Plan for Irrigation till 2020”. There are planned four new water reservoirs in the Vipava river basin: • Košivec – in municipality Ajdovščina, volume 1.176 million m^3 • Vrnivec – in municipality Ajdovščina, volume 1 million m^3 • Svinjšček – in municipality Ajdovščina, volume 1 million m^3 • Pasji rep – in municipality Vipava, volume 2.5 million m^3
9	Construction of dry reservoirs	The objective is to identify areas that require increased protection against floods and identify potential locations for building dry reservoirs.
10	Reconstruction of water reservoir Vogršček	The objective is to reconstruct the Vogršček water reservoir. The “Reconstruction of the Vogršček Barrier” is already planned and now documentation is being prepared.

13	Restoration of Vipava river and its tributaries	The objective is to establish original state of the Vipava river and its tributaries with removal of transversal and longitudinal protection objects. It proposes 16 potential locations for restoration of Vipava river and seven locations of its tributaries in total length of 21,926 m.
14	Restoration of old meanders and oxbows	The objective is to establish the original state of old meanders and oxbows with the restoration of the former connection of the main watercourse with its old meander and oxbow. It proposes restoration of old meanders in nine potential locations in a total length of 2,721 m.
17	Reconstruction of stabilizing and transverse constructions	The objective is to locate existing transversal and stabilizing construction in the tributaries of Vipava river and set the priority for the reconstruction. Their function is to stabilize water bed and prevent eroison. Reconstruction is conceived with the use of all known sustainable techniques.

'adaptation pathway'

With the creation of an inter-municipal expert working group (WMO 1), the much needed cooperation between municipalities and experts is set first. Together with options no. 5, the improvement of the financing system, and 2, the *awareness campaign focused on educating experts, they should be implemented first, in the first year (short term). Despite minor barriers due to varying levels of acceptability among stakeholders, they show many policy synergies. WMO 5, improving the financing system, will make the implementation of the rather costly options (WMO 6, 8, 9, 10, 13, and 14) more feasible.*

Despite minor barriers due to high costs, reconstruction of the existing Vogršček water reservoir (WMO 10) as such is already envisaged by the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) and is consequently in the short term (in first two years' time).

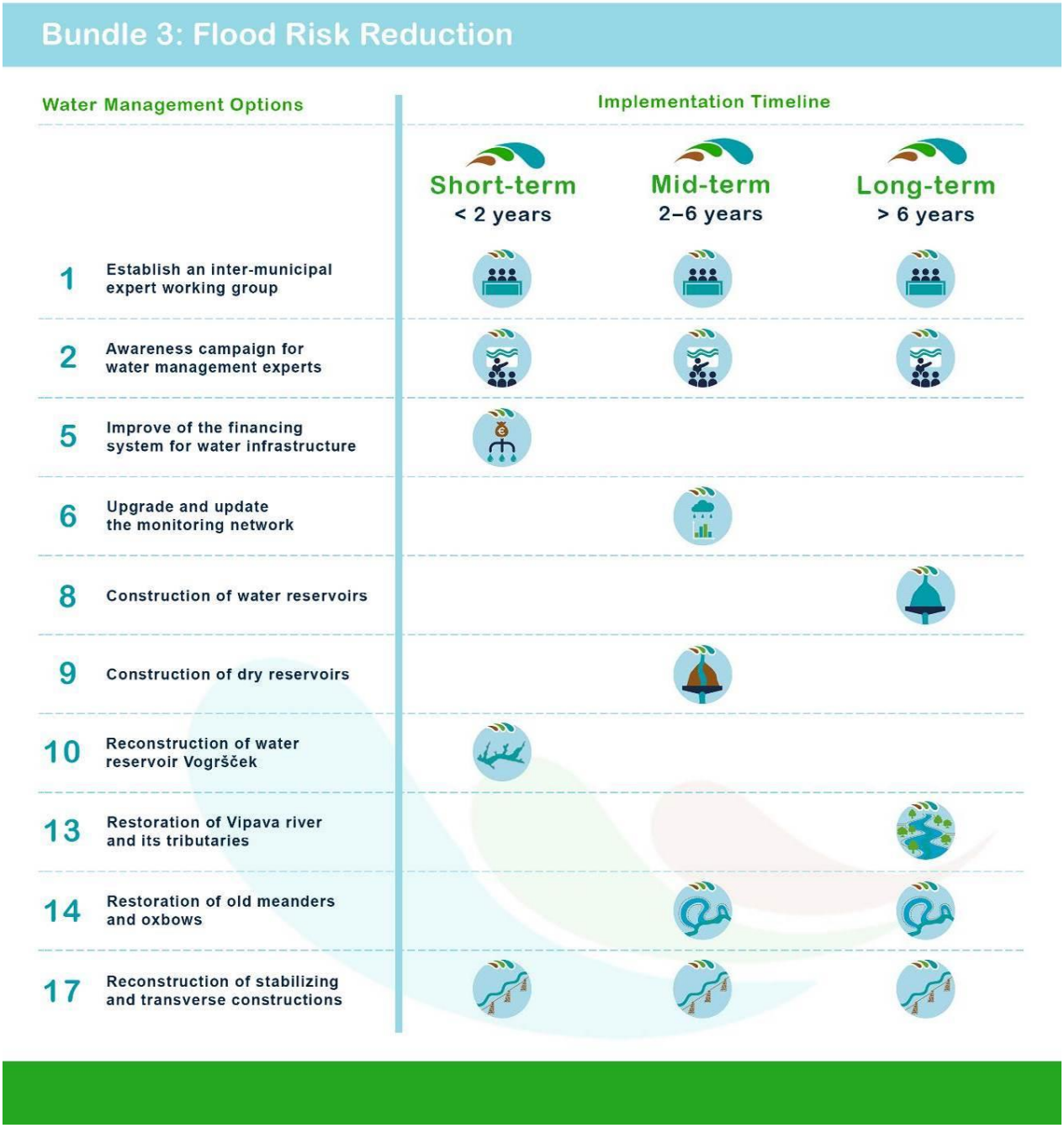
WMO 10 is followed by the reconstruction of stabilizing and transverse constructions in the Vipava's tributaries (WMO 17), which must be continuously maintained. WMO 17, concentrated on specific areas in the Vipava river basin, results in low costs, no major barriers for implementation, and the potential for many policy synergies. This option shows also high co-benefits with WMO 2 (considering more sustainable techniques).

The upgrade and update of the existing monitoring network for assessing the status of the water environment (WMO 6) should be implemented after WMO 5, but not necessarily after WMO 10 and 17. Namely, WMO 5, as written above, will make the implementation of the rather costly option WMO 6 feasible, as it reduces the highest implementation barrier, the costs of WMO 6. Therefore, the acceptability of stakeholders for WMO 6 could probably improve over time, once the funding sources are secured.

The option WMO 14 (restoration of old meanders and oxbows) should be implemented before WMO 13 (restoration of the Vipava river and its tributaries) due to higher acceptability among stakeholders. Both of the options would be implemented gradually, starting with WMO 14 in the third year and continuing with the implementation, when, later, WMO 13 would be put into motion. Both options show high co-benefits, improving the status of water and riparian ecosystems in larger scale.

Dry reservoirs (WMO 9), if backed up with the analysis, could be implemented in a later stage. If the rates of changes (flood events) increase and the Flood risk management plan recognizes the need for the implementation of such reservoirs, then option 9 could be brought forward. If the rates of changes are slower, then the implementation can be delayed or even abandoned. This option shows low co-benefits with WMO 1 and high co-benefits with WMO 2, as with proper planning and the use of more sustainable techniques considering water management in the project design possible negative impacts on the environment and society can be minimized.

Multifunctional water reservoirs (WMO 8) can only in a small part help reduce floods downstream and are so placed at the very end of the option list. Although many synergies with policy objectives do exist, major barriers due to high implementation costs and varying acceptability of stakeholders have been identified. This option, like WMO 9, shows co-benefits with WMO 1 and 2 for the same reasons, but shows conflicts with WMO 13 and 14 as water reservoirs on watercourses will affect structural water quality.



Way forward/implementation avenues

Options show synergies with the river basin management plan, except water management options 9, 10, and 17, where there is no connection with sectoral plans. WMO 8 is in conflict with the river basin management plan [29] due to the measure of restricting the granting of water rights that poses a precondition for the construction of water reservoirs. The flood risk management plan [63] has synergies with most water management options, but with WMO 1, 2, 6 no connection has been detected. Except for WMOs 1, 2, and 5, where no connection detected, other options are in synergy with the Natura 2000 Management Plan [70]. WMO 13 is in synergy with the programme for the management of fish in inland waters [76]. WMOs 1, 8, and 10 are in synergy with the national irrigation strategy in preparation [79]. The spatial plan of municipality ajdovščina and its amendments [92], together with draft spatial plan of the municipality of Ajdovščina (June 2014), plans for two water reservoirs, Košivec and Vrnivec (WMO 8). WMO 8 is also supported by the development programme of Northern Primorska (Gorizia development regions) 2014-2020 [91] within the measure A2P1, which plans a selection of the optimal project solutions of flood safety measures, which will allow multipurpose use and integration of financial resources across sectors and, consequently, best solutions from a technical, environmental, and economic point of view.

Funding of water infrastructure could be provided by the Water fund. Other water management options could be financed through other mechanisms, such as development programme of Northern Primorska [91], Horizon 2020, INTERREG MED Programme 2014-2020, CAP/European Agricultural Fund for Rural Development (EAFRD), European Regional Development Fund (ERDF) and Cohesion Fund.

Identified main actor for the implementation of this bundle is the Ministrstvo za okolje in prostor and its bodies, mainly the Direkcija Republike Slovenije za vode and the Agencija Republike Slovenije za. The Inštitut za vode Republike Slovenije and the Zavod Republike Slovenije za varstvo narave could be involved in the options of restoration (WMO 13, WMO 14) and reconstruction of objects on watercourses (WMO 17). Reconstructing and building new water reservoirs is an area where the Ministrstvo za kmetijstvo, gozdarstvo in prehrano and the Ministrstvo za should actively cooperate and support implementation. An important actor for the implementation of WMO 5 is the ministry responsible for finances. At the local level municipalities and regional development agencies could contribute to the success of this bundle.

During the third workshop (March, 2016) the municipalities, the water management company, the Služba vlade za razvoj in evropsko kohezijsko politiko, and health sector representatives the Nacionalni laboratorij za zdravje, okolje in hrano, and the Nacionalni inštitut za javno zdravje indicated their willingness to take up the bundle or individual water management options with differing roles in the implementation process.

4.3.4 Improving conditions for agriculture taking climate change impacts into account

Focus of the bundle

Agricultural land makes up 33% of the total Vipava river basin area. The impact of climate changes on the agriculture sector is important and must be taken into consideration. They are reflected in agricultural droughts and in pressures on water use in the growing season (especially in summer months). The bundle includes water management options addressing improvements in agriculture to the existing and forthcoming conditions, considering global change. Options included have the objective to optimise agricultural practices. This bundle addresses two identified challenges: water availability and appropriate water quality.

Proposed combination of options

Context		
Water management options included in this bundle have the objective of improving conditions for agriculture that lack water for irrigation. Objectives of proposed water management options included in the bundle primarily address the challenge of water availability. The majority of options complement each other and have scored co-benefits.		
Water management options		
1	Establish an intermunicipal expert working group	The task of the inter-municipal working group is to direct spatial planning considering water management in the river basin. Representatives of each local authority with external help of requisite expert knowledge will be included in the working group. The position would last through the financial cycle of river basin management plan.
3	Awareness campaign for farmers	The objective is to analyse existing agricultural practices together with suggestions for improvement. It is also to prepare guidelines for proper agricultural practices considering changing climate conditions.
7	Setting up monitoring for water abstractions	The objective is to verify existing water rights in Vipava river basin and actual water consumption. This is precondition for monitoring illegal water abstractions.
8	Construction of water reservoirs	The objective is to construct water reservoirs that are already part of the "Development Plan for Irrigation till 2020". There are planned four new water reservoirs in the Vipava river basin: • Košivec – in municipality Ajdovščina, volume 1.176 million m^3 • Vrnivec – in municipality Ajdovščina, volume 1 million m^3 • Svinjšček – in municipality Ajdovščina, volume 1 million m^3 Pasji rep – in municipality Vipava, volume 2.5 million m^3
10	Reconstruction of water reservoir Vogršček	The objective is to reconstruct the Vogršček water reservoir. The "Reconstruction of the Vogršček Barrier" is already planned and documentation is in preparation.
11	New irrigation systems	The objective is to develop new irrigation systems that are part of "Action plan for development of irrigation in Republic of Slovenia until 2020". There are 3,979.00 ha of new irrigation systems planned in the Vipava valley together with WMO 8 mentioned water reservoirs.
12	Reconstruction of existing irrigation system	The objective is to verify status of 1546 ha of existing irrigation systems in the Vipava valley and to recognize needs and scope of reconstruction works which will take place in the second phase of the option.
19	Improve the system of payment for water use	The objective is to improve the system of payment in a way to collect more money for water used for irrigation. A possible solution proposed by the option is to lower the limit of yearly consumption (from 5,000 m^3 to 2,500 m^3), when farmers do not need to pay for actual water use.

'adaptation pathway'

With the establishment of an inter-municipal expert working group (WMO 1), the much needed cooperation between municipalities and experts and the main objectives for agriculture is first set. Together with the options of setting up

monitoring on actual water use (WMO 7) and raising awareness (WMO 3), they should be implemented first, in the first year (short term). Despite minor barriers due to limited financial capacities or varying acceptability according to stakeholders, they show many policy synergies. They form the basis for the preparation of more concrete options that would improve the conditions for agriculture production.

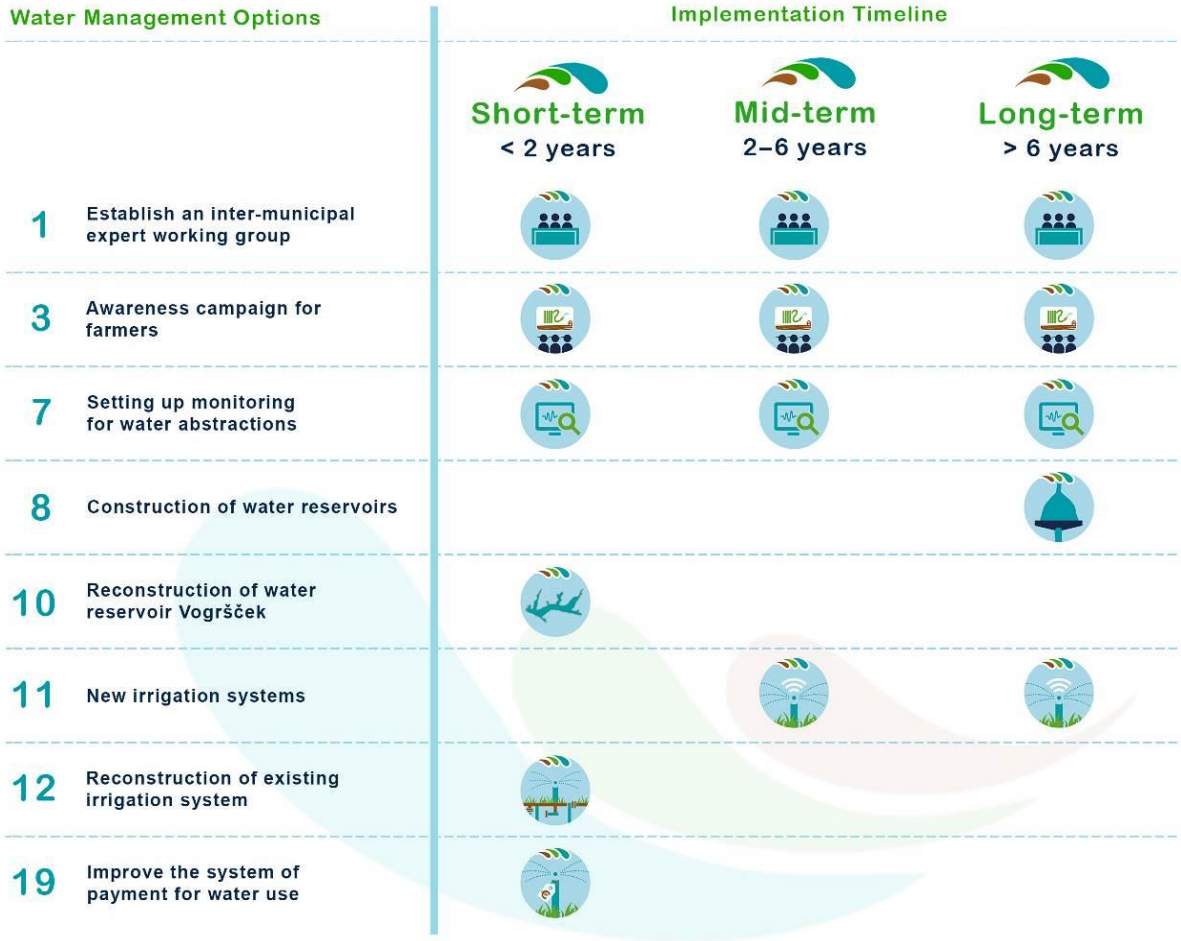
Despite minor barriers due to varying acceptability among stakeholders and low policy synergies (lacking strong political support/back-up), improvements to the system of payment for water used for irrigation (WMO 19) should also be implemented in the first two years' time. This option could make financing the operation of irrigation systems (WMO 12 and 11) more feasible.

Despite minor barriers due to high costs, the reconstruction of the existing Vogršček water reservoir (WMO 10) as such is already envisaged by the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) and is consequently placed in the short term (first two years' time).

WMO 10 is logically followed by reconstruction of existing irrigation systems derived from Vogršček (WMO 12) that despite limited financial capacities shows strong support from stakeholders and many policy synergies. New irrigation systems (WMO 11) derived from the Vogršček water reservoir would follow in the mid-term if there is shown a clear need by stakeholders (farmers). Due to the identified low feasibility and low preference regarding the results of multi-criteria analysis, the priority level for this option is low.

Although synergies with policy objectives do exist, major barriers due to high implementation costs and varying acceptability of stakeholders have been identified for implementing new water reservoirs (WMO 8) and are as such placed at the very end of the option list. It is more reasonable to verify the functionality and optimal utilization of existing irrigation infrastructure (WMO 10, WMO 12) before investing in new water reservoirs and irrigation systems derived from new reservoirs (WMO 11).

Bundle 4: Improving Conditions for Agriculture



Way forward/implementation avenues

Water management options show synergies with the river basin management plan, except for WMOs 10 and 12, which do not show any connections. WMOs 8 and 11 show a negative connection with the river basin management plan [29] due to the measure of restricting the granting of water rights, as is a precondition for the construction of water reservoirs and building new irrigation systems. WMOs 8 and 10 are in synergy with the flood risk management plan [63]. The Natura 2000 management programme [70] is in synergy with WMOs 3, 8, and 10. WMOs 1, 8, 10, 11, and 12 are in synergy with the national irrigation strategy in preparation [79]. WMO 1 is in synergy with the resolution on the national environmental action programme (2005–2012) [89], and others (e.g.: the local self-government act [90]) that allow the establishment of such associations. Option could help achieve objectives of programme 5.1 “A comprehensive spatial development of the region” of regional development programme of Northern Primorska (Goriška development region) 2014-2020 [91]. WMO 3 is supported also by the national adaptation strategy for forestry and agriculture (2008) [94] and its implementation document action plan from 2011 [95] - Pillar II: education, awareness, and counselling. Measures that are already in place and are planned in the future: 7. Raising awareness of farmers of the impact of climate change on agriculture. The spatial plan of municipality Ajdovščina and its amendments [92], together with the draft spatial plan of the Municipality of Ajdovščina (June 2014) plans two water reservoirs, Košivec and Vrnivec (WMO 8). This option is also supported by the regional development programme of Northern Primorska (Goriška development region) 2014-2020 [91] within a measure that plans a selection of the optimal project solutions of flood safety measures, which will allow for multipurpose use and the integration of financial resources across sectors and, consequently, best solutions from a technical, environmental, and economic point of view.

Funding for water infrastructure could be provided by the Vodni sklad (Water fund). Other water management options can be financed through other mechanisms, such as the Rural Development Plan 2014-2020, the Development Programme of Northern Primorska [91], Horizon 2020, the Common Agricultural Policy, and the European Regional Development Fund.

The main actor identified for the implementation of the bundle is the Ministrstvo za kmetijstvo gozdarstvo in prehrano (Ministry of Agriculture, Forestry and Food) with its Svetovalna služba (Advisory Service) and the Kmetijsko gozdarska zbornica Slovenije (Chamber of Agriculture and Forestry of Slovenia). On the part of water rights, the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) with its Direkcija Republike Slovenije za vode (Slovenian Water Agency) and the Agencija Republike Slovenije za okolje (Slovenian Environmental Agency) should take over the main role. The Inštitut za vode Republike Slovenije (Institute for Water of the Republic of Slovenia) could be included. With water management options, where big interventions are planned, the Zavod za varstvo narave RS (Institute of the republic of Slovenia for Nature Conservation) plays the main role. At the local level municipalities and regional development agencies could serve as the main actors for this bundle.

During the third workshop (March, 2016) local farmers and the Biotehniška šola (Biotechnical School) indicated their willingness to take up the individual water management options (irrigation and the awareness campaign respectively) with differing roles in the implementation process.

4.3.5 Adaptation of agriculture to climate change impacts

Focus of the bundle

Agricultural land comprises 33% of the total Vipava river basin area. Impacts of climate changes on the agriculture sector are important and need to be taken into consideration. They are reflected in agricultural droughts and in pressures on water use in the growing season (especially in summer months). The bundle includes water management options addressing the adaptation of agriculture and its practices to the existing and forthcoming conditions in terms of global climate change. This bundle addresses two identified challenges: water availability and appropriate water quality.

Proposed combination of options

Context		
Water management options included in this bundle have the objective of adapting agriculture to the impacts of global change. The options aim to lower water consumption. All options show co-benefits when implemented together.		
Water Management Options		
1	Establish an intermunicipal expert working group	The task of the inter-municipal working group is to direct spatial planning considering water management in the river basin. Representatives of each local authority with the external help of requisite expert knowledge will be included in the working group. The position would last through the financial cycle of the river basin management plan.
3	Awareness campaign for farmers	The objective is to analyse existing agricultural practices together with suggestions for improvement. The objective is also to prepare guidelines for proper agricultural practices considering changing climate conditions.
20	Preservation and introduction of shelterbelts	The objective is to preserve the existing and introduce new shelterbelts. Implementation of shelterbelts includes tree seedlings (4 seedlings per meter of approx. 50 cm high), with their marking and protection with poles.
23	Cultivation of climate change resistant crops	The objective is selection of new varieties and alternative crops that are more adapted to the climatic conditions influenced by global changes. It includes a review and analysis of suitable crops and also a market analysis if there exists a market for those crops.

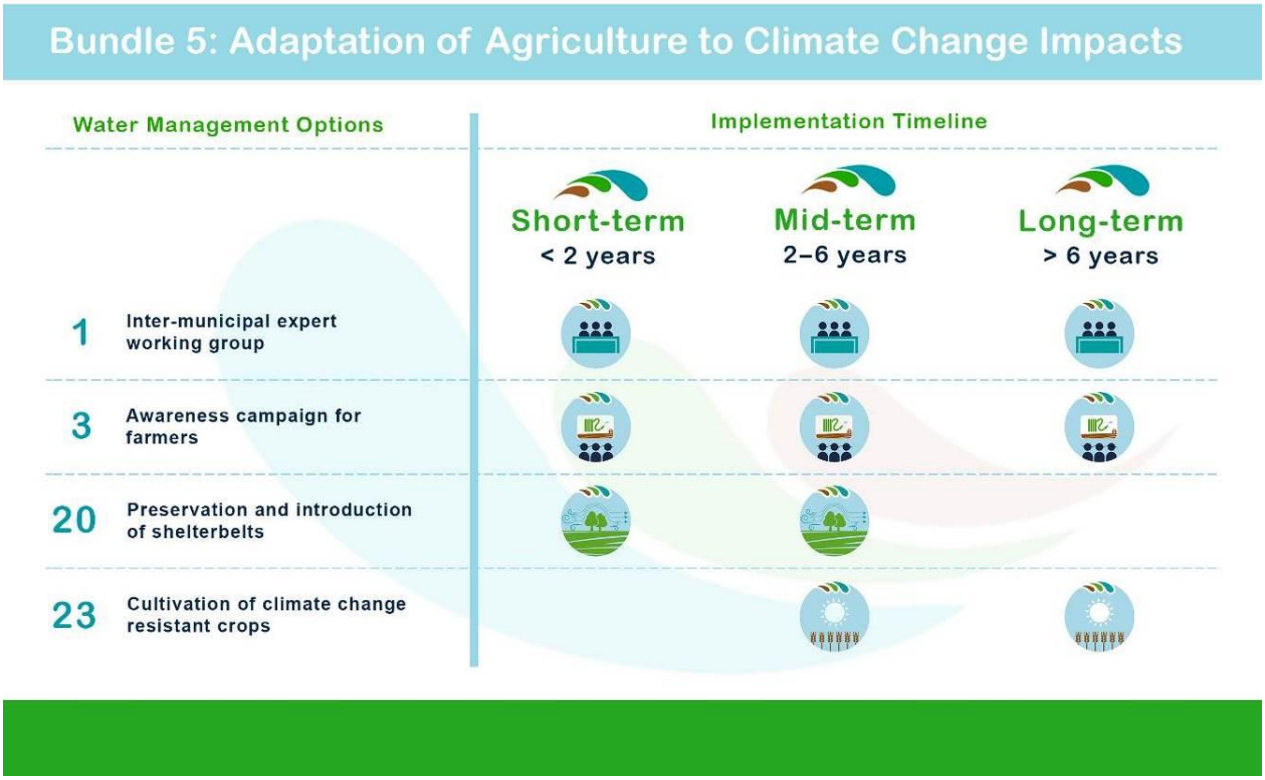
'adaptation pathway'

With the creation of an inter-municipal expert working group (WMO 1), the much needed cooperation between municipalities and experts with the main objectives for the awareness campaign is first set.

Although there are minor barriers identified due to ensuring the active involvement of all local farmers (need for financial initiatives), raising awareness among farmers (WMO 3) shows many policy synergies and is expected to be established in the beginning and continued for several years to come.

The preservation of the existing and introduction of new shelterbelts (WMO 20) should be implemented after WMO 3. WMO 3 will make farmers more aware of the positive effects of shelterbelts.

The cultivation of crops that are resistant to climate change (WMO 23) is involved with high costs and has varying acceptability amongst stakeholders. Therefore, the implementation of this option should start mid-term with the precondition that such crops are available for cultivation.



Way forward/implementation avenues

Water management options except WMO 20 present synergies with river basin management plan. WMO 23 is in synergy with the flood risk management plan. WMOs except WMO 1 are in synergy with the Natura 2000 management programme [70]. WMO 1 is in synergy with the resolution on the national environmental action programme (2005–2012) [89], and others (e.g.: local self-government act [90]) that allow for the establishment of such associations. Options could help achieve the objectives of programme 5.1 “A comprehensive spatial development of the region” of the regional development programme of Northern Primorska (Goriška development region) 2014-2020 [91]. WMO 3 is also supported by national adaptation strategy for forestry and agriculture (2008) [94] and its implementation document action plan from 2011 [95] - Pillar II: Education, awareness, and counselling. Measures that are already in place and are planned in future: 7. Raising the awareness of farmers of the impact of climate change on agriculture.

Funding could be provided by the development programme of Northern Primorska [91], Horizon 2020, INTERREG MED Programme 2014-2020 and the Common Agricultural Policy.

The main actor identified for the implementation of this bundle is the Ministrstvo za kmetijstvo gozdarstvo in prehrano (Ministry of Agriculture, Forestry and Food) and its Svetovalna služba (Advisory Service) and the Kmetijsko gozdarska zbornica Slovenije (Chamber of Agriculture and Forestry of Slovenia) and the Zavod za gozdove Slovenije (Slovenia Forest service). The Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) and its bodies can be partners especially in implementing WMO 20 (determination of the operator of shelterbelts). At the local level municipalities and the Regional Development Agency could be the main actors for this bundle.

During the third workshop (March, 2016) local farmers and the Biotehniška šola (Biotechnical School) indicated their willingness to take up the individual water management options with differing roles in the implementation process. The local farmers would be involved in the cultivation of crops, the implementation of shelterbelts, and the awareness campaign. The Biotehniška šola (Biotechnical School) declared an interest in being a part of the awareness campaign.

4.3.6 Development of sustainable tourism

Focus of the bundle

With its rich natural and cultural heritage, the Vipava valley, especially in the upper part, has a great potential for the development of ecotourism. There is a substantial desire from stakeholders for the further development of such tourism. Sustainable water management is the basis for improving water quality and indirectly enriching habitats and biodiversity. Water management options in the bundle beside the primary objectives of addressing the identified challenges also address the objective of sustainable tourism development.

Proposed combination of options

Context		
The water management options included do not directly address tourism development but they provide the basis for sustainable tourism, which will support more sustainable water quality and quantity management in touristic areas. The majority of WMOs are complement with each other and have scored co-benefits. 21 combinations out of 45 have scored no interlinkage as no co-benefit or conflict was assessed between them. Low conflicts are shown for pairs WMO 8-13 and WMO 8-14, the reason being that WMO 8 can have a negative effect on the ecological state of water. This is in contradiction to the objectives of WMOs 13 and 14 of restoring natural hydromorphology.		
Water Management Options		
1	Establish an intermunicipal expert working group	The task of the inter-municipal working group is to direct spatial planning considering water management in the river basin. Representatives of each local authority with the external help of requisite expert knowledge will be included in the working group. The position would last through the financial cycle of the river basin management plan.
2	Awareness campaign for water management experts	The objective of the awareness campaign for water management experts in the first place is to educate them on impacts of their work on hydromorphological pressures. The second objective is to educate them about more sustainable techniques in designing interventions on watercourses. The last objective is to collect existing good practices with suggestions for improvements and a complementing database of good practices.
4	Awareness campaign for local public	The objective is to inform the local public about the kind of impact on water management their actions have. The objective is also to prepare educational material for schools with the objective of presenting water-related challenges in Slovenia, focusing on Vipava river basin.
6	Upgrade and update the monitoring network	The objective is to review all of existing monitoring stations and their status and in the second phase to upgrade the network system with new stations where needed.
8	Construction of water reservoirs	The objective is to construct water reservoirs that are already part of the "Development Plan for Irrigation till 2020". There are planned four new water reservoirs in Vipava river basin: • Košivec – in municipality Ajdovščina, volume 1.176 million m^3 • Vrnivec – in municipality Ajdovščina, volume 1 million m^3 • Svinjšček – in municipality Ajdovščina, volume 1 million m^3 Pasji rep – in municipality Vipava, volume 2.5 million m^3
10	Reconstruction of water reservoir Vogršček	The objective is to reconstruct Vogršček water reservoir. The "Reconstruction of the Vogršček barrier" is already planned and now documentation is in preparation.
13	Restoration of Vipava river and its tributaries	The objective is to establish original state of the Vipava river and its tributaries with removal of transversal and longitudinal protection objects. It proposes 16 potential locations for the restoration of the Vipava river and seven locations of its tributaries in total length of 21,926 m.

14	Restoration of old meanders and oxbows	The objective is to establish original state of old meanders and oxbows with restoration of former connection of main watercourse with old meander and oxbow. It proposes restoration of old meanders on nine potential locations in total length of 2,721 m.
20	Preservation and introduction of shelterbelts	The objective is to preserve existing and introduce new shelterbelts. Implementation of shelterbelts includes seedling of trees (four seedlings per meter of approx. 50 cm high), with their marking and protection with poles.
22	Construction of municipal wastewater treatment plants	Agglomerations under 2,000 population equivalent (PE) – overall 21,225.44 PE is without existing public sewage system, 21.137,05 PE is without existing WWTP. Agglomerations above 2,000 PE – overall 4,767.36 PE is without existing public sewage system, 5,207.80 PE is without existing WWTP.

'adaptation pathway'

With the establishment of an inter-municipal expert working group (WMO 1), the much needed cooperation between municipalities and experts and the main objectives for developing tourism is first set. Together with WMO 2 and 4, they should be implemented first, in the first year (short term). Despite minor barriers due to limited financial capacities, they show many policy synergies. Activities planned in WMO 4 include the main elements of the educational tourism to be developed and should start being implemented in the first year. This also goes for WMO 2, the *awareness campaign focused on educating experts. By using more sustainable techniques in water management WMO 2 can achieve an attractive appearance and conditions of the aquatic and riparian ecosystems that can be integrated in the range of tourism services offered.*

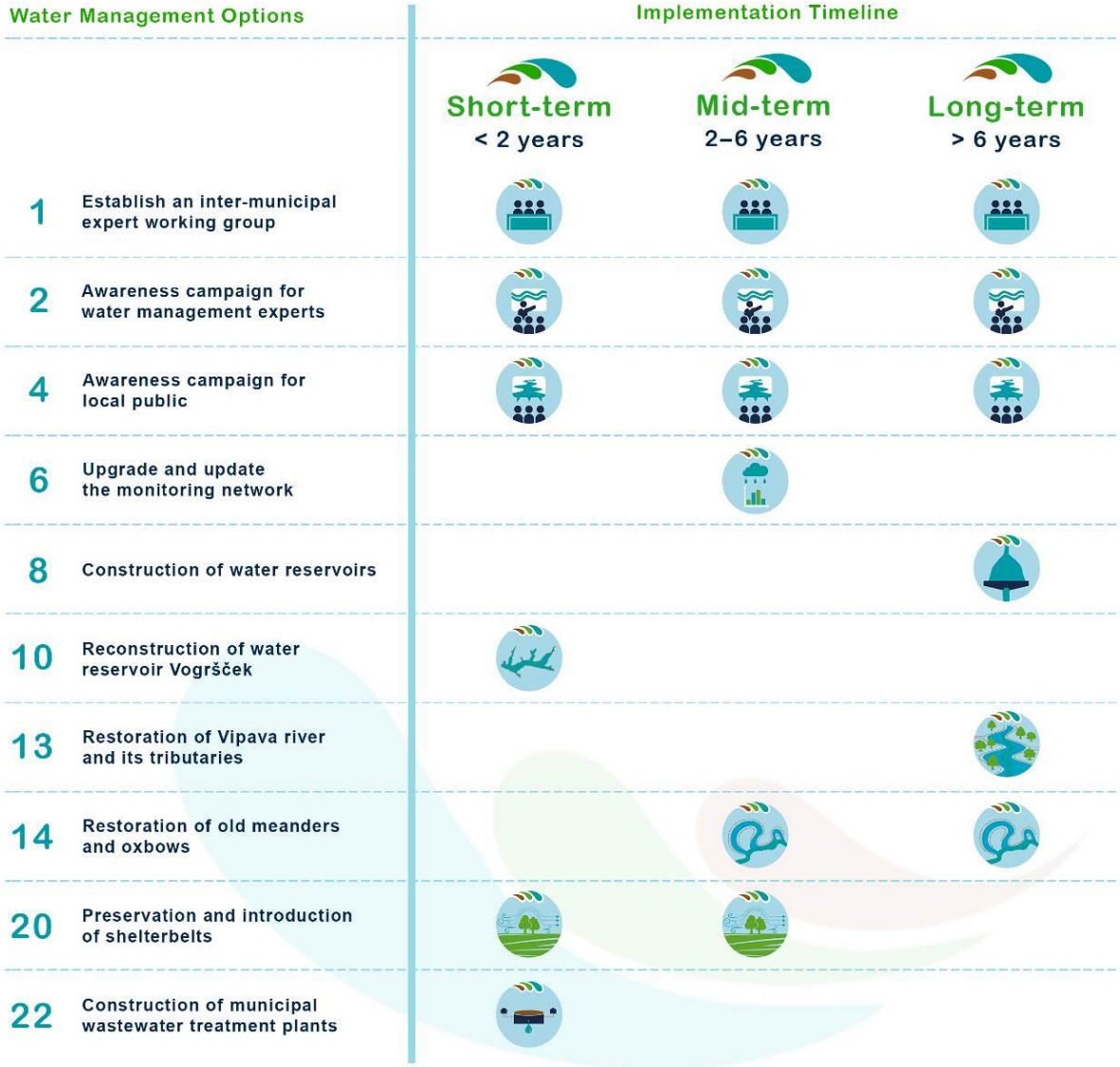
Although minor barriers exist due to high costs, reconstruction of the existing Vogršček water reservoir (WMO 10) as such is already envisaged by the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) and is consequently placed in the short term (first two years' time). Together with upgrading and updating the existing measurement network (WMO 6) they can serve as a tourist service linked to water environment.

Despite barriers due to high costs, constructing sewage and municipal wastewater treatment plants across the river basin (WMO 22) shows high policy synergies. WMO 22 can reduce burdening waters with pollutants (organic, nutrients, pathogens) and results in better water quality, especially in good quality for bathing waters. As such, WMO 22 should be implemented in parallel with WMO 10 and WMO 6.

Minor barriers due to high costs also accompany the next three proposed options, the restoration of old meanders and oxbows (WMO 14) and the preservation of the existing and introduction of new shelterbelts (WMO 20) could enrich the cultural landscape that plays an important role for the development of tourism. With that said, also the restoration of the Vipava river and its tributaries (WMO 13) could be implemented in the later stage. Both options show high co-benefits. If both applied, they improving the status of ecosystems in larger scale and give the variety of scenery that is a major attraction to visitors.

An additional option proposed by stakeholders (third workshop), namely multifunctional water reservoirs (WMO 8), can if planned from the beginning also function as a local tourist attraction. Although many synergies with policy objectives do exist, major barriers due to high implementation costs and varying acceptability of stakeholders have been identified and this option is consequently placed at the very end of the option list. This option shows high co-benefits with WMO 1 and 2, but shows conflicts with WMO 13 and 14, as water reservoirs on watercourses can affect structural water quality.

Bundle 6: Development of Sustainable Tourism



Way forward/implementation avenues

Water management options are show synergies with the draft river basin management plan, except options no. 10, 20, and 22. WMO 8 is in conflict with the river basin management plan due to the measure of restricting the granting of water rights, which is a precondition for the construction of water reservoirs. WMOs 8, 10, 13, and 14 are in synergy with the flood risk management plan. Except for WMOs no. 1, 2, and 22, other WMOs show synergy with the Natura 2000 management programme [70]. WMO 13 is in synergy with the programme for the management of fish in inland waters [76]. WMOs 1, 8, and 10 are in synergy with the national irrigation strategy in preparation [79]). WMO 1 is in synergy with the resolution on the national environmental action programme (2005–2012) [89] and others (e.g.: local self-government act [90]) that allow for the establishment of such associations. Option could help achieve objectives of the regional development programme of Northern Primorska (Goriška development region) 2014-2020 [91]. WMO 22 is in line with the operational programme for the discharge and treatment of urban waste water [69], which determines priority areas for the construction of sewerage systems and municipal wastewater treatment plants.

Funding of WMOs could be provided by the development programme of Northern Primorska [91], Horizon 2020, INTERREG MED Programme 2014-2020, the Common Agricultural Policy, the European Regional Development Fund, and the Cohesion Fund.

The main actor for the implementation of this bundle is the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) with its bodies the Direkcija Republike Slovenije za vode (Slovenian Water Agency) and the Agencija Republike Slovenije za okolje (Slovenian Environmental Agency). The Inštitut za vode Republike Slovenije

(Institute for Water of the Republic of Slovenia) and the Zavod za varstvo narave Republike Slovenije (Institute of the Republic of Slovenia for Nature Conservation) should be involved in WMO 13 and 14. Reconstructing and building new water reservoirs is an area where the Ministrstvo za kmetijstvo gozdarstvo in prehrano (Ministry of Agriculture, Forestry and Food) and the Ministrstvo za obrambo (Ministry of Defence) should actively cooperate and support the implementation. Important local actors are municipalities, Regional Development Agencies, and the Tourist Office.

During the third workshop (March, 2016) the municipalities, Regional Development Agencies, and the local Tourist Office indicated their willingness to take up the bundle or individual water management options with differing roles in the implementation process.

4.3.7 Implementation of nature protection management

Focus of the bundle

Water management in Slovenia is highly connected with nature protection management due to the fact that a lot of species and habitats are dependent on water. In the Natura 2000 management programme for 2015-2020 [70] there are a lot of species and habitats that have not achieved favourable conservation status and some extra options would be needed in order to restore the favourable conservation status of species and habitats. Options included in this bundle present the actual implementation of restoration options or options supporting the restoration of natural hydromorphology, which is an important element of nature conservation. This bundle addresses two identified challenges: water availability and appropriate water quality.

Proposed combination of options

Context		
Water management options included indirectly address the objectives of nature protection by supporting the restoration of natural hydromorphology in the river basin, which is an essential part of nature protection. The majority of WMOs are complement with each other and have scored co-benefits. 13 combinations out of 28 have scored no interlinkage as no co-benefit or conflict was assessed between them. Low conflicts are shown for pairs WMO 13-17 and WMO 14-17 due to the effect on interrupted sediment transport. This is in contradiction to the objectives of WMOs 13 and 14 of restoring the natural hydromorphology.		
Water Management Options		
2	Awareness campaign for water management experts	The objective of the awareness campaign for water management experts in the first place is to educate them on impacts of their work on hydromorphological pressures. The second objective is to educate them about more sustainable techniques in designing interventions on watercourses. The last objective is to collect existing good practices with suggestions for improvements and a complementing database of good practices.
4	Awareness campaign for local public	The objective is to inform the local public as to the kind of impact on water management their actions have. The objective is also to prepare educational material for schools with the objective of presenting water-related challenges in Slovenia, focusing on the Vipava river basin.
13	Restoration of Vipava river and its tributaries	The objective is to establish the original state of the Vipava river and its tributaries with removal of transversal and longitudinal protection objects. It proposes 16 potential locations for the restoration of the Vipava river and seven locations of its tributaries in total length of 21,926 m.
14	Restoration of old meanders and oxbows	The objective is to establish original state of old meanders and oxbows with restoration of the former connection of the main watercourse with its old meander and oxbow. It proposes restoration of old meanders on nine potential locations in total length of 2,721 m.
17	Reconstruction of stabilizing and transverse constructions	The objective is to locate existing transversal and stabilizing construction in the tributaries of the Vipava river and set the priority for their reconstruction. Their function is to stabilize water bed and prevent erosion. Reconstruction is conceived with the use of all known sustainable techniques.
20	Preservation and introduction of shelterbelts	The objective is to preserve existing and introduce new shelterbelts. Implementation of shelterbelts includes seedling of trees (four seedlings per meter of approx. 50 cm high), with their marking and protection with poles.
21	Removal of invasive non-native species	The objective is to collect data on invasive non-native species in the Vipava river basin. It is also to determine the method of removal and disposal for each species and prepare a work programme for invasive non-native species.
23	Cultivation of climate change resistant crops	The objective is the selection of new varieties and alternative crops that are more adapted to the climatic conditions influenced by global changes. It includes review and analysis of suitable crops and also a market analysis if there exists a market for those crops.

'adaptation pathway'

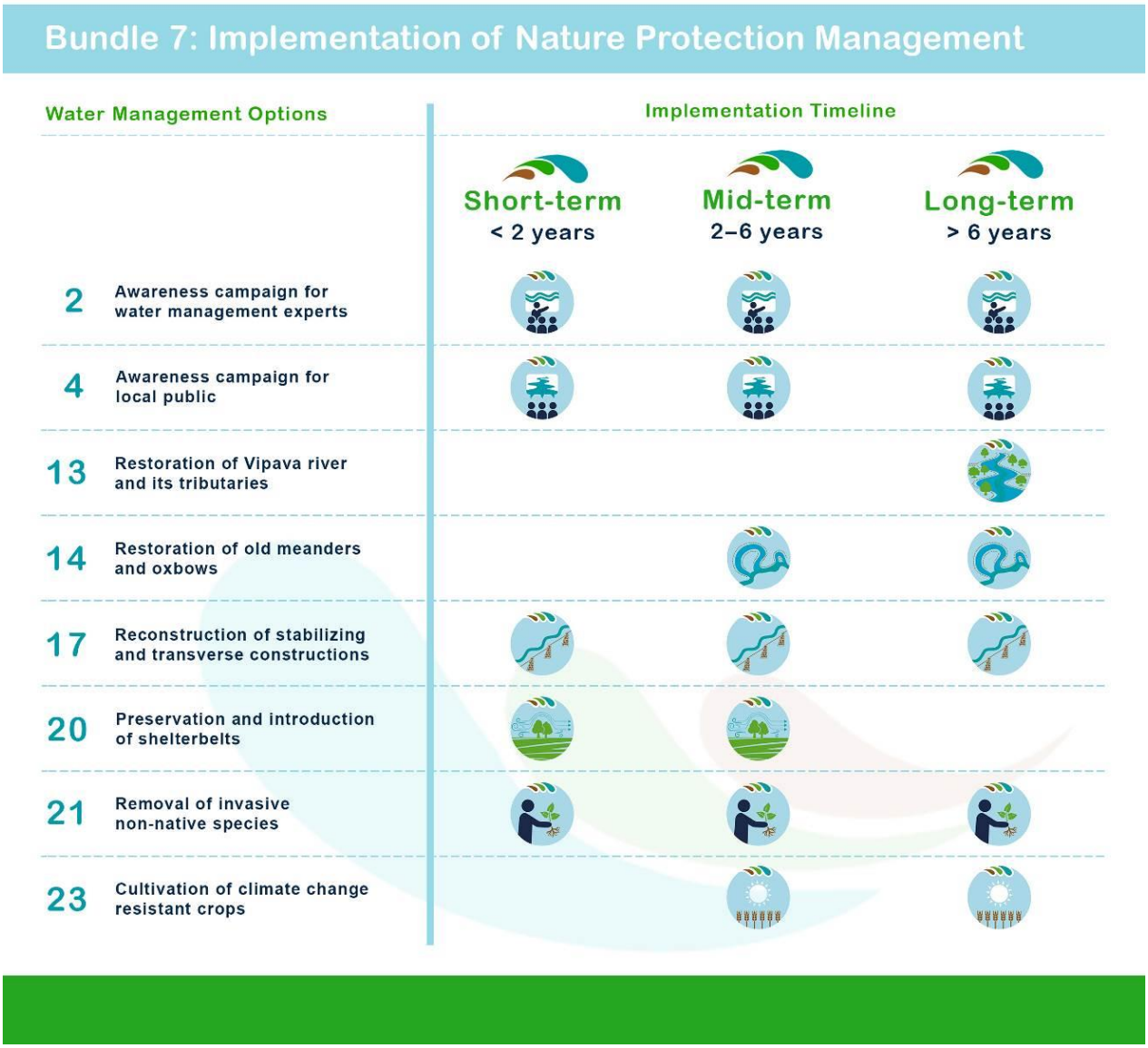
Raising awareness among experts (WMO 2) and local communities (WMO 4) about the positive effects of the proposed options with the aim of restoring natural elements is needed in the first year. In this sense nature protection management must be presented to society in a proper manner. Despite minor barriers due to limited financial capacities, WMO 4 shows many policy synergies.

Although minor barriers exist due to high costs, the preservation of existing and introduction of new shelterbelts (WMO 20) should begin to be implemented in the first year.

With low policy synergies (no National action plan of prevention and management of the introduction and spread of invasive alien species in Slovenia is in place) but low costs, removal of invasive non-native species (WMO 21) should also be implemented in the short term (first two years' time).

Restoration of old meanders and oxbows (WMO 14) and the restoration of the Vipava river and its tributaries (WMO 13) due to high costs or varying acceptability of stakeholders should be implemented in the next phase, with WMO 14 first in line. Both options would improve the ecosystem services of the river and riparian zones (including sediment and nutrient filtering, water storage, bank stabilization and provision of habitat for biodiversity). Both options show high co-benefits. If both applied, they would improve the status of ecosystems in a larger scale.

The cultivation of crops that are resistant to climate change (WMO 23) is a measure that can support the reduction of water consumption (irrigation) and supports the objectives of nature protection. However, high costs are involved. Therefore, the acceptability of stakeholders is not uniform. The implementation of the option should start in the mid-term, as some exotic or tropical crops are being already cultivated for research purposes. Therefore costs might decrease and acceptability increase.



Way forward/implementation avenues

Except WMOs 17 and 20, other WMOs are in synergy with the draft river basin management plan [29]. WMOs 13, 14, and 17 are in synergy with the flood risk management plan [63]. Except WMO 2, other WMOs are in synergy with the Natura 2000 management programme [70]. WMOs 13 and 21 are in synergy with the programme for the management of fish in inland waters [76].

Funding of options can be made through the development programme of Northern Primorska [91], Horizon 2020, INTERREG MED Programme 2014-2020, the Common Agricultural Policy, the European Regional Development Fund, LIFE, and the Cohesion Fund.

The main actor identified for this bundle is the Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) together with the Zavod za varstvo narave Republike Slovenije (Institute of the Republic of Slovenia for Nature Conservation) and other bodies such as the Direkcija Republike Slovenije za vode (Slovenian Water Agency) and the Agencija Republike Slovenije za okolje (Slovenian Environmental agency). By implementing WMOs 20, 21, and 23 the Ministrstvo za kmetijstvo gozdarstvo in prehrano (Ministry of Agriculture, Forestry and Food) and the Zavod za gozdove Slovenije (Slovenia Forest service) should be involved. At the local level municipalities and Regional Development Agencies could take the initiative.

According to third workshop (March, 2016) the Zavod za varstvo narave Republike Slovenije (Institute of the Republic of Slovenia for Nature Conservation), municipalities, and the local Tourist Office indicated their willingness to take up the bundle or individual water management options with differing roles in the implementation process.

4.4 Monitoring

Adaptive management assigns a strategic and central role to monitoring processes. An adaptive management approach means that plans are adjusted to future conditions as they unfold, taking account of uncertainty over future developments, and constantly updating the adaptation plan with new information from monitoring, evaluation, and learning [96]. Therefore, this section aims to outline the main elements that should be taken into account when monitoring the outcomes and impact of the proposed adaptation options.

Monitoring the environmental outcomes of implementing a particular water management option in a specific place and time is fraught with difficulties, as it is normally impossible to isolate the water system from the numerous external drivers and pressures affecting it alongside the implemented option. For instance, it is generally very hard to directly measure the impact of an option's generated water savings on the river flow, as the natural water availability in a system will depend on manifold factors such as recent meteorology, land use and its changes in the basin, the behaviour of other users, and so on. The same applies to measures addressing other goals, such as water quality. In view of the extreme complexity and the multiple causal chains impinging on single parameters, environmental programmes usually resort to monitoring the (degree of) implementation of a measure. In effect, they rely on scientific consensus about whether a measure delivers the desired effect on a certain parameter and about the expected range of this effect.

In addition to monitoring measures as described, monitoring in adaptive management often also addresses the overall system (the river basin in this context), so as to track its development over time and to enable reactions to unforeseen trends and developments.

Indicators for monitoring

Indicators for monitoring can assume various forms, each of which contributes to building a comprehensive overview of the option's or bundles' implementation. Types of monitoring indicators include [97]:

- *financial input indicators* that are used to monitor progress in terms of the annual payment of the funds available for any operation
- *output indicators* that measure activities directly realised within options (e.g. the number of training sessions organised)

When developing the water management options for this plan, a review of and comparison with existing management plans focusing on the river basin was undertaken (see Part 2). These existing plans, such as the River Basin Management Plans [27, 28, 29] developed in compliance with the European Water Framework Directive [21], have a monitoring and evaluation network in place in which the monitoring and evaluation of the presented water management options can be integrated. Such potential monitoring synergies exist, for example, with regards to the option of Reconstruction of the existing Vogršček water reservoir (WMO 10) and Reconstruction of the existing irrigation system (WMO 12).

Existing monitoring of the Vogršček water reservoir and its accompanying irrigation systems includes indicators showing water quantity and quality in the reservoir together with the quantity of water used for irrigation. Monitoring is under the responsibility of the operator of the facility and rules are laid down in the Operating Regulations. The existing practice is that the water reservoirs together with their monitoring are managed by concessionaires carrying out the Water Management Public Service. This is not the case in the existing irrigation systems, namely they are usually managed by agricultural cooperatives.

However, some water management options are unique to this river basin adaptation plan and therefore do not have specific links to existing monitoring efforts. For some of these options,

opportunities exist for their implement within the frame of an ongoing project, such as those financed under the LIFE programme, which includes a budget for monitoring and evaluation activities and requires output monitoring for all projects. Within this river basin adaptation plan, monitoring for the following options could be funded via an external financing scheme: Preservation of existing and introduction of new shelterbelts (WMO 20) and Removal of invasive non-native species (WMO 21). More specifically, preserving and introducing new shelterbelts (WMO 20) or so-called green windbreaks could be funded within the LIFE sub-programme Climate Action. Based on expected changes in the climate of this region, the frequency of extreme events (including strong and gusty bora winds) will increase. As green windbreaks are a well verified measure for reducing damage from strong gusty winds by lowering wind speed, their installation could increase the resilience of the Vipava river basin against climate change. As the expected impact of green windbreaks is on reducing wind speed, measurements of wind speed would be the most appropriate output indicator. To monitor the actual effects of green windbreaks, measurement points should be adequately determined. The option on the removal of invasive non-native species (WMO 21) could also be funded within the LIFE programme. Namely, invasive alien species have multiple impacts (ecological, economic and human health), but are recognized first and foremost as a major threat to Europe's biodiversity and can cause the local extinction of indigenous species, for instance through competition for limited resources such as food and habitats, inter-breeding, or the spread of exotic diseases. The impact of invasive alien species may sometimes be so profound that they can alter the structure and functioning of entire ecosystems, compromising their ability to provide valuable ecosystem services, such as pollination, water regulation, or flood control [98]. As such, "invasive alien species (IAS) or other threats" (unit specimen/ha) or "species and number of non-native plant and animal (fish) species detected and removed" could be a potential indicator for the option on removal of invasive non-native species (WMO 21).

5 From planning to action: recommendations for implementation

The Vipava River Basin Adaptation Plan is based on a participatory approach, which was followed so as to develop a set of targeted water management options and, subsequently, bundles of these options. The outlined (bundles of) options serve to address the main challenges that were identified by the basin's stakeholders. This chapter provides guidance and recommendations for decision-makers, individuals, and entities that are in a position to implement bundles of synergistic water management options or individual options. The information provided throughout the plan is thus intended to serve as a tool to help to guide policy and decision makers in selecting appropriate options or sets of options to implement within the basin to address the basin's specific needs.

Implementation of all options within a given bundle

The bundles presented in chapter 4.3 are sets of options that have been grouped together on the basis of their foreseen abilities to collectively address the identified challenges within the Vipava river basin and react to additional local needs (e.g. increasing sustainable tourism in the area). Implementation of an entire bundle ensures a high occurrence of synergies between the options and the pursuit of one or more common objectives. Two water management options that are strongly aligned may decrease the implementation or maintenance costs if they are implemented together. Other combinations may lead to an increased impact with regards to addressing an existing threat.

In the bundle factsheets in chapter 4.3, extensive information is provided on the interaction of the water management options to support decision-making processes. This includes, for example, indications of the objectives that may be reached by choosing to implement a given bundle, the costs involved, the ideal phasing of the options in time, etc. If an entire bundle is to be implemented, the 'adaptation pathway' provides further information about which options are critical to implementation before other water management options in the bundle. For example, implementing the bundle Implementation of Sustainable Water Management would focus on achieving sustainable water management at the river basin level, and could be estimated at €63,798,691.00. Should sustainable water management at the river basin level be prioritised as a key objective and limited financing be a main consideration, the bundle Organisation of Sustainable Water Management would better suit the objective.

Implementation of individual water management options

The existence of very specific objectives, resource or capacity limitations or other considerations may make the implementation of an entire bundle unfeasible. In this case, deciding instead to implement one or more individual options will not necessarily have a negative impact on the performance of these options. While all of the water management options presented are suitable for implementation in the river basin, the decision to implement individual options on their own requires verifying that the option is not dependent on any other water management option. Information on the relationship between the options is outlined in the bundle factsheets in chapter 4 and should be consulted in order to reach such conclusions.

Here, particular focus should be given to prioritised water management options, which have been identified based on the wishes and needs of the stakeholders engaged in the process and by taking into account implementation-oriented factors, such as the multi-criteria analysis, performance with regards to the challenges, feasibility, acceptability, and policy synergies. As such, these options are strongly aligned with community interests and are foreseen to offer large potential in addressing the targeted challenges identified within the basin (see Table 4.2). In order to assess the best implementation timing, the adaptation pathways as presented in chapter 4 should be consulted.

Following these criteria, the following water management options are recommended within the river basin:

- *Establishment of an inter-municipal expert working group* (WMO 1) addresses all three challenges, meaning water availability during droughts in the growing season (challenge A), flood risk reduction (challenge B) and appropriate water quality (challenge C). The option presents a path to a more coherent spatial development in the Vipava river basin, showing many co-benefits with other options. Hence, the option included in five out of seven bundles can help other options to be implemented easier and with the desired impact. The option represents a soft approach to adaptation, which was most preferred among stakeholders, having low implementation and operational costs and the most preferred outcome for all three identified challenges of Vipava river basin.
- *Awareness campaign for local public* (WMO 4) also addresses all three challenges, meaning water availability during droughts in growing season (challenge A), flood risk reduction (challenge B), and appropriate water quality (challenge C). The aim of the option would be to increase the awareness of the general public on the impacts of biological, chemical, hydrological and morphological pressures, biological pressures, the impacts of various pollution sources, etc. The option represents a soft approach to adaptation, which was most preferred among stakeholders, having low implementation and operational costs and the most preferred outcome for all three identified challenges of Vipava river basin.
- *Construction of water reservoirs* (WMO 8) addresses two challenges, meaning water availability during droughts in the growing season (challenge A) and flood risk reduction (challenge B). Water reservoirs would be used for two main purposes during droughts: 1) for irrigation of agricultural land and so avoiding agricultural drought and 2) as a water source in the function of enriching low waters by maintaining environmentally acceptable flow downstream and so avoiding hydrological drought. During short but heavy rainfall, water reservoirs would minimize floods downstream by retaining high waters. Although the option has most preferred evaluation outcome for the two identified challenges of the Vipava river basin, the option is a technical solution (grey approach to adaptation) with high implementation costs. As such it is also involved with low feasibility, but also with low co-benefits or even conflicts with other options and objectives of Water Framework Directive [21].
- *Awareness campaign for water management experts* (WMO 2) also addresses all three challenges, meaning water availability during droughts in the growing season (challenge A), flood risk reduction (challenge B), and appropriate water quality (challenge C). The aim of the option would be to increase the awareness of experts involved in water management (concessionaires for river management) so as to use more sustainable techniques when designing interventions on water bodies. The campaign would also increase the awareness of experts on the impacts of the effects of hydromorphological pressures (inadequate implementation of construction works). The option represents a soft approach to adaptation, which was most preferred among stakeholders, having low implementation and operational costs and the most preferred outcome for all three identified challenges of Vipava river basin.
- For many stakeholders the option *Improve the financing system for water infrastructure* (WMO 5) is one of the prerequisites for sustainable water management. The option addresses two challenges, meaning water availability during droughts in the growing season (challenge A) and flood risk reduction (challenge B). Through changes in legislation, this option aims to improve and optimize the system of financing water infrastructure from the national Water Fund; with the introduction of dedicated funding to finance measures to help achieve the objectives of water management and River Basin Management Plan. This option can result in the sustainability of water infrastructure, the prevention instead of recovery, sustainable flood protection and higher life quality, and reducing the damage caused by floods and droughts to different sectors (meaning also maintenance of the Vogršček water reservoir to help prevent damages to the agriculture in growing season). The option represents a soft approach to adaptation, which was most preferred among stakeholders,

having low implementation and operational costs and the most preferred outcome for all three identified challenges of Vipava river basin.

In order to assure the successful implementation of individual water management options or bundles of options, the development and execution of a monitoring plan including sound indicators is crucial. Therefore, the suggestions made in section 4.4 regarding the alignment of existing monitoring plans with the needs of the water management options specified in this plan should be considered. This includes finding synergies with existing monitoring schemes regarding the identification of suitable indicators for measuring the output.

PART 2

6 Detailed description of the water management options

WMO 1: Establish an inter-municipal expert working group for the Vipava river basin

Short explanation	A Vipava river basin working group (WG) would be established to have an active role in water management with objectives of optimizing water use in sectors dependent on water availability through active involvement in planning sustainable techniques (water saving equipment) and water sources (alternative, more suitable techniques). The WG would be also involved in spatial planning of all involved Municipalities and so coordinating existing and planned interventions that have impact on flood safety and scope of droughts. The WG would have a role of active, promptly resolving conflicts of interest in spatial and water use (tourism, fisheries, agriculture) and would consist of experts of various fields (spatial planning, hydrology, nature conservation, economy, agronomy, agro meteorology, etc.) connected with competent state authorities (Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) and its bodies Direkcija Republike Slovenije za vode (Slovenian Water Agency), Agencija Republike Slovenije za okolje in prostor (Slovenian Environmental Agency)). Objectives of working group (WG) are: • determination of objectives and targets to guide the development plans of the planning authorities; • active in processes of Municipal Spatial Plan development with the aim to ensure sustainable water management (providing expert assistance in determining land and water use); • to promptly discuss about present issues on Vipava River (and tributaries) and solving potential disagreement (conflicts) between stakeholders (conducting confrontations and seeking solutions); • to propose new ideas, initiatives, projects that would encourage sustainable development in Vipava river basin; • to improve communication between Municipalities and experts (better flows of information) and so ensure needed support in finding the optimal solution at the river basin level; • to improve communication and collaboration between local and state authorities.
Addressed challenges	Water availability during droughts (A), Flood risk reduction (B), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Local population (domestic), Tourism, Industry, Agriculture, Forestry, Energy, Water management, Fishery.
Benefits	Increased cooperation between municipalities and knowledge with involved experts can prevent inadequate water management and inadequate spatial planning. More coherent spatial development aims to resolve challenges of floods, water availability and water quality.
Potential negative impacts	Bigger workload of individual employees (managing various working areas and taking responsibility for the operation of the working group). Possible higher expenditures for water management can be balanced with reduced costs caused by inadequate water management and inadequate spatial planning (e.g. flood damages can be avoided if flood area and floodplains are taken into consideration when planning a development plan of a certain area).
Timeline of implementation	Should start in short (under 2 years' time) and continue till 2030.

Feasibility	Minor barriers with organizing a group (capacity of the group manager to make people in the group agree) and achieving agreements between different institutions.
Robustness	Yes
Flexibility	Yes
Costs/Actions	The total discounted cost towards year 2030: 138,506 euros (EUR 2018, discount rate: 5%) comprises of group organization that has maximum of 12 members (7 permanent and 5 external experts when needed) and animation of the group with 2 meeting per year.
Synergies and conflicts with policy objectives	No known conflicts. Synergies: • River Basin Management Plan [29] – within measure: Information, awareness and education expert and general public on water management (label DUPPS1). • Resolution on the National Environmental Action Programme (2005–2012) (in short NEAP) [89] with giving support in Point 7.2 Public participation in decision-making and objective to open political arena to all civil society stakeholders. • Local Self-Government Act (Article 61. and 86.) [90] allows establishment of such associations [99]. • Municipal special plans encourage to prepare harmonized and coherent Municipal Spatial Plans that would help tackle identified challenges in Vipava river basin. • On regional level also Regional Development Programme of Northern Primorska (Goriška development region) 2014-2020 [91]. It could help achieve objectives of programme 5.1 A comprehensive spatial development of the region. *Funding of such an option could be through The INTERREG MED Programme 2014-2020 (priority axis 3: MED RESOURCES (Protecting and promoting Mediterranean natural and cultural resources - protection of natural and cultural heritage, biodiversity, the development of human activities in coherence with environmental change which represent enormous challenges to the MED area)) or Horizon 2020 (Societal challenges / 12. Climate action, environment, resource efficiency and raw materials / 14. Secure societies – Protecting freedom and security of Europe and its citizens Spreading excellence and widening participation (no. 15)).*
Acceptance	Medium to high. Some doubts were raised on October 2015 event regarding jurisdiction of municipalities. Also there are some barriers regarding individual (investors) interests.
Suggested stakeholder involvement	Municipalities (also in form of Association of Municipalities and Towns of Slovenia) together with their Regional development Agencies (e.g. Ra ROD Ajdovščina, RDA of Northern Primorska Ltd Nova Gorica) could achieve clear vision of development of the river basin, with clear vision for water management and support in achieving the objectives of EU directives (could be presented more an opportunity rather than burden). Regional development Agency would on the initiative of municipality representatives animate the WG and also decide when the group has to come to a meeting (session) - resources necessary for the purpose of guidance, management of WG could potentially be provided from involved Municipalities. Upon request of Municipalities, Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) would issue a decision on the nomination of inter-municipal WG for the Vipava river basin. Expert support should be ensured by following institutions: Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) and its bodies Direkcija Republike Slovenije za vode (Slovenian Water Agency), Agencija Republike Slovenije za okolje in prostor (Slovenian Environmental Agency), Zavod Republike Slovenije za varstvo narave (The Institute of the Republic of Slovenia for Nature Conservation), Zavod za gozdove (Slovenian Forest Service), Inštitut za vode Republike Slovenije (Institute for Water of the Republic of Slovenia).
Preconditions for success	Willingness for cooperation of all Municipalities that share Vipava River but also that are part of Vipava river basin. Resources needed for implementation and operation of WG could potentially be provided from involved Municipalities.

Concrete examples where applied	Political support in short. In detail a vertical communication with various ministries preparing strategic plans needs to be ensured. In that way the proposals and guidelines can be communicated. There should be a shown interest and true commitment of local and state authorities to promptly discuss about issues of water management. Regional working groups for irrigation; Regional Development Agencies (RDA Ra ROD, RDA of Northern Primorska Ltd Nova Gorica, Regional Development Centre Koper); Skupnost Občin Slovenije (Association of Municipalities and Towns of Slovenia); "Svet za Vipavo" or Council for the Vipava River established in the end of year 2015. In past OVS = Regional Water Community (Primorska), 1975-1990.

WMO 2: Awareness campaign focused on educating experts involved in surface water management for sustainable water management

Short explanation	An awareness campaign would be launched to increase awareness of experts, involved in water management (concessionaires for river management) to use more sustainable techniques when designing interventions on water bodies. The campaign would also increase awareness of experts on impacts of the effects of hydromorphological pressures (inadequate implementation of construction works). Awareness campaign would be carried out in cooperation with experts in the field of ecology.
Addressed challenges	Water availability during droughts (A), Flood risk reduction (B), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Water management.
Benefits	Increased knowledge exchange and cooperation among experts, involved in water management, aiming to resolve challenges of floods, water availability and water quality more efficiently.
Potential negative impacts	None.
Timeline of implementation	Should start in short (under 2 years' time) and continue till 2030.
Feasibility	Minor obstacles – willingness of experts to participate, also capacity of the person leading the awareness campaign to design a quality program/process that will persuade experts to actively participate.
Robustness	Yes.
Flexibility	Yes.
Costs/Actions	The total discounted cost towards year 2030: 226,277 euros (EUR 2018, discount rate: 5%) comprises of: • preparation and management of a communication strategy: prepare and disseminate publications, organize events, maintain a website, social networks and a database of stakeholders: 12 person-months in the first year, then 3 person-months per year; • creation the website and the database (first year); • collecting information and produce material for the first period (2.5 person-months); • organization of 1 workshop in the basin every year, stating from year 2; • review, analysis and synthesis of best management practices every 5 year, publishing them and preparing the content for the seminars (6 person-months and 1 publication, 100 copies)
Synergies and conflicts with policy objectives	Conflicts between the objectives of nature conservation policies (practices) and economic development (hydropower plants, water use). Synergies: • Water Framework Directive [21] - Article 14 – informing and consulting all interested parties in the implementation of the Water Framework Directive, in particular in the production, review and updating of the river basin management plans. Member States shall ensure that, for each river basin district, they publish and make available for comments to the public, including users. • River Basin Management Plan [29] – within measure: Information, awareness and education expert and general public on water management (label DUPPS1). • Floods directive 2007/60/EC [31] – within Article 9 option can contribute to take appropriate steps to coordinate the application of this Directive and that of WFD focusing on opportunities for improving efficiency, information exchange and for achieving common synergies and benefits having regard to the environmental objectives laid down in Article 4 of Water Framework Directive [21]. *Funding of such an option could be through Horizon 2020 for steps 2 and 3 of WMO (research on existing practices of watercourse management) as it represents a research to support measures/knowledge on any significant water management issues. Within group: Societal challenges / 12.*

	Climate action, environment, resource efficiency and raw materials / 14. Secure societies – Protecting freedom and security of Europe and its citizens OR Group: Spreading excellence and widening participation (no. 15).
Acceptance	High.
Suggested stakeholder involvement	Ministrstvo za okolje in prostor (Ministry of the Environment and Spatial Planning) together with Direkcija Republike Slovenije za vode (Slovenian Water Agency) and Inštitutom za vode Republike Slovenije (Institute for Water of the Republic of Slovenia) as Institution leading the awareness campaign. Involved institutions: in the field of water management, nature conservation, ecology, and forestry and spatial planning. Also Water management companies who are with concessions responsible for maintenance of water infrastructure and aquatic and riparian land (concessionaires). Possible cooperation with existing associations in the field of water protection and management: e.g. Slovensko društvo za zaščito voda ((SDZV) Slovenian Association for Water Protection) to upgrade state-of-the-art knowledge on existing practices on watercourse management. Integrating the experience / knowledge of elderly inhabitants. Fakulteta za gradbeništvo in geodezijo (Faculty of Civil and Geodetic Engineering).
Preconditions for success	Funds available for implemention. Experts interested in cooperation/involvement in awareness campaign activities.
Concrete examples where applied	Slovenian River Restoration Centre (“Slovenski center za obnovo vodotokov”).

WMO 3: Awareness campaign focused on optimizing water use for farmers, for proper irrigation and minimize impacts on water quality through proper agricultural practices

Short explanation	An awareness campaign would be launched to increase awareness among farmers to: 1) move towards a sustainable agricultural production, to optimize water use and reduce the use of fertilizers and plant protection products;2) irrigate agricultural land in more sustainable way with the help of decision support system (optimal, targeting the type of crop and soil type) that can result also in reducing pollution of surface and groundwater caused by washouts of nutrients, fertilizers and plant protection products; 3) use climate-smart agriculture practices and 4) to minimize the effects of hydromorphological pressures by avoiding or adjusting cultivating land near watercourses (in protected zones of watercourses).
Addressed challenges	Water availability during droughts (A), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Agriculture, water supply sector.
Benefits	Higher knowledge transfer aiming to decrease negative impacts of agriculture on water quality and quantity.
Potential negative impacts	Possible loss of agricultural production.
Timeline of implementation	Should start in short (under 2 years' time) and continue till 2030.
Feasibility	Minor obstacles – willingness of farmers to participate.
Robustness	Yes.
Flexibility	Yes.
Costs/Actions	The total discounted cost towards year 2030: 316,408 euros (EUR 2018, discount rate: 5%) comprises of: • preparation and management of a communication strategy: prepare and disseminate publications, organize events, maintain social networks and a database of stakeholders: 12 person-months in the first year, then 3 person-months per year; • review and preparation of a report on existing agricultural practices together with suggestions for improvements (first year, 4 person-months); • review, analysis and synthesis of best management practices (technical guidelines for proper agricultural practices) every 3 years from year 1 on (3 person-months, 1 publication, 500 copies); • organization of 1 workshop in the basin every year, stating from year 2; • collection and dissemination of best management practices on existing agriculture events like International Fair Of Agriculture and Food (AGRA), seminars, workshops, conferences, symposiums, demonstrations (demo-sites), study tours and promote active participation of farmers in Vipava river basin on existing events from year 2 (1.5 person-months, travel costs).
Synergies and conflicts with policy objectives	No known conflicts. Synergies: • River Basin Management Plan [29] – within measure: Information, awareness and education expert and general public on water management (label DUPPS1). • Natura 2000 Management programme for Slovenia [70] – regarding the proper implementation of mowing meadows near watercourses, providing sufficient water flow. • Nitrates Directive [66] - Article 4: paragraph 1. (b) set up where necessary a programme, including the provision of training and information for farmers, promoting the application of the code(s) of good agricultural practice.

	• National Adaptation strategy for forestry and agriculture (2008) [94] and its implementation document (Action plan from 2011) [95] - Pillar II: Education, awareness and counselling. Measures that are already in place and are planned in future: 7. Raising awareness of farmers of the impact of climate change on agriculture with the program of Chamber of Agriculture and Forestry of Slovenia with Agricultural Advisory Service (KGZS), also various publications, brochures and leaflets as well as the media. *Funding of such an option could be through Horizon 2020 – within group: Societal challenges, 12. Climate action, environment, resource efficiency and raw materials and group: Spreading excellence and widening participation (no. 15). Also possible funding through Common Agriculture Policy/European Agricultural Fund for Rural Development (EAFRD) within sub measure M1.2 - support for demonstration activities and information activities.*
Acceptance	High.
Suggested stakeholder involvement	Leading the awareness campaign – proposing experts from University of Ljubljana, Biotechnical faculty, Department of Agronomy in close cooperation with Agricultural Institute of Slovenia and Ministry of Agriculture, Forestry and Food with Chamber of Agriculture and Forestry of Slovenia (CAFS) - Regional unit Nova Gorica, their agricultural advisory service. Experts from University are actively involved in irrigation projects already carried out and are part of so-called existing Working group for or the development of irrigation in Slovenia till 2020. Ministry of the Environment and Spatial Planning could help support agriculture to adapt to climate changes.
Preconditions for success	Farmers, who use mineral fertilizers, are obliged to make nutrient balances and farmers who participate in Agri-Environment Climate Measures. Active involvement of all local farmers. It is likely that farmers will need financial incentives - an incentive to voluntarily adopt less polluting technologies.
Concrete examples where applied	Chamber of Agriculture and Forestry of Slovenia with Agricultural Advisory Service (KGZS) are supportive towards measure. KGZS already organizes trainings and advisory through regional units. Farmers who apply for Agri-Environment Climate Measures must attend training.

WMO 4: Awareness campaign for local public on impact of their activities on the status of the Vipava river basin

Short explanation	An awareness campaign would be launched to increase awareness of the general public on the impacts of biological, chemical, hydrological and morphological pressures (due to legal and potential illegal water abstractions and impoundments of water, inadequate interventions in the riverbed), biological pressures (due to introduction of non-native (animal and plant) species into the environment), impacts of various pollution sources, etc.
	Topics that need to be considered:
	• water related challenges in Slovenia, focusing on Vipava river basin, including climate changes,
	  ○ needs (different water users), conflicts (between users), constrains that need to be considered (floods, Natura2000 sites, waterprotection zones) in Vipava river basin.
	• couse/effect relation (different pressures or modifications in relation to their impacts; mitigation measures planning);
	  ○ impact of the hydromorphological pressures on aquaric, riparian ecosystems,
	  ○ impacts of non-native species on aquatic, riparian ecosystems,
	  ○ impacts of various pollution sources on water quality.

Addressed challenges	Water availability during droughts (A), Flood risk reduction (B), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Local population (domestic), Tourism
Benefits	Higher knowledge transfer aiming to decrease negative impacts of different pressures on water quality and quantity.
Potential negative impacts	None.
Timeline of implementation	Should start in short (under 2 years' time) and continue till 2030.
Feasibility	Minor obstacles – willingness of local public to participate.
Robustness	Yes.
Flexibility	Yes.
Costs/Actions	The total discounted cost towards year 2030: 187,052 euros (EUR 2018, discount rate: 5%) comprises of: • preparation and management of a communication strategy: prepare and disseminate publications, organize events, maintain social networks and a database of stakeholders: 12 person-months in the first year, then 3 person-months per year; • preparation of audio-visual material in form of documentary film with the objective to present water related challenges in Slovenia, focusing on Vipava river basin, including climate changes (approx. 20 to 30 minutes long film can cost about 5,000.00 to 10,000.00 euros); • participitation in existing events from year 2 on (2 events per year, travel cost for 2 persons, person months already included in communication strategy) and to be included in educational programs (3 schools, twice a year, travel cost for 2 persons, person months already included in communication strategy); • preparation of information panels on key points of Vipava river basin (9 information panels, in year 1, maintenance: 5% of implementation costs).
Synergies and conflicts with policy objectives	No known conflicts. Synergies:

	• Water Framework Directive [21] – Article 14 – informing and consulting all interested parties in the implementation of the WFD, in particular in the production, review and updating of the river basin management plans. Member States shall ensure that, for each river basin district, they publish and make available for comments to the public, including users • River Basin Management Plan [29] – within measure DUPPS1: Information, awareness and education expert and general public on water management. • Environmental protection Act [65]- Article 144. Eco Fund, Slovenian Environmental Public Fund - encourages promotion of various forms of education and public awareness. • Natura 2000 Management programme for Slovenia [70] – within measure of structured riverbed and riverbanks. *Funding of such an option could be through Horizon 2020 – within group: Societal challenges / 12. Climate action, environment, resource efficiency and raw materials / 14. Secure societies – Protecting freedom and security of Europe and its citizens / 15. Spreading excellence and widening participation. Also possible funding through The INTERREG MED Programme 2014-2020, priority axis 3: Med resources.*
Acceptance	High.
Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning together with Slovenian Water Agency and Institute for Water of the Republic of Slovenia as Institution leading the awareness campaign, some suggestions also that National Education Institute of the Republic of Slovenia would lead the awareness campaign. Help ensuring (expert) with support of Municipalities, The Institute of the Republic of Slovenia for Nature Conservation and Slovenian Environmental Agency. Involved institutions: in the field of water management, nature conservation, forestry and spatial planning. Teachers could help develop a programme for informing high schools, elementary schools, give support in preparing audio-visual material, to accept and follow programs in schools, help organize field trips.
Preconditions for success	Funds available for implementing the option. Local public, especially schools interested in active cooperation/involvement in awareness campaign activities.
Concrete examples where applied	Not available.

WMO 5: Improve the financing system for water infrastructure

Short explanation	Through changes in legislation, this option aims to improve and optimize the system of financing water infrastructure from the national Water fund; with the introduction of dedicated funding to finance measures to help achieve the objectives of water management and River Basin Management Plan. This option can result in the sustainability of water infrastructure, prevention instead of recovery, sustainable flood protection and higher life quality, reducing the damage caused by floods and droughts to different sectors (meaning also maintenance of Vogršček water reservoir to help prevent damages to the agriculture in growing season).
Addressed challenges	Water availability during droughts (A), Flood risk reduction (B)
Target locations and water uses	Location: River as a whole. Water uses: Water management.
Benefits	Improved status of water infrastructure serving its purpose (lower flood risk, higher water availability, etc.). Achieving the objectives of River Basin Management Plan (Water Framework Directive).
Potential negative impacts	None.
Timeline of implementation	Short (under 2 years' time).
Feasibility	Possible minor barriers with sectors that currently receive funds.
Robustness	Yes.
Flexibility	Yes.

Costs/Actions	The total discounted cost toward year 2030: 178,610 euros (EUR 2018, discount rate: 5%) comprises of four main approaches:
	• If other uses, different from the one that water infrastructure was designed and build for, are present, they must contribute financially to maintain59 the water infrastructure.
	  ○ Explaination - Reservoir Vogršček is financed from two sources according to its specified primary (irrigation) and secondary use (flood protection). Other uses of water reservoir – e.g. tourism and fishery do not contribute to the financing scheme.
	  ○ Preparation of expert bases for the purpose of determination of contribution key. Good basis for information is measure label DDU19 [29] – 6 person months in year 1;
	  ○ Preparation of contracts with users of the water infrastructure (in accordance with article 48. of Waters Act – ZV-1 [59]). Pre-action is to identify this users! This information can be gained from measure label DDU19 [29] – 6 person months in year 1;
	  ○ Performance of the obligations determined in contracts – 1 person months from year 2 on.
	• Municipalities get annualy on average 60% of the funds contributed by the concession (water rights). The purpose of the use of these funds in municipal budget is not prescribed. The proposal is to prepare legal basis for eligible use of funds and that is for achieving the objectives of water management.
	  ○ Amendment of Financing of Municipalities Act [100] on the basis of expert analysis (Report for measure 4ED, 2013). The initiative must come from Ministry of the Environment and Spatial Planning but it is the Ministry of Finances that must amend the Act – 7 person months, year 1;
	  ○ Performance of amended Act [100] – Municipalities contribute funds for all the objectives of article 2. of Waters Act [59]; collaboration with Water Fund of the Ministry of the Environment and Spatial Planning to set priorities for measures needed for achieving the objectives of water management. No additional costs are expected for this action.

	• Improving the system of financing water infrastructure from the national Water fund; with the introduction of dedicated funding to finance measures to help achieve the objectives of water management and River Basin Management Plan, optimize use of resources, increase the realization the use of funds with respect to the eligible use of funds and an increase in personnel capacities.
	  ○ Expert basis/analysis have been already prepared (Report for measure 4ED, 2013) to help analyse all relevant policy instruments that affect financing of Water Fund and propose proper changes to help achieve the objectives of water management and RBMP, optimize use of resources, increase the realization the use of funds with respect to the eligible use of funds and an increase in personnel capacities. No additional costs are expected for this action.
	  ○ Amendments of policy instruments mentioned in Report 4ED. The initiative must come from Ministry of the Environment and Spatial Planning. Depending on proposition for amendments of different policy instruments, other ministries start the process on changing the legislation – 7 person months, year 1.
	  ○ Performance of amended policy instruments in Annual Programme of the Water Fund. No additional costs are expected for this action as the programme is existing task of Water Fund.
	• Assessment of the possibility of co-financing of water infrastructure from the EU funds, Operational Programme Cohesion Policy (2014 - 2020) and the transnational and cross-border programs.Co-financing of water infrastructure:
	  ○ To make an analysis of possible EU Funds, Operational Programme Cohesion Policy (2014 - 2020) and the transnational and cross-border programs. The analysis to be performed on regional level due to better knowledge on what issues need to ne addressed – 4 person months, year 1, year 4.

Synergies and conflicts with policy objectives	No known conflicts. Synergies: • River Basin Management Plan – within measures “Ensuring reimbursement of environmental costs and the cost of water as a natural resource” (label 3ED) and “Alignment of the funds collected from taxes on water pollution in water management (label 4ED). • Flood Risk Management Plan [63] - Achieving compliance with objective of reducing flood risks, and in synergy with measures U13 - Providing financial resources for the implementation of the public utilities of water management and U20 - Systemic, regulatory, financial and other measures. • Financing of Municipalities Act [100] - Municipalities would contribute funds for all the objectives of article 2. of Waters Act; collaboration with Water Fund of the Ministry of the Environment and Spatial Planning to set priorities for measures needed for achieving the objectives of water management. • Waters Act [59] - In accordance with the Act it is necessary to conclude an agreement and arrange relations in respect of mutual rights and obligations, use and maintenance of water infrastructure (Article 48). Water fund (Article 162 of Waters Act [59]) finances the modernization of water reservoirs intended for irrigation of agricultural land, which are government water infrastructure.
Acceptance	Not known – on October event (2015) no concrete answers on this question – possible low acceptance with Municipalities – this WMO would prescribe exactly for what funds should be envisaged. Also due to past experience when the energy sector got most of these funds to build hydropower plants.
Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning together with users of water infrastructure; Ministry of Finances – an initiative must come from Ministry of the Environment and Spatial Planning; in cooperation also with Municipalities. Ministry of the Environment and Spatial Planning (Water Sector) together with other ministries responsible for amending proposed policy instruments Local – regional development agencies together with Municipalities

Preconditions for success	In the options amendment of Financing of Municipalities Act [102] on the basis of expert analysis (Report for measure 4ED, 2013) is proposed. The initiative must come from Ministry of the Environment and Spatial Planning but it is the Ministry of Finances that must amend the Act.
Concrete examples where applied	Not available.

WMO 6: Upgrade and update the existing network for monitoring the status of water environment

Short explanation	Option aims to upgrade the monitoring network for the state of the water environment as there is a need for a good and representative monitoring of hydrological, biological and water quality-based parameters, possible meteorological and agro-meteorological parameters. This option aims to upgrade also the existing monitoring stations together with establishment of additional ones for water quality and hydrological, meteorological measurements. More representative data can help to better understand the current situation in the Vipava river basin and so improve planning measures to improve the river basin management.
Addressed challenges	Water availability during droughts (A), Flood risk reduction (B), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Water management, water supply sector, agriculture
Benefits	Improved hydrological data, data on, biological and water quality aimed at better understanding the current situation in the Vipava river basin and so improve planning measures to improve the river basin management.
Potential negative impacts	None.
Timeline of implementation	Short (under 2 years' time).
Feasibility	Minor barriers due to limited financial capacities.
Robustness	Yes.
Flexibility	No, as the measure will only have an impact if implemented entirely.

Costs/Actions	The total discounted cost toward year 2030: 491,330 euros (EUR 2018, discount rate: 5%) comprises the costs of the planning process, implementation of 1 hydrological station (Vrtojbica), 8 monitoring stations for water quality (4 for ecological state and 4 for chemical state on Vrtojbica, Vogršček, Branica and Močilnik).
	Investor must follow next step when implementing new monitoring stations:
	• Planning of monitoring stations (Review of all existing monitoring stations and their status, review of BOBER outcomes and what still needs to be covered. Determination of priority areas and existing monitoring stations that need to be implemented/upgraded. Also need to check if implementation of monitoring stations is allowed in Municipal spatial plans) – 1 person month/station.
	  ○ (Investor) plans monitoring stations in following steps ("plan"):
	  ▪ searching of plots,
	  ▪ searching for servitudes and consents (a consent of the owner in the form of easement agreements (slo: "služnostna pogodba")) with surveying snapshot,
	  ▪ Designing (dimensioning) and determine fixed boundary conditions (designing engineering base) with the help of hydraulic calculations (for monitoring stations on watercourses).
	• Preparation of project documentation – 0.5 person months/station.

Synergies and conflicts with policy objectives	No known conflicts. Synergies: • Water Framework Directive [21] – To know the status of watercourses and to determine precise measures for improving status of water environment.

	• River Basin Management Plan [29] – similarity to the measure "The establishment and implementation of monitoring of sediment (and debris) transport, construction of the sediment management plan and preparation of regulations on the manner and conditions of debris and sediment removal" (label DDU16). • Flood Risk Management Plan [63] – measure "Implementation of hydrological and meteorological monitoring" (label U4) where it is stated that rationality of establishing new locations of automatic hydrological stations on two of the areas of significant impact of floods (Podnanos and Vrtojba-Šempeter) need to be verified. U4 is somehow also connected to the measure Flood Forecasting (label U15). • Natura 2000 Management programme for Slovenia [70] – within measure of adapted water quality to the ecological requirements of the species. *Funding of such an option could be through Horizon 2020 – Research to support measures/knowledge on any significant water management issues and from Cohesion Funds.*
Acceptance	High with local public, local community and Municipalities. Slovenian Environmental Agency has low acceptance for additional monitoring stations (beside already planned/implemented in BOBER project) due to high operational costs of existing monitoring stations. Their objective is only to comply monitoring with WFD requirements.
Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning and its body Slovenian Water Agency and Slovenian Environmental Agency. Ministry is responsible for establishment of the measure. All of the above are actively involved in processes of site selection, implementation of monitoring stations and monitoring. Slovenian Environmental Agency must include the data from new monitoring stations in existing database (data processing) for forecasting extreme weather events like droughts and floods. Possible involvement of the Municipalities and local communities, also The National Laboratory of Health, Environment and Food. They are supportive towards measure as this data will support them in finding out the status of watercourses – for possible development of new activities on the watercourses (bathing sites).
Preconditions for success	Funds available for implementing WMO and later for operational costs (most important).
Concrete examples where applied	In the 2009-2015 period, the Slovenian Environmental Agency of the Republic of Slovenia is carrying out a project called BOBER, which is an acronym for Better Observation for Better Environmental Response (Boljše Opazovanje za Boljše Ekološke Rešitve). (part of a measure in River Basin Management Plan, NUV I [29]) [101] and PUBLICATION from 2010 (also text in English): [102]. Municipality Nova Gorica already monitors the water in Vogršček water reservoir (microbiology).

WMO 7: Setting up monitoring to reduce pressures on aquatic ecosystems resulting from water abstraction and water storage

Short explanation	This option aims to set up monitoring of hydromorphological pressures on aquatic ecosystems to ensure appropriate water management. With this option, more comprehensive data supporting water management regarding pressures will be obtained, meaning legal and potential illegal water abstractions and impoundments of surface water. Verifying actual water consumption at holders of water rights during a period of low natural flows. Verifying of possible illegal abstractions and impoundments.
Addressed challenges	Water availability during droughts (A), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Local population, Tourism, Industry, Agriculture, Forestry, Water management
Benefits	Decrease of hydromorphological pressures on aquatic ecosystems.
Potential negative impacts	Possible negative social impact – no more possible illegal abstractions - increase in costs of water use and crop reduction due to less irrigation.
Timeline of implementation	Should start in short (under 2 years' time) and continue till 2030.
Feasibility	Minor social barriers due to restriction of water use and limited financial capacities.
Robustness	Yes. Water use is limited with ecological acceptable flow.
Flexibility	No, as the measure will only have an impact if implemented entirely.
Costs/Actions	The total discounted cost toward year 2030: 65,507 euros (EUR 2018, discount rate: 5%) comprises the costs of: • Verifying existing water rights in Vipava river basin – 0.25 person month; • Verifying actual water consumption at holders of water rights during a period of low natural flows. Verifying of possible illegal abstractions, impoundments during a period of low natural flows – 1 person month (woth field trip); • Measurements on selected locations, analysis of the results and the written report – 4 person month; • If needed, proposal of measures to the Government: for example - adjustment of already acquired water rights in order to reduce negative impacts on the aquatic ecosystems / penalties for possible illegal water abstractions – 0.5 person month. These actions (1 to 4) are repeated every 5 years, starting year 1. verification of existing water rights, actual water consumption and possible illegal abstractions, costs of measurements and analysis of the results together with preparation of the proposal of measurements for the Government.
Synergies and conflicts with policy objectives	No known conflicts. Synergies: • Water Framework Directive [21] – To set up monitoring of hydromorphological pressures on aquatic ecosystems to ensure appropriate water management and to contribute achieving objectives (Annex V, 1.3.2. Design of operational monitoring); • River Basin Management Plan [29]; Ecological flows in the implementation of the Water Framework Directive [21] and within the measures "Monitoring the withdrawn the quantity of water" (label DDU18.3) and "Decision support system on water use" (label DDU26). *Funding of such an option could be through Horizon 2020 – within group: Societal challenges / 12. Climate action, environment, resource efficiency and raw materials.*
Acceptance	Low acceptance by water users (potential illegal users). High acceptance by political and environmental sector.

Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning should start implementing this option with help of the supporting services, Slovenian Water Agency, Slovenian Environmental Agency, Institute for Water of the Republic of Slovenia, The Institute of the Republic of Slovenia for Nature Conservation and Slovenian Forest Service. On local level the municipalities, Mandatory Municipal Public Utility Services (Drinking water), holders of water rights (hydropower plants – Company called SENG, farmers, etc.) and general public (possible illegal abstractors) should be actively involved in such monitoring providing data and support in implementation.
Preconditions for success	Funds need to be available for implementing the option. When option in place, a reference measuring site is needed to easily know the cause of lower water flows. This option would be ideally combined with raising awareness among farmers (WMO 3) and local population (WMO 4).
Concrete examples where applied	Similar project was part of a yearly programme of IzVRS in previous years: Measurements of the quantity of abstracted water, river flow and determination of Ecological flow in Vipava river basin (“Meritve količin odvzema in pretokov vode v Vipavi, določitev Qes-a.”).

WMO 8: Construction of water reservoirs on the watercourses in the upper part of the river basin

Short explanation	With construction of water reservoirs, high waters can be retained and accumulated in the colder part of the year (e.g. autumn peak of precipitations) in the upper part of the Vipava river basin. When high waters occur due to short but heavy rainfall, water retention in the upper part of river basin can minimize floods downstream. In the warmer part of the year (spring, summer) accumulated water can represent a water resource for two main purposes: 1) for irrigation of agricultural land and so avoiding agricultural drought and 2) water source in the function of enriching low waters by maintaining environmentally acceptable flow downstream and so avoiding hydrological drought. If not in conflict they can be planned as multifunctional reservoirs with possibility of e.g. developing tourism activities.
Addressed challenges	Water availability during droughts (A), Flood risk reduction (B)
Target locations and water uses	Location: Upper part of river basin. Water uses: Local population, Tourism, Agriculture, Water management, Fishery.
Benefits	Water available for irrigation during droughts, enrichment of low flows, reducing floods downstream.
Potential negative impacts	Effect on water quality (affecting structural water quality), fragmentation of river (aquatic and riparian) ecosystem, sediment continuum.
Timeline of implementation	Long (after 6 years) although stakeholders on third workshop suggested to start implementing the option in the short-term as it needs to start planning as soon as possible, but the actual implementation can be postponed to medium and long-term.
Feasibility	Serious barriers – long processes of placing water reservoirs in spatial plans of involved Municipalities; hard to economically justify the projects of building water reservoirs (e.g. Košivec – already assessed costs at 4.6 mio € without mitigation measures); negative opinion of The Institute of the Republic of Slovenia for Nature Conservation;
Robustness	No.
Flexibility	No.
Costs/Actions	The total discounted cost toward year 2030: 18,292,910 euros (EUR 2018, discount rate: 5%). In "Development Plan for Irrigation till 2020" following water reservoirs are planned in Vipava river basin (priorities till year 2020): • Košivec – in municipality Ajdovščina, volume 1.176 million m3 (is also object of land use changes in municipal spatial plan), • Vrnivec – in municipality Ajdovščina, volume 1 million m3, • Svinjšček – in municipality Ajdovščina, volume 1 million m3, • Pasji rep – in municipality Vipava, volume 2.5 million m3. Main costs have been determined with the help of last known implementation costs of water reservoir Košivec. The costs consist of: • Purchase of land (separately for each location); • Preparation of project documentation (separately for each location) (8 % of investment costs); • Implementation of water reservoirs (all 4 reservoirs separately implemented, year 2, year 4, year 6, year 8); • Maintenance (2 % of investment costs).
Synergies and conflicts with policy objectives	Conflicts: • Water Framework Directive [21] and River Basin Management Plan [29]: The construction of water reservoirs on watercourses will affect structural water quality. Although WMO is in conflict with the objectives of WFD [21] there are some exceptions included in Article 4.7 of Water Framework Directive [21]. There are several conditions that need to be met if the reservoirs will be built.

	• Natura 2000 Management programme for Slovenia [70]: Possible conflict with the protection objectives relating to the provision of passability (transitivity) of watercourses for aquatic organisms and reducing the hydromorphological pressures. • Ordinance of the municipal spatial plan of the Renče-Vogrsko Municipality [103] Synergies: • Rural Development Plan 2014-2020 [74], • Floods directive 2007/60/EC [31] - help achieving compliance with objective of reducing flood risks. • Flood Risk Management Plan [63] – similarity to measure –" Design and construction of building flood protection measures" (label U7). • Natura 2000 Management programme for Slovenia [70] – within measure of providing a sufficient volume of water. • Resolution on the strategic orientations of development of Slovenian agriculture and food industry by 2020 - "Securing you food for tomorrow" (Official Gazette of RS, no. 25/2011) [104] - Special attention will be given to investments that will enable the development of innovative technologies and adaptation to climate change. • Regional Development Programme of Northern Primorska (Goriška development region) 2014-2020, measure A1P2 (page 237) [91] and measure A2P1 (page 264) - selection of the optimal project solutions of flood safety measures, which will allow multipurpose use and integration of financial resources across sectors and, consequently, best solutions from a technical, environmental and economic point of view. Measure A1P2 has some limitations - Before investing resources in the preparation of documentation for the construction of new water reservoirs it is reasonable to verify functionality and optimal utilization of existing irrigation infrastructure (e.g. Vogršček water reservoir in the Vipava Valley). • not yet confirmed Plan for development of Irrigation until 2020 (Irrigation Plan) [79], • Spatial Plan of Municipality Ajdovščina and its amendments (Official Gazette of the Municipality of Ajdovščina, no. 7/1997) [92] - already planning two water reservoirs, Košivec and Vrnivec. Ordinance of the municipal spatial plan of the Renče-Vogrsko Municipality in Article 34 [103]. Paragraph 11 determines the construction of reservoirs for irrigation of agricultural land. They must be designed locally in order to minimize the impacts on hydrological system, taking into account the conservation of biodiversity and protection of natural features. Designing area of reservoirs should allow ingrowth of the natural ecosystem and allowing the use of other activities.
Acceptance	High acceptance by agricultural sector (farmers and their advisors). Low or no acceptance by environmental sector (The Institute of the Republic of Slovenia for Nature Conservation).
Suggested stakeholder involvement	Ministry of Agriculture, Forestry and Food together with Municipalities and their development agencies, Ministry advisory service Chamber of Agriculture and Forestry of Slovenia (CAFS) (Regional units) should prepare proposals for implementation together with farmers – land owners and potential users of reservoirs. Planning must be in close cooperation of Ministry of the Environment and Spatial Planning who leads SEA process (also Ministry of Defense) and other institutions that are involved in the process of obtaining needed permits (also EIA processes), meaning ensuring expert support in the implementation process (for each intervention into the watercourse it is necessary to obtain requirements or guidelines of the Institute; guidelines must be considered in project documentation) (e.g. Slovenian Water Agency, Slovenian Environmental Agency, The Institute of the Republic of Slovenia for Nature Conservation, The Fisheries Research Institute of Slovenia).
Preconditions for success	A precondition for the option to be implementable is the cooperation of landowners as they have to agree with giving up plots in order to create such reservoirs. Precondition is acceptance of planned reservoirs by all Spatial Planning Authorities (Slo.: "Nosilci urejanja prostora"), especially Environmental sector (Water, Nature conservation) within SEA and EIA processes! Precondition is also assured funding – determination of financial structure – it is suggested that this reservoirs are multifunctional, not just for irrigation and flood protection, but also for developing eco-tourism, recreation sites, etc. That said, all secondary functions of water reservoirs must

	ensure water for low flow in dry period of year. The regulation of operation must be prepared in a way that ensuring low flow in dry period of year has priority before other uses.
Concrete examples where applied	Vogršček water reservoir in the mid-/lower part of Vipava river basin in 1980s.

WMO 9: Construction of dry reservoirs

Short explanation	With construction of dry reservoirs, high waters in the colder part of the year (e.g. autumn peak of precipitations) can be retained till the water flow normalises. Water retention in the upper and lower part of the river basin would solve problems with floods downstream. If dry reservoirs would be built along watercourses, this option would represent a more sustainable solution then building dry reservoirs on watercourses.
Addressed challenges	Flood risk reduction (B)
Target locations and water uses	Location: River as a whole. Water uses: Local population, Water management
Benefits	Reducing floods downstream.
Potential negative impacts	Reducing agriculture production where reservoirs would be build (if placed on agricultural land). Depending the location of the dry reservoir – on or along watercourses – possible alteration of morphology of the watercourse.
Timeline of implementation	Med-term (between 2 and 6 years).
Feasibility	Minor barriers (placement of the reservoirs in spatial plans, cooperation of landowners, land users and farmers) - more acceptable for environmental sector (The Institute of the Republic of Slovenia for Nature Conservation). Limited financial capacities.
Robustness	Yes.
Flexibility	No.
Costs/Actions	The total discounted cost toward year 2030: 5,637,741 euros (EUR 2018, discount rate: 5%) comprises the: • Integrated analysis for potential location for dry reservoirs (year 1); • Purchase of land (separately for each location, land must be purchased where the barrier will stand); • Preparation of project documentation (separately for each location) (8 % of investment costs); • Implementation of dry reservoirs/barriers (4 dry reservoirs, year 2, year 4, year 6, year 8); • Maintenance (2 % of investment costs).
Synergies and conflicts with policy objectives	Conflicts: • possible with Water Framework Directive [21] (possible alteration of morphology of the watercourse). This depends on the location of the dry reservoir and construction technique – on or along watercourses – possible alteration of morphology of the watercourses. Possible conflict with fundamental measure HM8 of RBMP relating to the provision of good hydromorphological water status (in Slovene: "omejevanje novih ureditev vodotokov" (former DUPPS 21)). • Habitats Directive [72] - Possible negative impact on protective forests and forests with a special purpose and possible negative impact on nature conservation areas (Natura2000 sites, valuable natural features, ecologically significant area, designated nature protected areas). Synergies: • Floods Directive [31], and in comparison with water reservoirs the dry reservoirs present more suitable solution for Natura2000. • Flood Risk Management Plan [63] – similarity to measure "Design and construction of building flood protection measures" (label U7).
Acceptance	Higher acceptance by environmental sector (The Institute of the Republic of Slovenia for Nature Conservation), lower acceptance by agricultural sector (if arable land will be affected).
Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning and its bodies, which are involved in SEA procedure (e.g. The Institute of the Republic of Slovenia for Nature Conservation) should check the possibility of implementing such an option. Slovenian Environmental Agency is involved in SEA procedure, but also leading EIA procedure. Slovenian Water Agency is the one bearing responsibility in the field of water management -

	maintenance of the dry reservoirs and monitoring (data acquisition for water management). Cooperation of Ministry of Defense (Administration of the Republic of Slovenia for Civil Protection and Disaster Relief), Ministry of Agriculture, Forestry and Food together with Slovenian forest service (ZGS, OE Tolmin, KE Ajdovščina), Municipalities (local community) and landowners must be assured. Farmers (or landowners) would need financial initiative (compensation for the loss of income) – usually investor proposes three options: purchase of the land, compensation for the loss of harvest or can get substitution of agricultural land with a suitable one.
Preconditions for success	A precondition for successful implementation is a good analysis if and where this dry reservoirs are needed to achieve desired results (reducing floods downstream). A proper analysis must be conducted of most suitable locations of the reservoirs. Also in the process of searching for proper location, the measure can be implementable only if there is a common agreement and cooperation of landowners (farmers, land users, Mandatory Municipal Public Utility Services) as they have to agree on giving up plots in order to create such reservoirs. Last but not least there must be funds available for implementation.
Concrete examples where applied	Dry reservoirs Pikol and Pikolud in the Municipality Nova Gorica. Also a local dry reservoir in municipality Renče-Vogrsko (Arčoni pri Renčah) – the Municipality itself manages the reservoir.

WMO 10: Reconstruction of existing water reservoir Vogršček

Short explanation	With reconstruction of exsisting water reservoir Vogršček in the lower part of Vipava river basin, this options aims to improve the operation of reservoir Vogršček and its associated facilities. Good status of water reservoir Vogršček is the precondition for a well-functioning and optimal utilization of the irrigation system. The impact of this option will be more efficient irrigation of agricultural land in lower part of the river basin that can prevent agricultural drought, enable cleaner water for irrigation and healthier local food production.
Addressed challenges	Water availability during droughts (A)
Target locations and water uses	Location: Lower part of river basin. Water uses: Local population, Tourism, Agriculture
Benefits	More efficient irrigation with minimizing negative impact of drought on agriculture, appropriate water quality for irrigation.
Potential negative impacts	Economically this is an expensive option, but is already planned.
Timeline of implementation	Short (under 2 years' time).
Feasibility	Minor barriers (economical). WMO costs a lot of money – due to limited financial capacities reconstruction has been delayed.
Robustness	No.
Flexibility	No.
Costs/Actions	The total discounted cost toward year 2030: 4,428,486 euros (EUR 2018, discount rate: 5%). Ministry of the Environment and Spatial Planning is with "Conceptual plan" (slo: "projektna naloga" of terms of reference) already in process of public procurement for Reconstruction of barrier Vogršček and its accompanying facilities. In conceptual plan, project and investment documentation for obtaining a building permit must be prepared (construction works carried by a contractor). We used last known estimated cost of restoration works of the reservoir from year 2013. The costs consist of: • Preparation of project documentation (8 % of investment costs); • Implementation of reconstruction works; • Maintenance (2 % of investment costs) – here we also took into account existing costs of maintaining the reservoir Vogršček (100,000 Eur/year).
Synergies and conflicts with policy objectives	No known conflicts. Synergies: • Flood Risk Management Plan [63] – similarity to measure –"Design and construction of building flood protection measures" (label U7). • Natura 2000 Management programme for Slovenia [70] – with measure of ensuring a sufficient volume of water. • Rural Development Plan 2014-2020 [74] - Funds available for construction of large irrigation systems (reservoir Vogršček is a part of a large irrigation system and reconstruction of extraction facility is a precondition to develop new irrigation systems from reservoir Vogršček), • Water fund (Article 162 of Waters Act [59]) finances the modernization of water reservoirs intended for irrigation of agricultural land, that are government water infrastructure. • Resolution on the strategic orientations of development of Slovenian agriculture and food industry by 2020 - "Securing you food for tomorrow" (Official Gazette of RS, no. 25/2011) [104], • Regional Development Programme of Northern Primorska (Goriška development region) 2014-2020 plans within measure A1P2 (page 237) [91];

	• not yet confirmed Plan for development of Irrigation until 2020 (Irrigation Plan) [79].
Acceptance	High acceptance with agriculture sector, also with water sector.
Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning as an owner of the reservoir is with "Conceptual plan" (slo: "projektna naloga" of terms of reference) already in process of public procurement for Reconstruction of barrier Vogršček and its accompanying facilities. In conceptual plan, project and investment documentation for obtaining a building permit must be prepared (construction works carried by a contractor). Involved should be also Ministry of Agriculture, Forestry and Food, Ministry of Defense (Administration of the Republic of Slovenia for Civil Protection and Disaster Relief) and Municipalities (local community). Funds available for implementing WMO.
Preconditions for success	The main problem is unclarified ownership of the reservoir and its infrastructure between government and the private sector, which, in the past 20 years, has resulted in poor management, improper functioning, lack of operation and maintenance funding. Although formally the owner of the entire system Vogršček (reservoir and irrigation systems) is one (government), we can see that shared ownership between the Ministry of Agriculture, Forestry and Food (irrigation systems) and Ministry of the Environment and Spatial Planning (reservoir) represent the main problem (disagreements) for proper functioning (maintenance) [105]. So the precondition for success would be improved legal framework concerning the ownership, management and financing for maintaining the system (not just reservoir). Reservoir needs to be seen as a part of the whole system.
Concrete examples where applied	In 2013 some refurbishment works (first phase) took place on the reservoir Vogršček with the objective to ensure the safe operation of the dam.

WMO 11: Development of new irrigation systems

Short explanation	This option develops/implements new irrigation systems, derived from the existing water reservoir Vogršček or from other planned water reservoirs (e.g. Košivec, Vrnivec, Svinjšček, Pasji rep). This measure can prevent agricultural drought and consequently reduce the damage caused in the agriculture and consequently, also increase self-sufficiency in food. Also cleaner and more appropriate water for irrigation means reducing the risk of contamination and consequently healthier local food production. The establishment of proper irrigation systems, new technologically more efficient and equipped with proper agrometeorological support with sensors for optimal irrigation, targeting the type of crop and soil, and also reducing water consumption caused by inappropriate irrigation techniques.
Addressed challenges	Water availability during droughts (A)
Target locations and water uses	Location: Upper part of river basin. Water uses: Agriculture
Benefits	Increased irrigated crop production and self-sufficiency in food.
Potential negative impacts	More intensive agricultural production can lead to deterioration of water quality.
Timeline of implementation	Long-term (> 6 years' time). According to stakeholder comments also short-term (under 2 years' time) for irrigation systems that are linked to existing water reservoir Vogršček.
Feasibility	Serious barriers – involvement of different stakeholders must be assured to implement this option (farmers, landowners, and spatial planning stakeholders), also relatively big financial burden.
Robustness	No. This option only functions if there is sufficient water for irrigation. Therefore, if the future is extremely dry, or wet, the option does not have a great effect anymore.
Flexibility	Yes.

Costs/Actions	The total discounted cost toward year 2030: 22,500,811 euros (EUR 2018, discount rate: 5%) comprises the costs of project documentation, implementation and maintenance costs of new irrigation systems with total area of 3,797 ha.
	Steps that need to be considered:
	• Preparation of project documentation (8 % of investment costs);
	• Implementation of new irrigation systems (For cost assessment we decided to take into account data from "Action plan for the development of irrigation in the RS until 2020"71 on planned new irrigation systems for 2,700.00 ha of net agricultural land. Action plan also financially evaluated the measure based on information on funds of rural development program (2007 - 2013) intended for the construction of new irrigation systems. It has been estimated that 6,046.00 €/ha is the cost of new irrigation system.);
	• Maintenance (2 % of investment costs) starting from the year following the implementation.
	Plan for implementation of new irrigation systems (according to Action plan and information based on one of our stakeholders in the field of agricultural consultancy):
	• Irrigation system from water reservoir Vogršček with area 1,080 ha:
	  ○ project documentation in year 1,
	  ○ implementation in year 2.
	• Irrigation system from water reservoir Košivec with area 600 ha:
	  ○ project documentation in year 3,
	  ○ implementation in year 4.

	• Irrigation system from water reservoir Vrnivec with area 1,107 ha:
	  ○ project documentation in year 5,
	  ○ implementation in year 6.
	• Irrigation system from water reservoir Svinjšček with area 188 ha:
	  ○ project documentation in year 7,
	  ○ implementation in year 8.
	• Irrigation system from water reservoir Pasji rep with area 822 ha:
	  ○ project documentation in year 9,
	  ○ implementation in year 10.

Synergies and conflicts with policy objectives	Conflicts: • Possible overexploitation of water resources – conflicts with Water Framework Directive [21] – River Basin Management Plan [27, 28]. Synergies: • Development Programme of Northern Primorska (Gorizia development regions) 2014-2020, measure A1P2 (page 237) [91]; • not yet confirmed Plan for development of Irrigation until 2020 (Irrigation Plan) [79] has included new irrigation system in the area of Vipava river basin; • Rural Development Plan 2014-2020 has funds available for construction of large irrigation systems (Measure M4.3)[74].
Acceptance	Medium (high acceptance with agriculture sector and low with water sector).
Suggested stakeholder involvement	Ministry of Agriculture, Forestry and Food on the basis of a proposal given by the applicant (proposer) issues and enforces regulation or decision on the introduction of an irrigation system according to the Agricultural Land Act. Proposers for the introduction of the irrigation system can be melioration communities or legal person on behalf of the owners of agricultural land on the planned irrigated area or individual owners of agricultural land that is planned to be irrigated. Ministries supporting services Chamber of Agriculture and Forestry of Slovenia (CAFS) (Regional units) could support farmers in the planning and implementation processes, but an initiative must come from farmers with interest of using water for irrigation. Municipalities can be initiators for future planning of irrigation systems and possibly help with management issues (as part of their public service). Within implementation process there are other institutions involved: Ministry of the Environment and Spatial Planning leads the SEA process (spatial plans), Slovenian Environmental Agency leads EIA process (if irrigation system needs a building permit, it is necessary to do an environmental impact assessment. On the basis of EIA assessment environmental consent is issued.), and Slovenian Water Agency that issues water permit. Due to amendments of Agricultural Land Act (Official Gazette of RS, no. 27/16) [106] there is the possibility that the local community (Municipalities or/and irrigation communities) can have a bigger role in management and maintenance of national (state) irrigation systems. Namely, if the interest is expressed, with conducted contract between the Ministry of Agriculture, Forestry and Food landowners and local community the ownership of national irrigation systems is transferred to the local community. At the same time the management and maintenance of the system is transferred as well (except for the management and maintenance of irrigation equipment as it is already owned and managed by the users) and so the national irrigation system becomes a local irrigation system.
Preconditions for success	The selected water source must have sufficient water quantities (issued water permit). Cooperation and agreement of land owners who own more than 80% of agricultural land where irrigation systems are planned. There must be clear interest of farmers (cultivating land that would be irrigated) to use irrigation systems and to pay for its usage. Operator of irrigation systems needs to be determined! Last but not least funds must be available for implementing the option. Within the document *Development Programme of Northern Primorska [91]* is stated one major conditions and that is: Before investing resources in the preparation of

	documentation for the construction of new irrigation systems it is reasonable to verify functionality and optimal utilization of existing irrigation infrastructure (eg. water reservoir Vogršček in the Vipava Valley).
Concrete examples where applied	Not available.

WMO 12: Reconstruction of existing irrigation systems

Short explanation	This option aims to replace the current irrigation network from water reservoir Vogršček to arable land. The existing irrigation systems are outdated, inappropriately managed and this results in unsustainable use of water for irrigation (pipes are leaking - loss of water, the lack of pressure in the system, etc.). This measure can prevent agricultural drought and consequently reduce the damage caused in the agriculture and consequently, also increase self-sufficiency in food. Also cleaner and more appropriate water for irrigation means healthier local food production. The establishment of proper irrigation systems, new technologically more efficient and equipped with proper agrometeorological support or modernization of existing irrigation systems with sensors for optimal irrigation, targeting the type of crop and soil, and also reducing water consumption caused by inappropriate irrigation techniques (sprinklers vs drip irrigation).
Addressed challenges	Water availability during droughts (A)
Target locations and water uses	Location: Upper and lower part of river basin. Water uses: Agriculture
Benefits	Increased irrigated crop production and self-sufficiency in food. Proper irrigation can reduce water consumption and pollution of groundwater caused by washouts of nutrients, fertilizers and plant protection products.
Potential negative impacts	Possible overexploitation of water resources (known as rebound effect (or take-back effect) that means the reduction in expected gains from new technologies that increase the efficiency of resource use). If irrigation properly in place farmers could choose to cultivate crops that need more water (are usually economically speaking, more profitable).
Timeline of implementation	Short-term (under 2 years' time)
Feasibility	Minor barriers – existing irrigation systems need to be reconstructed and this can represent a financial burden for some farmers already struggling with the loss of income due to market situation.
Robustness	No. This option only functions if there is sufficient water for irrigation. Therefore, if the future is extremely dry, or wet, the option does not have a great effect anymore.
Flexibility	Yes.
Costs/Actions	The total discounted cost toward year 2030: 2,864,605 euros (EUR 2018, discount rate: 5%) comprises: • to review status of existing irrigation systems, needs and scope of the needed reconstruction works – 3 person month, year 1; • Preparation of project documentation (8 % of investment costs), year 1; • Reconstruction works in year 2 - for cost estimation we decided to take into account cost assessment of planned reconstruction of existing irrigation systems in Action plan for the development of irrigation in the RS until 2020 [79]. Action plan financially evaluated the measure with help of data based on information on funds of rural development program (2007 - 2013) intended for the reconstruction of existing irrigation systems. It has been estimated that 2,395.00 €/ha is the cost of reconstruction of existing irrigation system.). As no data is available on the status of existing irrigation systems we assumed that all 1,000 ha of existing irrigation systems need to be reconstructed due to the fact that most systems are 20 to 30-years old; • Maintenance (2 % of investment costs) starting from the year following the implementation.
Synergies and conflicts with policy objectives	No known conflicts. Synergies: • Development Programme of Northern Primorska (Gorizia development regions) 2014-2020, measure A1P2 (page 237) [91];

	• not yet confirmed Plan for development of Irrigation until 2020 (Irrigation Plan) [79] promotes renovations of existing irrigation systems; • Rural Development Plan 2014-2020 has funds available for reconstruction of irrigation systems (Measure M4.3) [74]. *Possible funding through CAP/European Agricultural Fund for Rural Development (EAFRD) within sub measure M1.2 - support for demonstration activities and information activities but most importantly within art. 17 Investments, linked to irrigation (1: efficient, responsible and sustainable use of water resources in agriculture: only indirect links to Significant Water management Issues (SWMIs); cooperation and irrigation/water savings possible).*
Acceptance	High acceptance by the agriculture sector.
Suggested stakeholder involvement	Stakeholders involved in the process of reconstruction of existing irrigation systems are common to those that are involved in construction of new irrigation systems (look above at the WMO 11: Construction of new irrigation systems).
Preconditions for success	Funds must be available for implementing WMO. Farmers (users of the system) would likely need financial initiatives. Namely they have limited financial capacities (also due to the current situation on the market). It is also the case that farmers are not well connected between each other although agricultural cooperative association (KZ Vipava) exist. There is incoherent organization of the existing irrigation fields and so we believe that this issue needs to be solved first by establishment of proper operator - active operator of irrigation system that has also expert knowledge on irrigation (requires formal legal arrangement) together with proper system of financing the operation of irrigation systems (possible introduction of counters for water consumption). Commitment of farmers using irrigation systems and paying usage must be achieved.
Concrete examples where applied	Not available.

WMO 13: Restoration of Vipava river and its tributaries

Short explanation	This option aims to restore the functionality of natural aquatic and also riparian ecosystems on Vipava river and its tributaries. Aim of this option is also to start implementation procedures for improvement of ecological status of Vipava River and all the other benefits that comes together with this option such as improvement of hydromorphological elements of river body quality.
Addressed challenges	Water availability during droughts (A), Flood risk reduction (B), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole (excluding settlement areas). Water uses: Local population, Tourism, Agriculture, Water management.
Benefits	With restoration of regulated watercourses, the stability and functionality of the natural aquatic ecosystems is established, which enables dynamic stability and biodiversity and so increases the self-cleaning capability of the aquatic ecosystems. With retaining flood waves and prolonging the runoff, flood magnitudes can be reduced downstream. With natural self-cleansing capability, based essentially on the action of microorganisms and plants that can survive in polluted water or soil, and either absorb, break down or neutralize harmful waste substances, water quality is improved or preserved. With capacity of retaining water, this results in natural enrichment of groundwater (raising the level of ground water) and also results in natural humidification of the soil. Providing a suitable habitat for animal and plant species that are tied to occasional flooding and so maintain a favourable status of protected and endangered plant and animal species (Natura 2000 management) and creating conditions for preserving biodiversity of aquatic, riparian and wetland ecosystems. If buffer zones or water margins along watercourses are established they can also slow down the wind and locally prevent wind erosion. Giving the Vipava River and its tributaries more needed space, natural river processes and link between water and terrestrial ecosystems can be restored. In the areas where agriculture prevails, improving habitat and biodiversity, and thus connectivity of ecosystems is important. Increased self-cleaning capacity of the watercourse eases the effects of chemicals (pesticides, insecticides) on aquatic and riparian ecosystems and the quality of water is preserved. Increased retention function of aquatic and riparian ecosystems results in natural humidification of the soil and raised groundwater level.).
Potential negative impacts	Restoration of riparian ecosystems and natural flow needs a lot of space at the expense of agricultural land. Furthermore, when restoring the natural water flow conditions, it can affect hydropower. Contradiction with the WMOs on reservoirs (#8, #9).
Timeline of implementation	Long-term (> 6 years' time).
Feasibility	Minor barriers – low acceptance by farmers that cultivate land near watercourses.
Robustness	Yes.
Flexibility	Yes.
Costs/Actions	The total discounted cost toward year 2030: 5,868,377 euros (EUR 2018, discount rate: 5%). For the purpose of cost estimation, few options for restoration are prepared by IzVRS expert. On Vipava river and its tributaries all together 23 locations potentially suitable for restoration have been determined. On Vipava river, 16 potential locations have been determined with a total of 11 km (11,016 metres) and 74 ha (40 m protected zone on each side). On tributaries, 7 potential locations have been determined with a total of 11 km (10,910 metres) and 11 ha (5 m protected zone on each side). For calculations of the area of restoration, one- or two-sides of riverbank was taken into account. Main costs have been determined with the help of IzVRS expert. The costs consist of: • Preparation works to examine potential locations for restoration, preparation of "restoration plan" by expert 0.25 person month/location, 23 locations would mean 6 person months in year 1; • Purchase of land (separately for each location);

Synergies and conflicts with policy objectives	• Preparation of project documentation (separately for each location) (8 % of investment costs); • Implementation of measures (Removal of lateral walls / hard lateral structures (allowing for morphologic development) and planting riparian reed vegetation) (separately for each location, not for all locations planting riparian reed vegetation is planned); • Maintenance (2 % of investment costs). Possible conflicts: • Natura 2000 Management Programme for Slovenia for the period 2015-2020 [70] – some species (slo: "močvirska sklednica" or *Emys orbicularis*) need to have riverbank covered with grass and not trees, bushes (need to be trimmed) – here different maintenance techniques must be adopted (species specifics). • There are known sections where the river continuity must not be enabled (small hydropower plant in Prvačina). This is due to the fact that there are Natura 2000 fish species (*Barbus plebejus*) whose living area is upstream of the hydropower plant dam (in Prvačina). The predatory fish species (*Silurus glanis*) live downstream of the dam where this Natura 2000 species (*Barbus plebejus*) are no longer present. Synergies: • Habitat Directive [72] – within Natura 2000 Management Programme for Slovenia for the period 2015-2020 [70], Vipava Valley (SI3000226) is proposed for restoration. • Water Framework Directive f21] – Article 4: Member States shall protect, enhance and restore all surface water bodies, for artificial and heavily modified water bodies with the aim of achieving good ecologic status/potential. • River Basin Management Plan [29] – within measure –"Sustainable regulation of the watercourse and flood control reservoir (dry reservoirs)" (label DUDDS5.2). • Waters Act [59] determines in Article 14 a 15 m (40 m) width buffer stripes for Rivers of first order (Vipava) of width and 5 m width buffer stripes for Rivers of second order (its tributaries). Within Article 16 it determines that local community can in order to facilitate the overall water use, decide that the status of natural public water good is established on the part of coastal land of inland waters. • Flood Risk Management Plan [63]– measure U2 or so called "Identification, establishment and maintenance of the retention areas for high waters". • Programme for the Management of Fish in Inland Waters of the Republic of Slovenia, 2015 [76] – The program for the management of fish in inland waters 2010-2021 has already proposed Vipava river (section Vipava – Kasovlje) for restoration. *Possible funding through CAP/European Agricultural Fund for Rural Development (EAFRD) within Art. 18 ("restoring agricultural production potential damaged by natural disasters and catastrophic events and introduction of appropriate prevention actions"), Art. 24 ("prevention and restoration of damage to forests from forest fires and natural disasters and catastrophic events) and Art. 17 (investments in non-productive physical assets, such as achieving biodiversity conservation status of species and habitat as well as enhancing the public amenity value of a Natura 2000 area or other high nature value systems). Also through The INTERREG MED Programme 2014-2020 within priority axis 3, European Regional Development Fund (ERDF) within TO 5 (climate change adaptation, risk prevention): ecosystem-based approaches for hydromorphological alterations (reconnection of wetlands/floodplains), possibly nutrient pollution (diffuse pollution from agriculture) and TO 6 (protecting the environment and promoting resource efficiency): organic pollution (UWWTP, industrial point sources), nutrient pollution (UWWTP, industrial point sources), hazardous substances pollution (UWWTP industrial point sources), hydromorphological alterations (reconnection of wetlands/floodplains). Also possible funding through Cohesion Fund (CF) within Climate change adaptation and risk prevention: hydromorphological alterations (reconnection of wetlands/floodplains).*

Acceptance	High acceptance by environmental sector (The Institute of the Republic of Slovenia for Nature Conservation) although on third workshop concern was raised that during construction works negative impact on the river ecosystem can emerge. Low acceptance by farmers that cultivate land near watercourses. On first workshop they commented that in past money was spent for regulating the Vipava River and its tributaries. Now it would be the opposite and does not make sense.
Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning could give financial support by directing funds from Water fund for implementation of this measure. The ministry is with its bodies (e.g. , Slovenian Environmental Agency, The Institute of the Republic of Slovenia for Nature Conservation and Slovenian Forest Service) involved in SEA procedures – obtaining permits for implementations of the option. This option has support from Municipalities that are already involved in some projects within Council for Vipava (Svet za Vipavo, projektna skupina). Local population – inhabitants with their knowledge and valuable experience need to be involved in planning of restoration.
Preconditions for success	Funds available for implementing WMO (buying land, implementation). Acceptance of farmers to relinquish their farm plots and land owners to sell their land near watercourses. Also spatial planning authorities must give consent for implementation of the option.
Concrete examples where applied	LIFE project Ljubljanica Connects (“Ljubljanica povezuje”). Project Kučnica/ Kutscheniza (European Territorial Cooperation, the Operational Programme Slovenia–Austria 2007-2013). Publication on all restored watercourses [107]

WMO 14: Restoration of old meanders and oxbows of Vipava river and its tributaries

Short explanation	This option aims to restore functionality of abandoned (non-functional) natural aquatic ecosystems called meanders and oxbows on Vipava river and its tributaries. The stability and functionality of the natural aquatic ecosystems is established, which enables dynamic stability and biodiversity and so increases the self-cleaning capability of the aquatic ecosystems.
Addressed challenges	Water availability during droughts (A), Flood risk reduction (B), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole (focusing on locations of abandoned meanders that sometimes functioned on the Vipava River). Water uses: Local population, Tourism, Agriculture, Water management.
Benefits	The stability and functionality of the natural aquatic ecosystems is established, which enables dynamic stability and biodiversity and so increases the self-cleaning capability of the aquatic ecosystems. With retaining flood waves and prolonging the runoffs, floods can be reduced downstream. With natural self-cleansing capability, based essentially on the action of microorganisms and plants that can survive in polluted water or soil, and either absorb, break down or neutralize harmful waste substances, water quality is improved. With capacity of retaining water, this results in natural enrichment of groundwater (raising the level of ground water) and also results in natural humidification of the soil. Providing a suitable habitat for animal and plant species that are tied to occasional flooding and so maintain a favorable status of protected and endangered plant and animal species (Natura 2000 management) and creating conditions for preserving biodiversity of aquatic, riparian and wetland ecosystems.
Potential negative impacts	When restoring the natural water flow, it can affect hydropower. Contradiction with the WMOs on reservoirs (#8, #9).
Timeline of implementation	Medium (2 to 6 years).
Feasibility	Minor barriers – low acceptance by farmers that cultivate land near watercourses (still this will not affect their land – all potential areas are covered with forest and landowner is the government.
Robustness	Yes.
Flexibility	Yes.
Costs/Actions	The total discounted cost toward year 2030: 1,276,262 euros (EUR 2018, discount rate: 5%). For the purpose of cost estimation, few options for restoration are prepared by IzVRS expert. On Vipava river and its tributaries all together 9 locations potentially suitable for restoration have been determined with a total of 2 km (2,721 metres). Main costs have been determined with the help of IzVRS expert. The costs consist of: • Preparation works to examine potential locations for restoration, preparation of “restoration plan” by expert 0.25 person month/location, 9 locations * 0.25 month = 2.5 person months; • Implementation of measures (restoration of meander or oxbow) together with preparation of project documentation; • Maintenance (2 % of investment cost).
Synergies and conflicts with policy objectives	Possible conflicts: • Natura 2000 Management Programme for Slovenia for the period 2015-2020 [70] – some species (slo: “močvirska sklednica” or *Emys orbicularis*) need to have riverbank covered with grass and not trees, bushes (need to be trimmed) – here different maintenance techniques must be adopted (species specifics).

	• There are known sections where the river continuity must not be enabled (small hydropower plant in Prvačina). This is due to the fact that there are Natura 2000 fish species (*Barbus plebejus*) whose living area is upstream of the hydropower plant dam (in Prvačina). The predatory fish species (*Silurus glanis*) live downstream of the dam where this Natura 2000 species (*Barbus plebejus*) are no longer present. Synergies: • Habitat Directive [72] – within Natura 2000 Management Programme for Slovenia for the period 2015-2020 [70], Vipava Valley (SI3000226) is proposed for restoration. • Water Framework Directive [21] – Article 4: Member States shall protect, enhance and restore all surface water bodies, for artificial and heavily modified water bodies with the aim of achieving good ecologic status/potential. • River Basin Management Plan [29] – within measure –"Sustainable regulation of the watercourse and flood control reservoir (dry reservoirs)" (label DUDDS5.2). • The program for the management of fish in inland waters 2010-2021 [76] has already proposed Vipava river (section Vipava – Kasovlje) for restoration. • Waters Act [59] determines in Article 14 a 15 m (40 m) width buffer stripes for Rivers of first order (Vipava) of width and 5 m width buffer stripes for Rivers of second order (its tributaries). Within Article 16 it determines that local community can in order to facilitate the overall water use, decide that the status of natural public water good is established on the part of coastal land of inland waters. • Flood Risk Management Plan [63]– measure "Identification, establishment and maintenance of the retention areas for high waters" (label U2). *Possible funding same as with WMO 13.*
Acceptance	High acceptance by environmental sector (The Institute of the Republic of Slovenia for Nature Conservation) although on third workshop concern was raised that during construction works negative impact on the river ecosystem can emerge.
Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning could give financial support by directing funds from Water fund for implementation of this measure. The ministry is with its bodies (e.g. , Slovenian Environmental Agency, The Institute of the Republic of Slovenia for Nature Conservation and Slovenian Forest Service) involved in SEA procedures – obtaining permits for implementations of the option. This option has support from Municipalities that are already involved in some projects within Council for Vipava (Svet za Vipavo, projektna skupina). Local population – inhabitants with their knowledge and valuable experience need to be involved in planning of restoration.
Preconditions for success	Funds available for implementation of the option. Money for buying land is not needed as the potential areas for restoration are all in owned by the government.
Concrete examples where applied	LIFE project Ljubljanica Connects ("Ljubljanica povezuje"). Publication on all restored watercourses. BioMura project (LIFE06NAT/SLO/00006) establishing of old canal distributaries.

WMO 17: Reconstruction of stabilizing and transverse constructions from natural stone in the smaller tributaries of Vipava river

Short explanation	This option aims to reconstruct stabilizing and transverse constructions from natural stone in the smaller tributaries of the Vipava River. These barriers would be in function of slowing down the flow and retention of sediment and woody debris.
Addressed challenges	Flood risk reduction (B)
Target locations and water uses	Location: River Basin as a whole. Water uses: Water management.
Benefits	Reducing floods and flood damages downstream.
Potential negative impacts	Depending on the material and technical solution (height) - if constructions would be passable for water organisms, material as rocks not concrete is used, then no negative impacts.
Timeline of implementation	Short-term (under 2 years' time), and as stakeholders commented on third workshop the option must be implemented continuously through mid- (2 to 6 years) and long-term (> 6 years' time) as it is considered as much needed maintenance.
Feasibility	No major barriers.
Robustness	No.
Flexibility	No.
Costs/Actions	The total discounted cost toward year 2030: 173,934 euros (EUR 2018, discount rate: 5%). No data on the state of stabilizing and transverse constructions for Vipava river basin exist. There are some data on web portal "e-Vode"73 on where water infrastructure in located, but the state and needed reconstruction works are not known. For this option steps are proposed: • Analysis of all stabilizing and transverse constructions (weirs) on the smaller tributaries on steep slopes needs and review of activities that are already carried out (through concessions) intended mainly to reduce flood risk. Afterwards priority areas of reconstruction need to be determined, taking into account the objectives of the Water and Floods directive and also existing iniciatives from involved Municipalities – 6 person month • Preparation of the reconstruction project (8 % of investment costs). • Implementation of the measure – cost estimation of reconstruction/implementation of one transverse construction for stabilizing river bed was prepared by IzVRS expert – for 5 meter wide watercourse (5 meters into the bottom level of 0.5 meters, 0.5 meters deep): 11,500.00 €/location; • Maintenance (2 % of investment costs) starting from the year following the implementation.
Synergies and conflicts with policy objectives	Conflicts: It depends. If torrents, where migratory fish do not live, river continuity is not obligatory and is not reasonable. Also somewhere this existing constructions will need to be reconstructed to achieve flood safety, for some that would not have this function, could be removed (WMO #13). At this point we do not know locations and best solutions. Synergies: • Flood Risk Management Plan [63]– measure "Regular maintenance of watercourses, water facilities and aquatic and inshore land" (label U10). • Natura 2000 Management programme for Slovenia [70] - transversal structures in a way can imitate natural conditions in upper parts of torrent tributaries in Vipava river basin. With use of sustainable techniques and material we believe that some co-benefits could be achieved. One of positive things would be increased aeration.

	• Draft Spatial plan of the Municipality of Ajdovščina, June 2014 [108] within Article 104 determines: Arrangements on watercourses and torrents must be made primarily from natural materials. The natural dynamics of watercourses must be maintained, except for regulations needed for protection against floods and torrential waters. • Ordinance on Municipal Spatial Plan of the Municipality of Vipava [109]within Article 116 determines: Arrangements on watercourses and torrents must be made primarily from natural materials.
Acceptance	High acceptance with water sector and municipalities.
Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning could give financial support by directing funds from Water fund for implementation of this measure. In cooperation with its bodies like Slovenian Water Agency and Slovenian Environmental Agency (together with the concessionaires) they could implement the option. Slovenian Water Agency is responsible for water (regulation) management. This option can contribute to other objectives of water management (flood safety). Support would be given from municipalities (local communities), hydrologists, and planners, possible in the scope of proposed inter-municipal working group. The Fisheries Research Institute of Slovenia can ensure expert support in the process of the implementation. Namely the Institute performs public service activities in the fields of Freshwater fisheries. For each intervention into the watercourse it is necessary to obtain requirements or guidelines of the Institute. Guidelines must be considered in project documentation. The Institute also carries out fish monitoring and holds information on fish species and communities within the area of intervention. These data are the basis for the preparation of the guidelines.
Preconditions for success	Funds need to be available for implementing the option. There is a clear need for an analysis which barriers need reconstruction or are no longer needed and can be removed (as part of restoration option). Need to combine this measure with other measures aiming at reducing floods.
Concrete examples where applied	Not available.

WMO 19: Improving the system of payment for water used for irrigation

Short explanation	This option aims to improve the system of payment for water used for irrigation. Water availability would be reflected in the payments that need to be made to allow water being used for irrigation purposes. Two options are proposed: 1. To lower the limit of yearly consumption (from 5.000 m3 to 2.500 m3) when farmers do not need to pay for actual water use by changing the provisions of the *Decree on the water fee* [110]. 2. To increase the level of water reimbursement fee for the use of water for irrigation of agricultural land to the value specified for the irrigation of non-agricultural land (in year 2013 that was 0.0015 €/m3 for agricultural land compared to non-agricultural land 0.0919 €/m3) by changing the provisions of the *Decision determining the amount of water charge basis for the use of water, alluvial deposits and water areas* [111].
Addressed challenges	Water availability during droughts (A), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Local population, Agriculture, Water management.
Benefits	By reflecting water availability in pricing, this measure would result in reducing water consumption (from water reservoirs Vogršček, groundwater, surface water), and can also result in providing incentives for more efficient water use, all potentially resulting in reducing impact on aquatic ecosystems (more sufficient quantities of water mean better water quality and ecological status).
Potential negative impacts	Potential conflicts with users of water for irrigation (farmers, inhabitants).
Timeline of implementation	Short-term (under 2 years' time).
Feasibility	Minor barriers – low acceptance of agricultural sector.
Robustness	Yes.
Flexibility	No, as the measure will only have an impact if implemented entirely.

Costs/Actions	The total discounted cost toward year 2030: 83,895 euros (EUR 2018, discount rate: 5%).
	There are two possible ways to improve system of payment for water used for irrigation. Both options need to be further analysed if feasible:
	• Overall analysis of both proposed options, their effectiveness, and on farmers willigness to pay more for irrigation – 6 person month in year 1;
	• To lower the limit of yearly consumption (from 5.000 m3 to 2.500 m3) when farmers do not need to pay for actual water use.
	  ○ Amendments of Decree on the water fee (http://www.pisrs.si/Pis.web/pregledPredpisa?id=URED2657). Here it is important to know, if any analysis is needed to determine boundaries of yearly consumption showing also result of such an action! – 7 person month in year 2;
	• To increase the level of water reimbursement fee for the use of water for irrigation of agricultural land to the value specified for the irrigation of non-agricultural land (in year 2013 that was 0.0015 €/m3 for agricultural land compared to non-agricultural land 0.0919 €/m3).
	  ○ Amendments of Decision determining the amount of water charge basis for the use of water, alluvial deposits and water areas [111] – 4 person month in year 2.

Synergies and conflicts with policy objectives	No known conflicts. Synergies with River Basin Management Plan [29], within measure –" The provision of compensation of environmental costs and the cost of water as a natural resource" (label 3ED).

Acceptance	Low acceptance by farmers as they do not believe this will not solve the problems with water quality and quantity. High acceptance by water sector and environmental sector.
Suggested stakeholder involvement	Ministry of Agriculture, Forestry and Food with supporting services of Chamber of Agriculture and Forestry of Slovenia (CAFS) (Regional units), an initiative must come from Ministry of the Environment and Spatial Planning and its supportive bodies Slovenian Water Agency and Slovenian Environmental Agency.
Preconditions for success	Strong political support/back-up would be needed. Review of good practices of the system of payment for water used for irrigation around the world. Also analysis to definite exact figure on (1) changing the limit of yearly consumption (from 5.000 m^3 to 2.500 m^3) when farmers do not need to pay for actual water use with assessed impacts of the option and (2) increasing the level of water reimbursement fee for the use of water for irrigation of agricultural land (in year 2013 that was 0.0015 €/m^3 for agricultural land compared to non-agricultural land 0.0919 €/m^3). Within the payments for the usage of irrigation systems the costs of operation and maintenance in addition to water reimbursement fee should be taken into consideration. An appropriate professional manager (operator) of irrigation systems needs to be assigned (determined).
Concrete examples where applied	Not available.

WMO 20: Preservation of existing and introduction of new shelterbelts

Short explanation	This option aims to protect the land against the effects of wind. Shelterbelts would reduce velocity of the strong winds (Bora), and would reduce damage in agriculture caused by this strong bora wind and also would be in function of reducing evaporation and the impact of summer winds on soils (drying, loss of water in soil). Also this vegetation belts represent a habitat for animal species that feed on insects (biodiversity, pest management) - lower consumption of plant protection products and related water pollution (sustainable agriculture). It is important to use native trees species - probably deciduous trees.
Addressed challenges	Water availability during droughts (A), Appropriate water quality (C)
Target locations and water uses	Location: Upper part of the river basin. Water uses: Agriculture.
Benefits	Reducing wind damages, reducing evaporation and impact of summer winds on soil. Increasing habitat for animal species – can result in lower consumption of plant protection products and related water pollution (sustainable agriculture). Option can help create a rich cultural landscape that is a good basis for development of sustainable tourism.
Potential negative impacts	None.
Timeline of implementation	Short- (under 2 years' time) to mid-term (2 to 6 years' time) – Shelterbelts can fully function only when trees grow to a certain height.
Feasibility	Minor barriers due to low awareness of farmers, also not available funds for implementation and operation of the option. The land where shelterbelts are planned was already reserved within Republican Green Plan and excluded at the time of land readjustment and is treated as common good (slo: "javno dobro").
Robustness	Yes.
Flexibility	Yes.
Costs/Actions	The total discounted cost toward year 2030: 1,018,971 euros (EUR 2018, discount rate: 5%). Potential locations and length of shelterbelts in upper part of Vipava river basin (last information from March 2015): • Ajdovsko polje: 6,500 meters, • Lokavec: 8,850 meters, • Log-Zemono: 14,506 meters, • Vipavski Križ: 10,370 meters. Steps for successful implementation of shelterbelts: • Preparation of implementing regulation or amending existing Forest Act of its implementing regulations, with the objective to regulate the system of financing for the implementation and maintenance of shelterbelts – 4 person month in year 1; • Already mentioned new implementation regulation or amendments of the existing ones, proper control of shelterbelts must be ensured – 12 person month from year 2 on; • Implementation of shelterbelts (all together 40,226 meters) - 11.70 Eur/m; • Maintenance - 3.70 Eur/m (cost in 4 years).

Synergies and conflicts with policy objectives	No known conflicts. Synergies: • Habitat and Bird Directive [38, 39] – within Natura 2000 Management Programme for Slovenia for the period 2015-2020 [70], Vipava Valley (SI3000226) is proposed for restoration. • Water Framework Directive [21] – Article 4: Member States shall protect, enhance and restore all surface water bodies, for artificial and heavily modified water bodies with the aim of achieving good ecologic status/potential. • Common Agricultural Policy (CAP) – RDP 2014 – 2020. *Possible funding through CAP/European Agricultural Fund for Rural Development (EAFRD) within Art. 18 ("restoring agricultural production potential damaged by natural disasters and catastrophic events and introduction of appropriate prevention actions"), and Art. 17 (investments in non-productive physical assets, such as achieving biodiversity conservation status of species and habitat as well as enhancing the public amenity value of a Natura 2000 area or other high nature value systems). Also through The INTERREG MED Programme 2014-2020 within priority axis 3 and LIFE (Climate Change Adaptation)..*
Acceptance	High acceptance by environmental sector (Slovenian Forest Service, The Institute of the Republic of Slovenia for Nature Conservation).
Suggested stakeholder involvement	Ministry of Agriculture, Forestry and Food together with Municipalities and Ministry advisory service Chamber of Agriculture and Forestry of Slovenia (CAFS) (Regional units) and Farmland and Forest Fund of the Republic of Slovenia. Implementation and maintenance with the help of the experts – ZGS – Slovenian Forest Service. Farmers, local inhabitants.
Preconditions for success	It is essential to determine the operator of shelterbelts and to make funds available for implementation and later on for operation of the option. It is essential to raise awareness among local inhabitants (WMO 4) and farmers (WMO 3) of the positive effects of shelterbelts and involve them actively in their implementation.
Concrete examples where applied	In the frame of Republic Green plan (1970-1980), shelterbelts (wind barriers) were planted to minimize the impact of bora wind on agriculture. Most of them were illegally removed by farmers (lack of awareness), only few were left till today (Lokavec).

WMO 21: Removal of invasive non-native species

Short explanation	Non-native plant and animal species have a direct impact on the biodiversity of aquatic environment, changing and threating the natural balance of aquatic ecosystems (their functional and structural features). With changing the composition of riparian and aquatic habitats, they degrade ecosystems and so have indirect impact on water quality. Introduction of fish in aquatic systems can affect trophic relationships and set off "trophic cascades" with resulting declines in native species and degradation of water quality [114] (e.g. Common Carp (Cyprinus carpio) feeds by searching through underwater vegetation. This feeding habit uproots plants which muddies the water. This makes it hard for other fish to see and destroys the food and cover for other fish. Also they compete with native species or are their predators, can be vectors of disease to native species). This can be also the case of plant species (e.g. Japanese knotweed threatens native plants and animals by forming dense thickets, blocking routes used by wildlife to disperse). More exactly there are problems with non-native fish species that were introduced by fishermen (fish farming) - for Vipava river it means a biological pressure - 9 non-native fish species were recorded in the project Analysis of biological pressures With measure identification, data collection and removal of invasive non-native species is planned. This measure would be addition to measure of restoration of watercourses in river basin to maintain a favorable status of protected and endangered plant and animal species.
Addressed challenges	Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Water management, Nature conservation, Fishery
Benefits	Obtaining data on all invasive non-native species. Reducing number of invasive non-native species and biological pressures.
Potential negative impacts	None.
Timeline of implementation	Short- (under 2 years' time) to long-term (> 6 years' time) till year 2030.
Feasibility	Minor barriers – low acceptance with fishery (posing restrictions with fish introduction), understaffing and limited financial capacities of institutions that should implement this option. Limited success of removal of invasive fish species.
Robustness	Yes.
Flexibility	No - The measure will only have an impact if implemented entirely. Otherwise, the species might come back. (Note: Depending on species – which species, their prevalence, etc.)
Costs/Actions	The total discounted cost toward year 2030: 175,921 euros (EUR 2018, discount rate: 5%). Not enough data on the species, number and prevalence is available (available only for fish species in Vipava river). Hence next steps are needed to implement this WMO: • Identification and data collection of invasive non-native species in Vipava river basin – 2 person month, year 1. 4. 7. 10, 13; • Determination for which species, the area and the method of removal and disposal is possible – 1 person month, year 1. 4. 7. 10, 13; • Preparing work program of removal of invasive non-native species – 0.5 person month, year 1. 4. 7. 10, 13; • Choosing the location of the disposal of invasive non-native species – 0.5 person month, year 1. 4. 7. 10, 13; • Preparing and execution of monitoring programme – 1 person month, year 1. 4. 7. 10, 13; • Execution of removal of non-native species (priority: Vipava river; duration of the removal approx. 5 years) – 2 person month, year 1. 4. 7. 10, 13.

Synergies and conflicts with policy objectives	No known conflicts. Still Slovenian legislation does not use the terminology/definition of invasive non-native species [113]. A legal void is also in the protocol of removing invasive non-native plant or animal species that threaten native species, since implementing regulations envisaged by the Nature Conservation Act has not yet been adopted. Synergies: • Water Framework Directive [21] - Establishing monitoring systems for the purpose of estimating the values of the biological quality elements specified for each surface water category or for heavily modified and artificial bodies of surface water. In applying the procedure set out below to heavily modified or artificial water bodies, references to ecological status should be construed as references to ecological potential. Such systems may utilise particular species or groups of species which are representative of the quality element as a whole. • River Basin Management Plan - within measures "Direct removal of invasive non-native species" (label DUPPS3), "Systematic data collection and processing of invasive non-native species" (label DDU9), "Preventing the spread of invasive non-native species" (label DDU33) and "Amendments of legislation in the field of non-native species" (label DDU34). • Habitats Directive [39] –promoting measures that help establish natural watercourse biocoenosis. • Natura 2000 Management programme for Slovenia [70] - without exotic species of turtles, the stock of native fish that does not threaten amphibians, excluding non-native species in streams, without the propagation of non-native species (crayfish), excluding non-native species in the ponds, biocoenosisof natural watercourse, without the propagation of non-native species of catfish over a dam in Prvačina. • Nature Conservation Act [34] - Terminology/definition for non-native species can be adopted/used from receptive Europe-wide lists. • EU Biodiversity Strategy to 2020 [114] - Protecting species and their habitats, help us combat climate change and adapt to its impacts and contribute to meeting the goals of the EU's resource-efficient Europe initiative. One of 6 priority targets that aim to combat invasive alien species. • Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species [115]- Sets out rules to prevent, minimise and mitigate the adverse impact on biodiversity of the introduction and spread within the Union, both intentional and unintentional, of invasive alien species. • Programme for the Management of Fish in Inland Waters of the Republic of Slovenia [76]: The program for the management of fish in inland waters 2010-2021 has already proposed that in Vipava river population of *Silurus glanis* needs to be reduced by classifying it as an invasive species. *Possible funding through The INTERREG MED Programme 2014-2020 within priority axis 3 and LIFE Nature & Biodiversity (sub-programme for Environment) - Within the LIFE Nature and Biodiversity strand, specific funding is targeted at Biodiversity, a LIFE project category for innovative or demonstration projects that tackle wider biodiversity issues. These can range from the creation of green infrastructure, such as species corridors, to climate change adaptation measures and the removal of invasive species.*
Acceptance	Highly acceptable by environmental sector. Low acceptable by fishermen.
Suggested stakeholder involvement	Ministry of the Environment and Spatial Planning with the support of Slovenian Water Agency, Slovenian Environmental Agency and The Institute of the Republic of Slovenia for Nature Conservation could with the implementation of the option achieve objectives defined in national and EU legislation and obtain information in-situ. This institutions need to cooperate with the Ministry of Agriculture, Forestry and Food and their supporting bodies (Fisheries department - fish species), Agricultural Institute of Slovenia (KIS, for plant species)) by raising awareness among farmers and owners of fish farms. Some of them could help organize the removal. On third workshop local Biotechnical School is already involved in raising awareness and educating high school students. They would need support in a form of materials for awareness campaign for different publics (kindergarten, primary school…). They are willing also to actively participate in the implementation of the option.

Preconditions for success	Knowing the ecology of all species so that removal is successful, still it is known that removal of these species (especially fish) has limited success [116]. Raising awareness among local people, also including them in the removal of invasive species. Local Slovenian Environmental Agency and The Institute of the Republic of Slovenia for Nature Conservation need to be more involved. Slovenia should adopt National action plan according to Regulation (EU) No 1143/2014 [115].
Concrete examples where applied	LIFE project – removing Japanese knotweed on Ljubljansko barje [117]

WMO 22: Construction of municipal wastewater treatment plants and sewage systems

Short explanation	Problem of small and dispersed settlements and insufficient sewage systems and municipal wastewater treatment causing pollution (organic, pollution with nutrients and pathogens) of surface and ground water. All municipal wastewater treatment plants (WWTP), also can be implemented as biological WWTP, constructed wetlands for wastewater treatment, etc., depending on the analysis of most suitable treatment technology. Construction of small wastewater treatment plants Lozice, Črnice and other small WWTP in dispersed settlements. Also additional treatment of municipal wastewaters in the areas of bathing waters (in the case of the establishment of eco-bathing).
Addressed challenges	Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Local population, Water management.
Benefits	Reducing burdening waters with pollutants (organic, nutrients, pathogens) and so would result in better water quality (achieving objectives of WFD). Also result in good quality for bathing waters.
Potential negative impacts	None.
Timeline of implementation	Short-term (under 2 years' time).
Feasibility	Minor barriers – lack of funds available for the implementation. Municipalities have problems with limited financial capacities (there are EU funds available but VAT is not eligible cost). They have also problems with acquisition of easements.
Robustness	No - often, WWTP are planned for a certain throughput. If, due to water scarcity in the future, this is not given, the WWTP might not be effective.
Flexibility	No.

Costs/Actions	The total discounted cost toward year 2030: 55,461,147 euros (EUR 2018, discount rate: 5%) comprises the costs of the preparation of the project documentation and implementation with maintenance costs of sewage system for about 26,000 person equivalent and wastewater treatment plants for about 26,300 person equivalent.
	The overall results have been prepared on the basis of the number of PE in each agglomeration:
	• Agglomerations under 2,000 PE (no. of person equivalent):
	  ○ 21,225.44 PE is without existing public sewage system – cost of implementation of sewage system for agglomerations under 2,000 PE is 1,500 €/PE;
	  ○ 21,137.05 PE is without existing (municipal) WWTP - cost of implementation of WWTP for agglomerations under 2,000 PE is 800.00 €/PE;
	  ○ Project documentation (8% of implementation costs);
	  ○ Maintenance (2 % of implementation costs).
	• Agglomerations above 2,000 PE (no. of person equivalent):
	  ○ 4,767.36 PE is without existing public sewage system – cost of implementation of sewage system for agglomerations above 2,000 PE is 1,000 €/PE;
	  ○ 5,207.80 PE is without existing (municipal) WWTP - cost of implementation of WWTP for agglomerations above 2,000 PE is 500 €/PE;
	• Project documentation (8% of implementation costs);
	• Maintenance (2 % of implementation costs).

Synergies and conflicts with policy objectives	No known conflicts. Synergies: • Council Directive 91/271/EEC [47]- Determination of priority areas for the construction of sewerage systems and municipal wastewater treatment plants. • National legislation regulating water quality (Waters Act [59] and its statutory instruments) and wastewater treatment (Operational programme for the discharge and treatment of urban waste water [69], etc.). - Determination of priority areas for the construction of sewerage systems and municipal wastewater treatment plants. *Possible funding through European Regional Development Fund (ERDF)(within TO 6 (protecting the environment and promoting resource efficiency): organic pollution (UWWTP, industrial point sources), nutrient pollution (UWWTP, industrial point sources), hazardous substances pollution (UWWTP industrial point sources), hydromorphological alterations (reconnection of wetlands/floodplains)) and Cohesion Fund (CF) (Investment in the water and waste sectors, and the urban environment: organic pollution (UWWTP, industrial point sources), nutrient pollution (UWWTP, industrial point sources, urban run-off), hazardous substances pollution (UWWTP, industrial point sources, urban run-off).*
Acceptance	High acceptance by local population, water sector.
Suggested stakeholder involvement	Municipalities (and local communities) and Operators of public service of collection and treatment of wastewater are already involved in accordance with their financial capacity. Planning process in cooperation with Ministry of the Environment and Spatial Planning and its bodies (SEA and EIA processes). Individuals (where public sewage system is not planned). Ministry has also the role of setting priorities for agglomerations that urgently need sewage system and WWTP (in phase of preparation of new Operational programme).
Preconditions for success	Funds available for implementing the option need to assured. Explore the options of convincing people to replace inappropriate septic tanks (slo: “nepretočnih”) with suitable WWTP. To raise awareness among inhabitants to replace inappropriate septic tanks (slo: “nepretočnih”) with suitable WWTP.
Concrete examples where applied	WWTP Vipava (central WWTP - trial operation). Still in construction WWTP Vrtojba.

WMO 23: The cultivation of crops that are resistant to climate changes (drought, pests and diseases)

Short explanation	To cultivate crops resistant to droughts, pests and diseases. Problem of agriculture is that it is not adapted to climate changes. This measure can reduce water use (irrigation), water pollution (reducing the use of plant protection products) and increase self-sufficiency in food.
Addressed challenges	Water availability during droughts (A), Appropriate water quality (C)
Target locations and water uses	Location: River as a whole. Water uses: Agriculture.
Benefits	Increase self-sufficiency in food. Decrease of negative impact of droughts on agriculture. Reducing impact of unsustainable agricultural practices on water quality. Using old varieties of crops, also new ones, but not using genetically modified organisms.
Potential negative impacts	Possible decrease in profitability of crop production.
Timeline of implementation	Mid-term (2 to 6 years' time) as suggested by stakeholders on third workshop to long-term (>6 years' time).
Feasibility	No major barriers – some farmers and their advisors believe that better solution for them is crop production that uses water for irrigation (comments from stakeholders on second workshop).
Robustness	Yes.
Flexibility	Yes.

Costs/Actions	The total discounted cost toward year 2030: 452,957 euros (EUR 2018, discount rate: 5%).
	Review and analysis of existing data, studies, projects on the best selection of crop type regarding water requirements, growth phases (when and how long) and soil type - 6 person months;
	• Formation of an experimental center (test area - can be an active or abandoned agricultural land, part of a farm, where the municipality, agricultural cooperative or an individual farmer is owner and is willing to sell/rent the farm for experimental cultivation of these crops and to put theory into practice.
	  ○ Purchase of the farm, and purchase of agricultural land of about 20 ha (some of existing equipment and basic infrastructure – e.g. tractor within the farm, warehouse);
	  ▪ Some expert assume 200,000 to 300,000 € cost for buying a farm; we used 250,000.00 €;
	  ▪ For buying an agricultural land we used data where 1 ha is estimated at 24,000 €77
	  ○ Preparation of project documentation (8%) – new equipment – one greenhouse (10x63 meter)78, cold storage (cost is part of the warehouse) and warehouse (around 1,000 m2);
	  ○ Implementation;
	  ○ Maintenance (2%) of implementation works plus running costs:
	  ▪ 24 person month from year 3 on,
	  ▪ 6 person month from year 3 on.
	• Replacement of maize with sorghum crops from year 8 on (80 ha/year). In year 12 area of 400 ha will be replaced with sorghum.

Synergies and conflicts with policy objectives	No known conflicts. The use of genetically modified organism (GMO) is not planned. Also there is a National Restriction or Prohibition of the Cultivation of Genetically Modified Plants Act (Official gazette, no. 69/15) [118] in place that prohibits the use of GMO. Synergies:

	• National Adaptation strategy for forestry and agriculture (2008) [94] and its implementation document (Action plan from 2011) [95] - Pillar I: Building capacity to handle the adaptation of agriculture and forestry. Measures that are already in place and are planned in future: 5. The functioning of experimental-demonstration centres for crop and livestock production that are already in place and where research work is carried out with the aim of searching and introducing new technologies production, creating new varieties of crops and production monitoring in various conditions. • and with policies aiming at water resource conservation (Water Framework Directive [21] – River Basin Management Plan [29]). • Natura 2000 Management programme for Slovenia [70] – similarity with the measure of extensive meadows. • Flood Risk Management Plan [73] – some similarity with measure –"Aadaptation of land use" (label U3). *Possible funding through CAP/European Agricultural Fund for Rural Development (EAFRD) within Axis 2: improving the environment and the countryside and Rural development plan (2014-2020) within sub measure M1.2 - support for demonstration activities and information activities. Also through The INTERREG MED Programme 2014-2020 within priority axis 3 and Horizon 2020 within Societal challenges (9. Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bio economy/ 12. Climate action, environment, resource efficiency and raw materials / 13. Europe in a changing world – inclusive, innovative and reflective Societies).*
Acceptance	Low acceptance by farmers due to lower profitability.
Suggested stakeholder involvement	With the support of the Ministry of Agriculture, Forestry and Food together with their professional services (Chamber of Agriculture and Forestry of Slovenia (CAFS) (Regional units)) and in close cooperation with local farmers and agricultural cooperative, researchers from agro-meteorological field (ARSO, UNI BF and KIS) could be the leading partners in the implementation of the option.
Preconditions for success	Raising awareness of farmers regarding the benefits of cultivating drought resistant agricultural crops. Farmers would likely need some compensation for loss of income, hence funds available for implementing the option need to be assured (not just for compensation but also for implementation of the option itself). This option should be implemented in combination with agro-environmental and technological measures. Cross compliance must be assured. One of the preconditions that stakeholders pointed out at third workshop is the availability of such crops for cultivation. Nevertheless important for this measure is also to make market analysis - verify the interest of the market for such crops and farmers interest in growing new crops…here it would be preferable also to check the interest of private sector to commit on marketing such crops in their supply chains (to make clear commitments).
Concrete examples where applied	Agricultural Experimental Centre Jable [119] and Gene bank of Crops [120].

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Annex I: List of engagement activities held in Vipava River Basin

Engagement activity	Objective	Target group	Dates
First stakeholder workshop	Identification of challenges regarding water management in the Vipava river basin, drawing an outline for future WMOs in the Vipava river basin.	A wide group of local, regional and national stakeholders.	6th June 2014
Stakeholder interviews	Collection of information from policy-makers on the current situation of adaptation to climate changes on national and river basin level, their experience with public participation in the design of policies and potential conflicts that may appear. Discussion on current water use problems and desired state for the Vipava river basin.	Policy-makers and other relevant stakeholders not able to attend the first workshop in June.	September – November 2014
Stakeholder consultations (I)	Validation and harmonization of FCM as a result of the first stakeholder workshop and stakeholder interviews.	A group of local, regional and national stakeholders actively engaged in the BeWater project.	February 2015
Second stakeholder workshop	Evaluation of WMOs as a result of the first stakeholder workshop.	A group of local, regional and national stakeholders actively engaged in the BeWater project.	27th May 2015
Expert/stakeholder consultations	Supplementation of information on implementation steps and costs of WMOs.	Selected experts and stakeholder actively engaged in the BeWater project from national instutites, agencies, university and companies.	August – October 2015
Stakeholder consultations (II)	Presentation and discussion of final list of WMOs.	A wide group of local, regional and national stakeholders.	12th October 2015
Third stakeholder workshop	Validation of draft adaptation plan for the Vipava river basin.	To be decided.	23rd March 2016
Fourth stakeholder worshop	Presentation of adaptation plan for the Vipava river basin.	A group of national stakeholders. / To be decided.	February 2017

Annex II: List of dissemination activities held in Vipava River Basin

Parallel to the stakeholder engagement, other dissemination activities are taking place in the Vipava river basin with the aim to forward results of the BeWater project, to expand the list of stakeholders, to raise social awareness and to encourage capacity building, empowerment and social formation in water management challenges and adaptation.

Dissemination activity	Content	Target group	Dates
GEP/BeWater meeting	Presentation of results of GEP Project, focusing on hydrogeological and spatial surveys on the Slovenian border area.	GEP and BeWater project team.	26th September 2014
Awareness Campaign	A mobile exhibition comprising of seven roll-up posters on display at key venues in critical communities throughout the Vipava river basin and in Ljubljana.	Venues: Development Agency ROD in Ajdoščina, Ministry of Agriculture, Forestry and Food (in cooperation with Ministry of the Environment and Spatial Planning) in Ljubljana, Municipalities Ajdovščina, Vipava, Miren-Kostanjevica and Šempeter-Vrtojba,Nova Gorica, Renče-Vogrsko, Central public library called "Lavričeva knjižnica Ajdovščina" in Ajdovščina and Vipava, Lanthieri mansion in Vipava.	27th November 2014 - ongoing
Event called „Water days of Primorska"	Presentation of BeWater project on 12th February in the session on ongoing projects and plans for the region.	A wide group of local, regional and national stakeholders.	11th – 12th February 2015
Awareness Campaign for Highschool Students	Presentation of BeWater project and organization of field trip to the Vipava river basin.	Students of Biotechnical Secondary School Nova Gorica.	15th April 2015
International workshop in the frame of 7FP Cropsustain	Presention of the objectives and results of BeWater Project, especially the participatory approach.	A wide group of international experts in the field of agriculture and environment.	24th November 2015

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