

B.4.1. Cross-border flood response strategy report

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Acronyms, Abbreviations and Definitions

Acronyms	Definitions
CBC	Cross Border Cooperation
EWS	Early Warning System
FVI	Flood Vulnerability Index
GIS	Geographic Information Systems
GR	Greece
IPA	Instrument for Pre-Accession Assistance
IPCC	International Panel of Climate Change
RNM	Republic of North Macedonia
JFRM	Joint Flood Risk Management

1 Introduction

1.1 General Project Information

Project title: Joint flood risk governance and management in the Axios/Vardar cross border area

Acronym: FLOODSHIELD

Timetable: 21/07/2022 to 15/12/2023

Project budget: 1.474.450,00€

Corporate Structure:

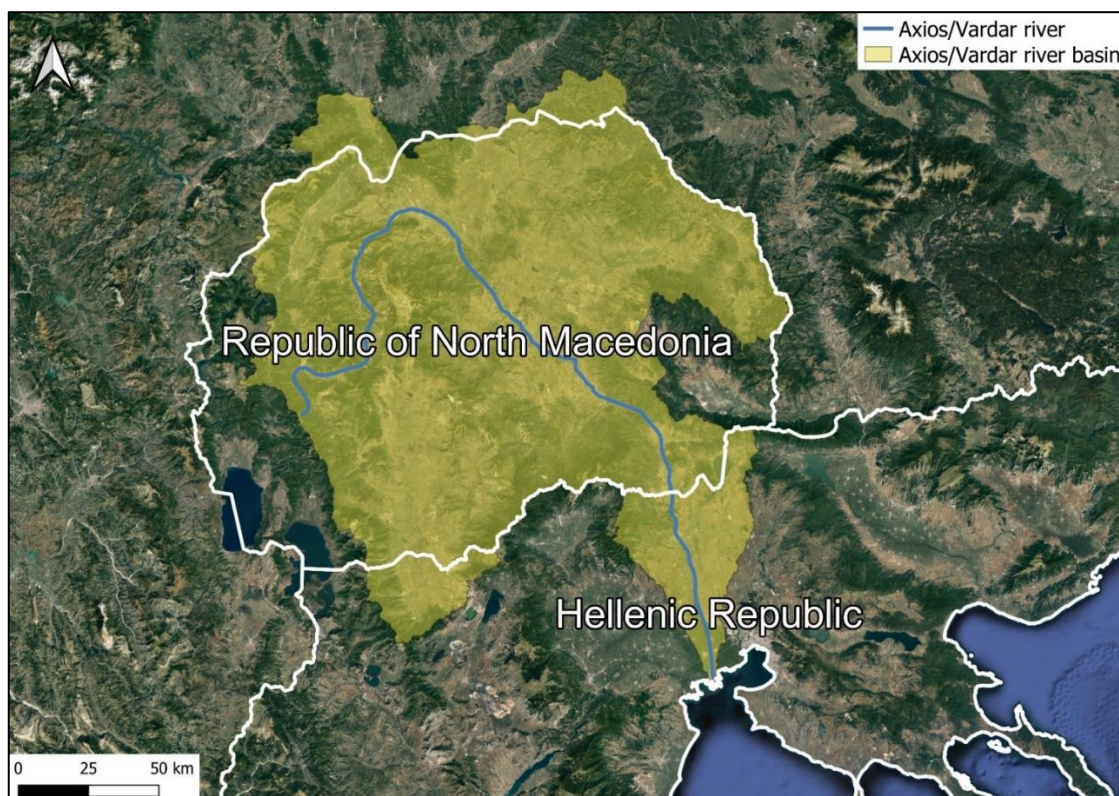
Decentralized Administration of Macedonia and Thrace – GR (Lead Partner)

General Secretariat of Natural Environment and Water – GR

Ministry of Environment and Physical Planning – RNM

Protection and Rescue Directorate – RNM

The project is implemented under the programme INTERREG IPA CBC "Greece – Republic of North Macedonia 2014 – 2020" in the Priority Axis 2 "Protection of Environment – Transportation", in the Thematic Priority c: Promoting sustainable transport and improving public infrastructure and the specific objective 2.4: "Prevention, mitigation and management of natural disasters, risks and hazards".



Picture 1: Map of the catchment area of the cross-border river Axios/Vardar.

1.2 Subject of the Contractor

According to the contract of 6/04/2023 "provision of consulting services for the technical support of the project "Joint flood risk governance and management in the Axios/Vardar cross border area" and acronym "FLOODSHIELD" (MIS 5062181)", implemented in the framework of "INTERREG Greece - Republic of North Macedonia 2014-2020", between the Decentralized Administration of Macedonia and Thrace (D. A.M.T.), Contracting Authority (CA) and the company LEVER - Development Consultants S.A., Contractor is foreseen to implement certain activities as described in the relevant contract and the project contract documents. More specifically, the scope of work to be implemented by the contractor concerns the support of the D.A.M.T. in the implementation of the deliverables of work packages 2, 3, 4 and 5 of the project, ensuring the adherence to the work schedule and the quality of these deliverables. In this context, the Contractor will support DAMT in the following actions (A.1-5.) and deliverables (numbered with two numerical digits A.1.1. - B.5.2.):

A.1. Development, implementation, monitoring and evaluation of the project's Communication Plan

A.1.1.1. Project Communication Plan

A.1.2. Summary reports of the communication actions (2 in total)

A.2. Creation of promotional material and public relations

A.2.1. Two (2) newsletters

A.2.2. Press release

A.2.3. Report on the implementation of the press conference

A.2.4. Project brochure (600 copies in total)

A.2.5. Guideline booklet (600 copies in total)

A.2.6. Popularized Report (250 copies in total)

A.3. Development, updating and maintenance of the official project website and social media

A.3.1. Creation of a Website and a Facebook page

A.3.2. Project website and social media update reports (as a sub-chapter of Deliverable A.2.)

A.4. Organization of the final project event in Thessaloniki

A.4.1. Implementation report of the final event and networking lunch

A.5. Organize two (2) seminars on the operation and use of the flood risk monitoring and response system and conduct paper and structural field exercises

A.5.1. Report on the implementation of the seminars (e-learning and in situ) and exercises on paper and field tests

A.6. Awareness and information activities:

A.6.1. Awareness-raising video of a maximum duration of two (2) minutes

A.6.2. Presentation report of the pages to be posted on the official project website

A.6.3. Report on the implementation of informal training and information of the units for disabled persons and elderly persons

A.6.4. Report on the implementation of the Event in Thessaloniki

A.7. Encouragement and promotion of volunteering

A.7.1. Report on the encouragement and promotion of volunteering

B.1. Compilation of a report on the civil protection system in Greece

B.1.1. Report on the identification of the civil protection system in Greece

B.2. Preparation, organization of two (2) meetings and participation in the remaining meetings of the Joint Flood Risk Management Group

B.2.1. Reports of participation in the Joint Flood Risk Management Group Meeting (Four Reports)

B.3. Investigation and mapping of existing monitoring systems in the Axios transboundary basin

B.3.1. Report on the investigation and mapping of existing monitoring systems in the Axios transboundary river basin

B.4. Formulation of the transboundary flood response strategy

B.4.1. Report on the transboundary flood response strategy

B.5. Preparation of a Vulnerability Analysis for the Axios river basin

B.5.1. Draft Vulnerability Analysis Report for the sites located in the Axios river basin

B.5.2. Final Vulnerability analysis report for the sites in the Axios river basin

1.3 Subject of the present report

This report is deliverable B.4.1. Report on the cross-border flood response strategy" of Activity "B.4. This report provides comprehensive information on flood-related policies and institutions at various levels, including the United Nations Organization, European Union, Greece, and North Macedonia. It outlines the present situation, detailing the responsibilities of relevant actors, the role of local institutions in communication and information dissemination during floods, and the availability of means and equipment. The report also delves into flood evacuation plans and safe routes.

A significant portion is dedicated to describing the Floodshield Project, encompassing information actions, the establishment of the Joint Flood Risk Management Group, awareness-raising activities, volunteering promotion, station study and installation, development of a Data Platform and Early Warning System (EWS), and vulnerability analysis.

The report concludes with proposals for a common strategy, suggesting measures such as a Memorandum of Understanding, whose aim is to minimize the cross-border flood risks and disasters by strengthening the cross-border cooperation organizational, technological and social levels, an open line of communication, data exchange, and outlining next steps. This comprehensive overview aims to contribute to effective flood risk management and collaboration among relevant stakeholders.

2 Flood-related policies and institutions

2.1 United Nations Organization

The United Nations (UN) has several policies and institutions related to flood management and disaster risk reduction. Some of these policies are:

1. **Sendai Framework for Disaster Risk Reduction (2015-2030):**

- The Sendai Framework is a global agreement adopted at the Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, in 2015. It outlines the international strategy for disaster risk reduction for the next 15 years. While it doesn't specifically focus on floods, it addresses the broader context of disaster risk reduction, which includes flood-related risks.

2. **United Nations Office for Disaster Risk Reduction (UNDRR):**

- The UNDRR plays a central role in supporting the implementation, follow-up, and review of the Sendai Framework. It works to enhance the understanding of disaster risk, strengthen disaster risk governance, and promote the integration of disaster risk reduction into development processes.

3. **International Strategy for Disaster Reduction (ISDR):**

- The ISDR is a key player in the UN's efforts to reduce disaster risk. It has been instrumental in advancing policies related to floods and other natural disasters.

4. **Water, Sanitation, and Hygiene (WASH) Initiatives:**

- UN agencies such as UNICEF and WHO work on water-related issues, which can include flooding and its impact on water supply and sanitation.

5. **United Nations Development Programme (UNDP):**

- UNDP is involved in various development projects, and its work often includes addressing the impacts of natural disasters, including floods, on sustainable development.

6. **Climate Change Initiatives:**

- Given the interconnectedness of climate change and extreme weather events, the UN Framework Convention on Climate Change (UNFCCC) and related initiatives are also relevant to flood-related policies and adaptation strategies.

7. **Humanitarian Response Coordination:**

- In the event of a flood or any other disaster, the UN Office for the Coordination of Humanitarian Affairs (OCHA) plays a crucial role in coordinating international emergency humanitarian response efforts.

2.2 European Union

The European Union (EU) has policies and institutions in place to address flood-related issues and disaster risk reduction. Some of these policies are:

1. **Floods Directive (2007/60/EC):**

- The Floods Directive is a key piece of EU legislation aimed at establishing a framework for the assessment and management of flood risks. It requires Member States to develop flood risk maps and flood risk management plans, promoting a coordinated approach to flood risk prevention and management.

2. **Civil Protection Mechanism:**

- The EU Civil Protection Mechanism facilitates cooperation among EU Member States in responding to disasters, including floods. It enables the sharing of resources and expertise among participating countries to enhance the overall effectiveness of disaster response.

3. **European Solidarity Corps:**

- The European Solidarity Corps supports volunteering and humanitarian aid initiatives. While not specific to floods, it can share a role in response to disasters and support of communities affected by flooding.

4. **European Regional Development Fund (ERDF) and Cohesion Policy:**

- These financial instruments support regional development projects, and they can include initiatives related to flood risk reduction, infrastructure improvement, and resilience building.

5. **EU Strategy on Adaptation to Climate Change:**

- The EU has a strategy on adaptation to climate change that encompasses various aspects of climate-related risks, including those associated with extreme weather events such as floods.

6. **European Environment Agency (EEA):**

- The EEA provides information and assessments related to environmental issues, including floods. It supports the development of policies and measures aimed at improving environmental sustainability and resilience.

7. **European Commission's Directorate-General for Environment:**

- The Environment Directorate-General is responsible for developing and implementing EU policies related to the environment. It plays a role in the oversight and coordination of initiatives addressing flood risks.

2.3 Hellenic Republic

The General Plan for Emergency Response and Immediate/Rapid Management of the Consequences of Flood Events (2nd edition) in Greece, with the code name "DARDANOS 2", aims at the immediate and coordinated response of the stakeholders at Central, Regional and Municipality level, for the response to flood emergencies and the effective management of their consequences. Synergy, cooperation and interoperability of the bodies involved at central, regional and municipality level is considered a prerequisite for achieving this objective.

The objectives of the General Plan for Emergency Response and Immediate/Rapid Management of the Consequences of Flood Events are:

- Implementation of preparatory measures and civil protection actions. Such measures and actions contribute to the readiness of human resources and means for dealing with emergencies and the immediate/rapid management of the consequences of flood events.
- Effective response to emergencies, caused by the occurrence of flood events. Immediate management of their consequences include actions, aimed at protecting life, health and property of citizens, as well as the protection of the natural environment, natural resources and infrastructure of the country.

The following main actions are triggered by this plan:

- a) Preparatory actions (Regular Preparedness - Phase 1)
- b) Increased preparedness actions in the face of an imminent risk of flood events (Increased Preparedness - Phase 2)
- c) Emergency response and immediate/rapid management of the consequences of the occurrence of flood events (Immediate Mobilization/Intervention - Phase 3)
- d) Actions for immediate assistance to the affected people and immediate/rapid rehabilitation of the consequences of the disaster (Rehabilitation/Relief - Phase 4)

All the above phases are described in detail in the Civil Protection textbook (<https://civilprotection.gov.gr/sxedia-politikis-prostasias/2i-ekdosi-toy-genikoy-shedioy-antimetopisis-ektakton-anagkon-kai>).

2.4 Republic of North Macedonia

North Macedonia has taken various measures to address flood-related issues and disaster risk reduction. The Crisis Management Centre (CMC) plays a pivotal role in preparing and updating the Integrated Assessment of all risks and hazards. Coordinated decision-making, issuance of guidance, and recommendations for prevention are integral to its functions under Article 45 of the law. The Integrated Assessment integrates assessments from competent entities within the CMS, offering a multi-sector approach to risk evaluation.

Under the Decree, the CMC consolidates risk data into a single database through a multi-hazard assessment process. It coordinates with institutions for vulnerability and exposure analysis related to floods and droughts. The Regulation on Methodology for Preparation of Integrated Assessment, adopted in January 2011, provides a detailed framework for vulnerability and exposure analysis.

The Protection and Rescue Directorate (PRD) assesses natural disasters, proposes protective measures, and develops National Protection and Rescue Plans. The PRD collaborates with the Hydro-Meteorological Service (HMS) for information, maintaining an inventory of risks and hazards.

The HMS operates an observation network, providing meteorological and climatological services. It actively participates in Disaster Risk Reduction (DRR) by supplying data, forecasts, and technical support. Local self-government units establish commissions for disaster damage assessment, submitting reports to the Government Committee.

There are overlaps and lack of coordination between the CMC and DPR in floods risk assessment. The National Protection and Rescue Strategy (NPRS) prioritizes compatibility, regional information sharing, and the establishment of an IT center. However, specific action plans and indicators for monitoring are lacking.

Improving operational linkages and defining specific roles within the Crisis Management System are essential for effective inter-sector cooperation and collaboration.

3 Present situation

3.1 Responsibilities of the relevant actors as regards their coordination during a flood event

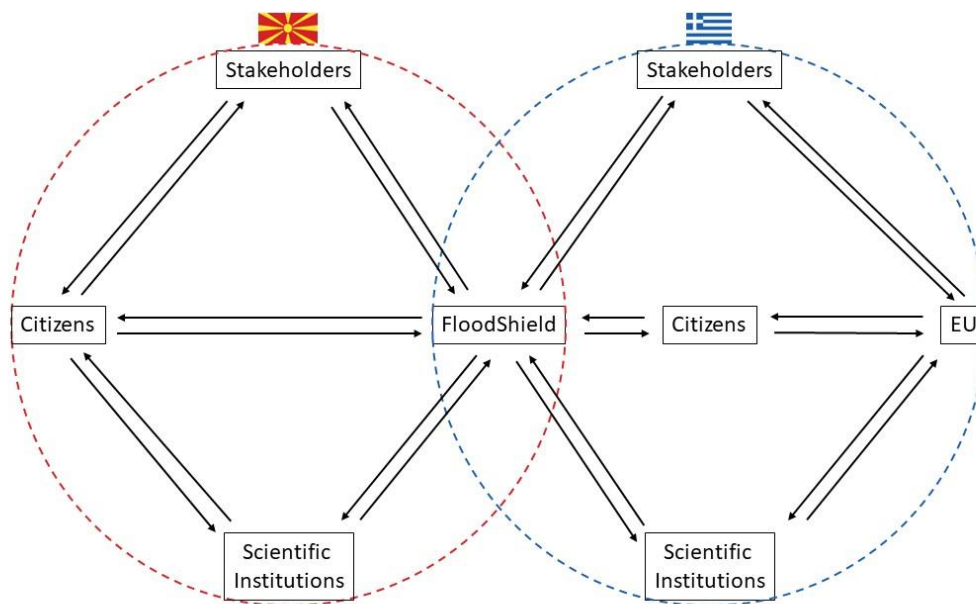
During a flood, coordination among relevant actors is crucial to ensure an effective and efficient response. Various entities, both governmental and non-governmental, play specific roles in managing different aspects of the flood response. The responsibilities of key actors involved in coordination during a flood include:

- **Government Authorities:**
 - National Disaster Management Agency/Authority: Responsible for overall coordination of disaster response efforts at the national level.
 - Local Government Authorities: Coordinate response activities within their jurisdictions, including evacuation plans, emergency shelters, and local resource allocation.
- **Meteorological and Hydrological Agencies:**
 - Meteorological Agencies: Provide timely and accurate weather forecasts to predict rainfall patterns and potential flood events.
 - Hydrological Agencies: Monitor river levels, assess water flow, and provide data for flood modeling.
- **Emergency Services and First Responders:**
 - Fire Departments, Police, and Emergency Medical Services: Mobilize personnel and resources for immediate response, including rescue operations and medical assistance.
 - Search and Rescue Teams: Conduct search and rescue operations to save lives and aid affected populations.
- **Civil Protection and Crisis Management Authorities:**
 - Civil Protection Agencies: Oversee the coordination of emergency response efforts, including communication, evacuation plans, and resource mobilization.
 - Crisis Management Centers: Act as command centers for coordinating response activities, providing situational awareness, and facilitating communication.
- **Health Authorities:**
 - Public Health Agencies: Address health-related concerns, including disease prevention, medical support, and management of public health risks in the aftermath of a flood.
- **Infrastructure and Public Works Agencies:**
 - Transportation Authorities: Coordinate road closures, manage transportation routes, and ensure the safety of critical infrastructure.
 - Utility Companies: Manage and restore essential services such as electricity, water supply, and telecommunications.
- **Community-Based Organizations (CBOs) and NGOs:**

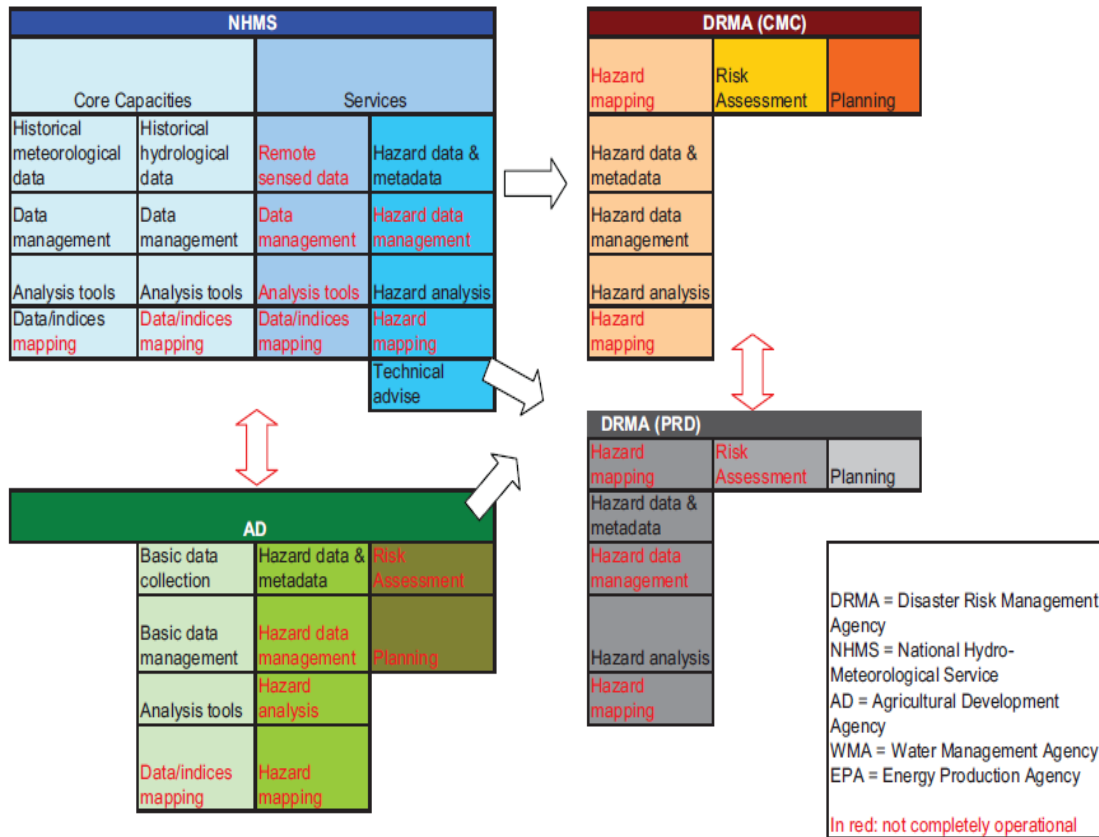
- Local NGOs and Volunteer Organizations: Mobilize community support, aid in evacuation, and offer aid to vulnerable populations.
- International NGOs: Assist in resource mobilization, emergency relief, and long-term recovery efforts.
- Communication and Media:
 - Public Information Officers: Disseminate accurate and timely information to the public, including evacuation orders, emergency contact numbers, and safety instructions.
 - Media Outlets: Provide updates on the flood situation, share official announcements, and raise public awareness.
- Military and Defense Forces:
 - National Defense Forces: May be called upon to provide logistical support, manpower, and resources for large-scale disaster response efforts.
- International Organizations and Donor Agencies:
 - UN Agencies, Red Cross, and Other International Organizations: Contribute expertise, resources, and funding to support national and local response efforts.

Effective coordination involves clear communication channels, regular updates, and collaboration among these various actors. It is essential to have pre-established coordination mechanisms, contingency plans, and a unified command structure to respond swiftly and comprehensively during a flood event.

A typical example of actor linkage is shown in the picture below.



Picture 2: Actor Linkage example between both Partners.



Picture 3: Actor Linkage example (North Macedonia).

However, the best way to confront an incident is to avoid it. On this regard, a step beyond to the prevention and preparedness for floods crucial is the role of both Ministries participating at FLOOD SHIELD project, through:

- the provision of relevant plans including flood risk management plans and in general data with regards to the quantity and quality of waters, dams and other information considered appropriate.
- The planning and formulation of the policy for the protection and management of water resources
- The Implementation of the 2007/60/EC Directive for the assessment and management of flood risks and of the 2000/60/EC Directive for the establishment of a framework for Community action in the field of water policy or equivalent.
- The coordination of national, regional, local authorities and water related agencies.

3.2 Availability and accessibility of means and equipment.

Flood events necessitate a range of specialized means and equipment to respond effectively, mitigate risks, and ensure the safety of communities. The following outlines key tools and resources commonly employed during flood-related situations:

- **Evacuation Vehicles:**
 - Boats, amphibious vehicles, and high-water rescue trucks for transporting people in flooded areas.
 - Helicopters for aerial rescues and evacuations from isolated or hard-to-reach locations.
- **Flood Barriers and Sandbags:**
 - Portable flood barriers to redirect or contain floodwaters.
 - Sandbags used for constructing temporary barriers around critical infrastructure and homes.
- **Emergency Shelters:**
 - Temporary shelters equipped with basic amenities for displaced individuals and families.
 - Mobile shelter units that can be rapidly deployed to affected areas.
- **Water Rescue Equipment:**
 - Lifeboats, life jackets, and rescue buoys for water rescue operations.
 - Rope systems, harnesses, and swift water rescue gear for specialized water rescues.
- **Communication Tools:**
 - Two-way radios, satellite phones, and communication networks to facilitate coordination among emergency responders.
 - Portable communication equipment for residents to stay connected during evacuations.
- **Emergency Medical Supplies:**
 - First aid kits, medical tents, and mobile clinics for providing immediate healthcare in flood-affected areas.
 - Emergency medical transport vehicles equipped to navigate flooded terrain.
- **Drones and Aerial Surveillance:**
 - Drones for aerial assessment, mapping, and surveillance of flooded regions.
 - Satellite imagery to monitor the extent of flooding and assess damage.
- **Decontamination Equipment:**
 - Equipment for cleaning and decontaminating flooded areas to mitigate health risks.
 - Hazardous material response units for addressing chemical spills during floods.
- **Power Generation and Lighting:**
 - Mobile generators to provide electricity in areas affected by power outages.
 - Portable lighting systems for nighttime rescue and relief operations.
- **Community Education Resources:**

- Educational materials, brochures, and public service announcements to raise awareness about flood preparedness.
- Training programs for community members on safety measures and evacuation procedures.
- GIS Technology:
 - Geographic Information Systems (GIS) for mapping and analyzing flood-prone areas.
 - Real-time mapping tools for emergency responders to navigate and coordinate efforts.

A well-equipped response to flood events involves a combination of technology, vehicles, communication tools, and resources that cater to the diverse challenges posed by flooding. Coordination and preparedness are key to effectively utilizing these means and equipment in safeguarding lives and minimizing the impact of flood events.

3.3 Flood evacuation/evacuation plans and safe routes

Floods present a serious threat to communities, emphasizing the need for organized evacuation plans and designated safe routes to ensure residents' safety. A successful flood evacuation plan requires careful coordination, clear communication, and efficient resource utilization.

An effective flood evacuation plan begins with advanced meteorological monitoring and alert systems. Timely notifications enable authorities to inform residents, allowing for adequate preparation.

Well-defined evacuation routes are crucial for guiding residents to safety. These routes should consider factors like elevation, road conditions, and proximity to water bodies. Clear signage and communication channels assist individuals in navigating these routes.

Identifying and establishing safe shelters away from flood-prone areas is vital. Evacuation plans include a network of shelters equipped to accommodate residents with necessary amenities. Regular drills and community awareness programs familiarize people with these locations.

Evacuation plans must address the needs of vulnerable populations, such as the elderly, disabled, or those with medical conditions. Specialized transportation and support services should be integrated into the plan to ensure inclusivity.

Robust communication strategies are paramount during evacuation efforts. Authorities should utilize various channels, including emergency broadcasts, social media, and community networks, to disseminate information about evacuation orders, routes, and shelter locations.

Close collaboration with emergency services, including police, fire departments, and medical teams, is essential. Coordinated efforts streamline evacuation procedures, ensuring a swift and organized response to emerging challenges during floods.

Community involvement is crucial for the success of any evacuation plan. Regular drills, workshops, and educational campaigns enhance public awareness, fostering a culture of preparedness. Clear communication about the importance of following designated evacuation routes contributes to smoother evacuations.

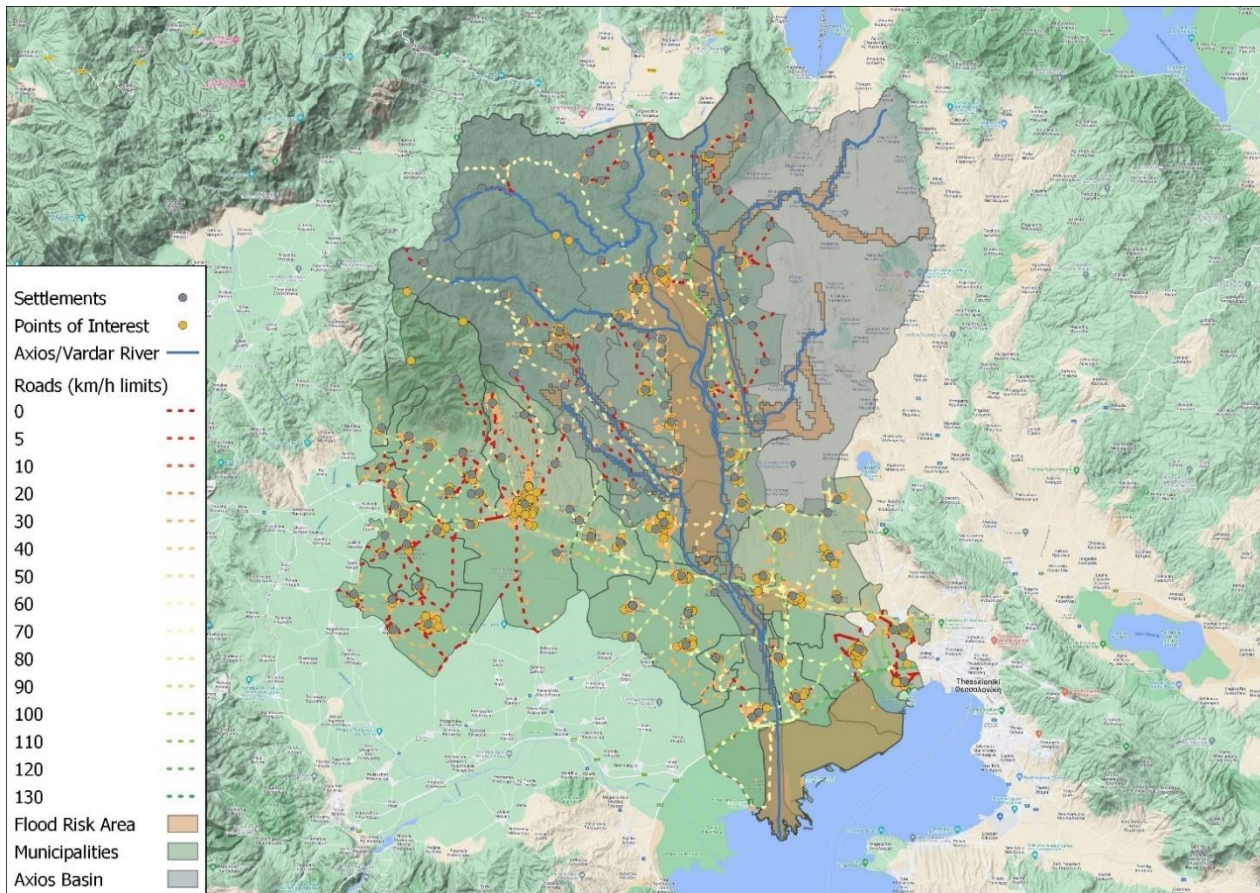
Evacuation plans should be dynamic and adaptive, considering factors such as changing weather conditions and evolving flood risks. Regular reviews and updates based on past experiences contribute to the continuous improvement of evacuation strategies.

A well-designed flood evacuation plan, coupled with clear communication and community engagement, is essential for safeguarding lives during flood emergencies.

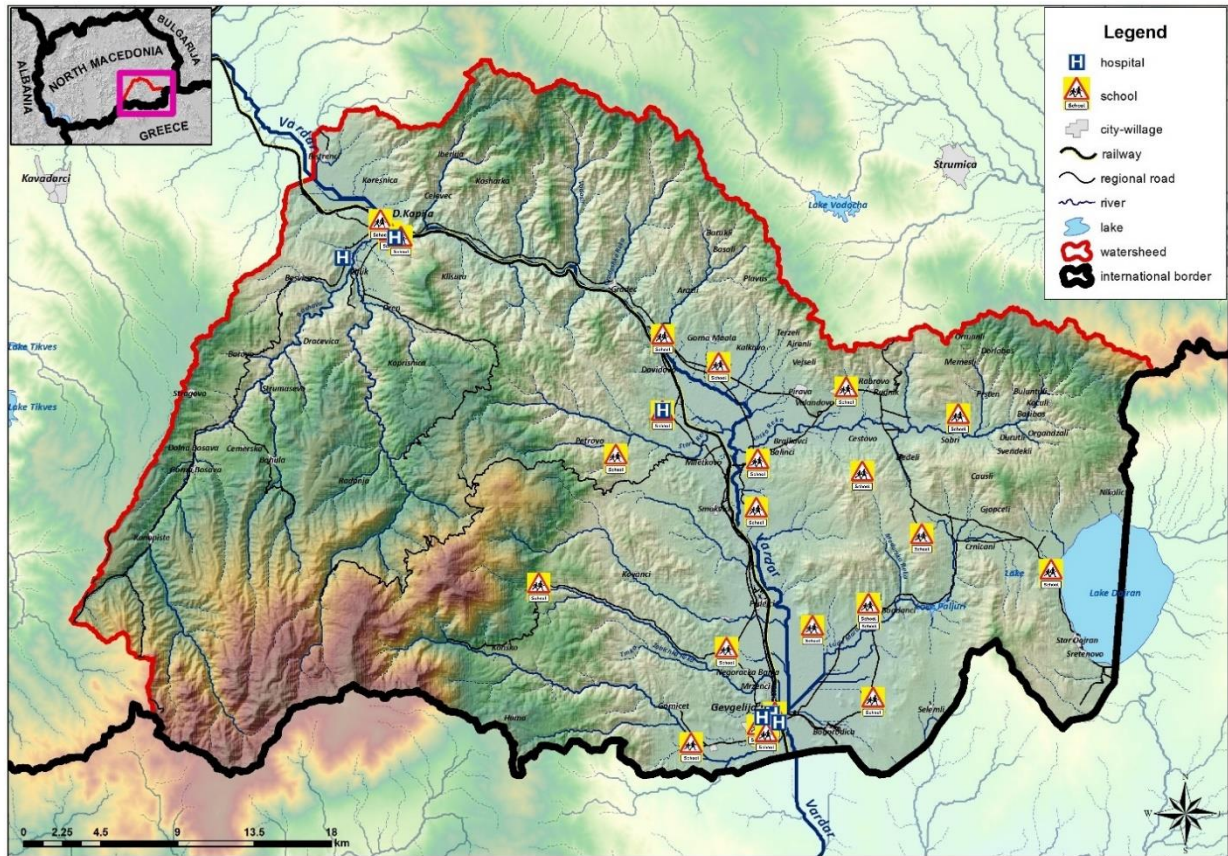
By prioritizing safety, communities can effectively navigate the challenges posed by flooding and minimize the potential impact on residents.

Both Partners' Civil Protection Agencies have implemented their own versions of flood evacuation plans.

Such examples of escape points in the event of flooding and routes to get there quickly and safely can be seen in the pictures below.



Picture 4: Map showing points of interest (hospitals, schools etc.) and the road network that will be used in case of a flood event, in the Greek region.



Picture 5: Map showing points of interest (hospitals, schools etc.) and the road network that will be used in case of a flood event, in the North Macedonian region.

Also, a series of education in schools and unions of disabled and elder people were carried out where the Lead Beneficiary, Project Beneficiary 3 and Project Beneficiary 4 organised several events in order to inform the project’s target groups and raise awareness. Video material and the self-protection guidelines complement this effort.



Picture 6: Photograph taken during the presentation of Floodshield in a union of elder people.

4 Description of the Floodshield Project

4.1 Information actions

The project FLOOD SHIELD focuses on the transboundary Axios/Vardar River that has the potential to provide a wide range of benefits, i.e., environmental, social, economic and strategic, but also disservices such as flood risks to the regions it flows through. Numerous challenges hamper effective cross border cooperation in general and cooperation on transboundary floods management in particular, thereby increasing vulnerability to floods at the cross-border areas of Greece and Republic of North Macedonia. The project's main objective is the minimization of the cross-border flood risks and disasters at the Axios/Vardar River basin by strengthening the cross-border cooperation, organizationally, technologically and socially.

In particular, the project combines different aspects to achieve the following sub-objectives:

1. Strengthening the flood risk governance at the Cross-border area to better assess, plan, monitor, prevent and react against floods.
2. Improving the technical capacity for effective cross-border flood risk assessment, monitoring, preparedness and response.
3. Promoting the role of citizens and voluntarism groups in the civil protection actions in case of flood disasters to protect themselves and actively involved in prevention and reaction activities.

The implementation of the project's activities and the delivery of their anticipated outputs contributes to the achievement of the project's specific objectives as follows:

- The strengthening of the flood risk governance will be achieved through:
 - a) the establishment of a Joint flood risk management group that will improve and pool together the capacity of authorities, services and volunteer groups,
 - b) the establishment of operational cross border centers,
 - c) the definition of the procedures needed to overcome the barriers in the cross-border cooperation,
 - d) the elaboration of a cross border flood reaction strategy and
 - e) the training of the staff of the authorities, services and volunteer groups participating in the interventions during floods.
- The improvement of the technical capacity for effective cross-border flood risk assessment, monitoring, preparedness and response will be achieved through:
 - a) the Flood Early Warning System development,
 - b) the flood risks and vulnerable sites mapping,
 - c) the accessibility modeling of means and equipment in the neighboring territories and

d) the Incident Management and Collaboration Platform development for Civil protection and other stakeholders to train, prepare and respond in case of flooding,

- The promotion of the role of citizens and voluntarism groups will be achieved through awareness raising, information and promotional campaigns that will include events, informal education in schools, audio and video materials etc.

The project's partnership consists of public national and regional authorities with the greatest competence in flood risk management and civil protection in their country, thus ensuring the achievement of project objectives.

4.2 Preparation, organization of meetings and participation in the meetings of the Joint Flood Risk Management Group

Four meetings of the JFRM Group have been organized in total within the framework of the project. The activities related to this action where:

- the Formulation of the meeting schedule, including topics such as arrival and departure times, topics to be discussed, coffee breaks, etc. in consultation with the Lead Beneficiary and the PB4 partner who is the lead for this deliverable and with the contribution of all the partners.
- contacts with the relevant Civil Protection authorities, stakeholders, groups, etc. for their participation in the meetings.

the quest of a suitable venue for this event including all appropriate facilities and particularly internet connection in order to guarantee the parallel virtual participation of the members that could not be present.

4.3 Awareness-raising activities

Several seminars (e-learning and in situ) have been carried out in both countries. Their organization focus was the operation and use of the flood risk monitoring and response system and the recent developments in the international disaster response practices. In addition, common tabletop exercises for knowledge and operational experience exchange were conducted.

Informal education and information has also been carried out aiming to a wider public and particularly vulnerable groups of population such as disabled and elder people and students.

Furthermore, video material has been created also for educational and informative purposes.

Additionally a campaign to acknowledge the role of volunteers and attract additional ones through informative actions and raise awareness activities has also been foreseen and implemented successfully. Also, the final event of the Floodshield project was

organized and took place during the international day for Disaster risk reduction in Thessaloniki.

That kind of activities certainly raise awareness and contribute to the project's general cause of being better prepared and manage effectively flood incidents.

4.4 Encouraging and promoting volunteerism

Encouraging and promoting volunteerism is a very delicate procedure governed by national laws, thus all partners could not do but a few such as exchange of information and ways of operation on this regard, Then it was, is and will be up to each country to choose certain actions in order to enhance volunteers' participation / inclusion and contribution.

In Greece, a campaign has been designed including the purpose, message, audience and resources to promote volunteering in the Axios River Basin, under the aim of motivating local citizens to participate in volunteer groups or create new groups in accordance with the provisions of Law 4662/2020.

The campaign to promote the participation of citizens in voluntary groups was implemented through the definition of methods for raising awareness and informing citizens. The process of attracting and recruiting volunteers to the project must have been thorough and targeted at an experienced audience that had the time, skills and interests to contribute and provide directly to the project's purpose. The methodology, followed by the contractor was determined in collaboration with the Civil Protection Division and included the following:

- a) Development of an approach to promote volunteerism,
- b) Organization of a press conference and
- c) Production of a radio spot.

Various in situ seminars were carried out regarding the operation and use of the common flood risk monitoring and response system, the recent international practices for disaster prevention, preparedness and response and obtaining humanitarian aid, relevant legislation aimed at enhancing institutional capacities, raising awareness and motivating citizens to protect themselves, as well as to actively participate in prevention and response activities.



Picture 7: Photograph taken during the presentation of Floodshield in a union of civil protection volunteers.

4.5 Study and installation of stations

The aim of this deliverable was to map all monitoring systems existing in the Axios transboundary basin.

The modality approach involves the collection of available information from different sources, such as:

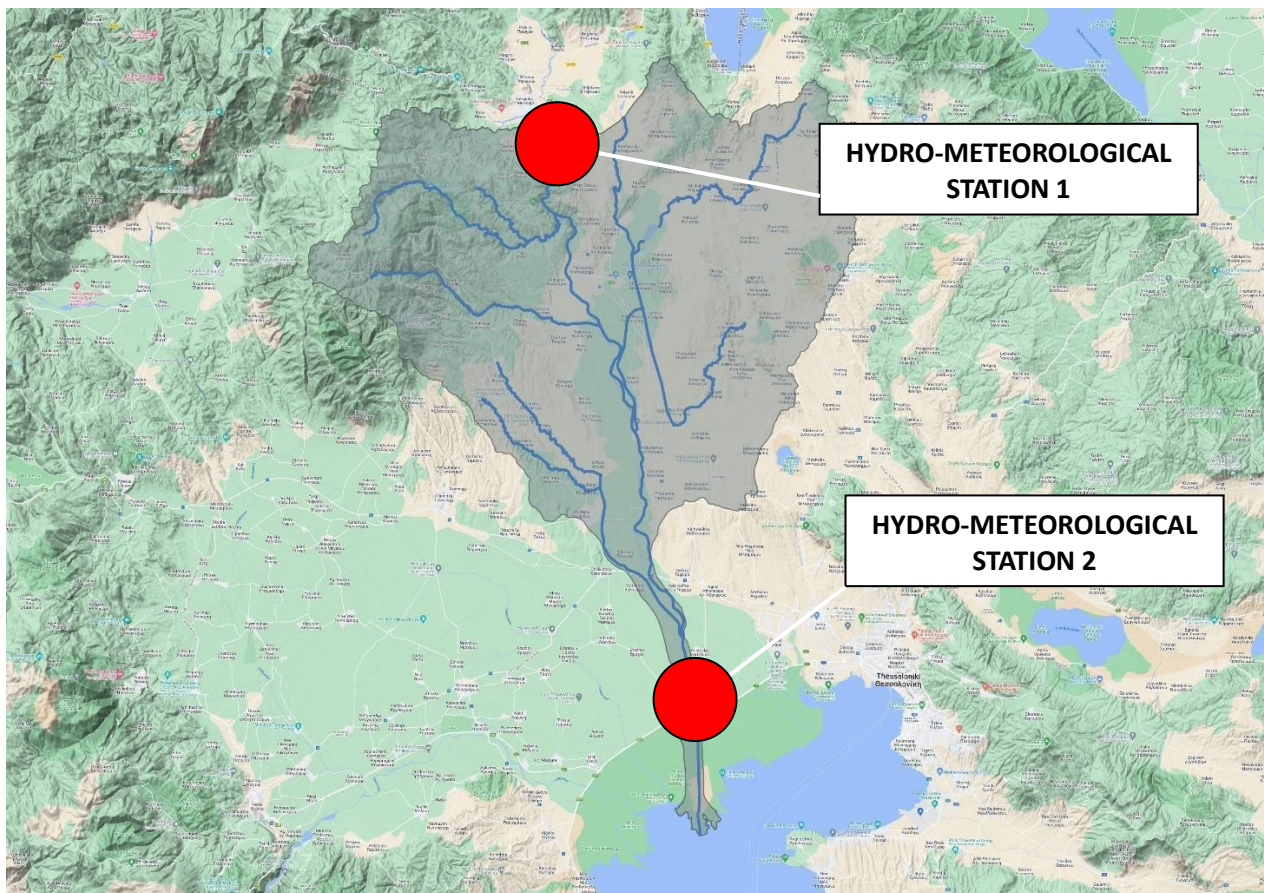
- National Water Monitoring Network, General Directorate of Water, Ministry of Environment and Energy
- Water Directorate of Central Macedonia, Decentralized Administration of Macedonia - Thrace.
- Institute of Soil and Water Resources, ELGO-DIMITRA (implementation of water measurements on behalf of the National Network)
- River Basin Management Plan of the Central Macedonia Water Department (EL10)
- Chemical Quality of Irrigation Water (surface and groundwater) at the scale of the river basins of Macedonia - Thrace and Thessaly. (Ministry of Rural Development and Food)
- Technical Report with the assessment of the existing environmental parameter monitoring networks and the needs for their upgrading and extension (Institute of Marine Biological Resources and Inland Waters)
- The deliverables and input of other European Projects e.g. CO-PREVENT.

For the complete inventory of the existing monitoring systems, the cooperation with both the Water Directorate of Central Macedonia of SA and the General Secretariat for

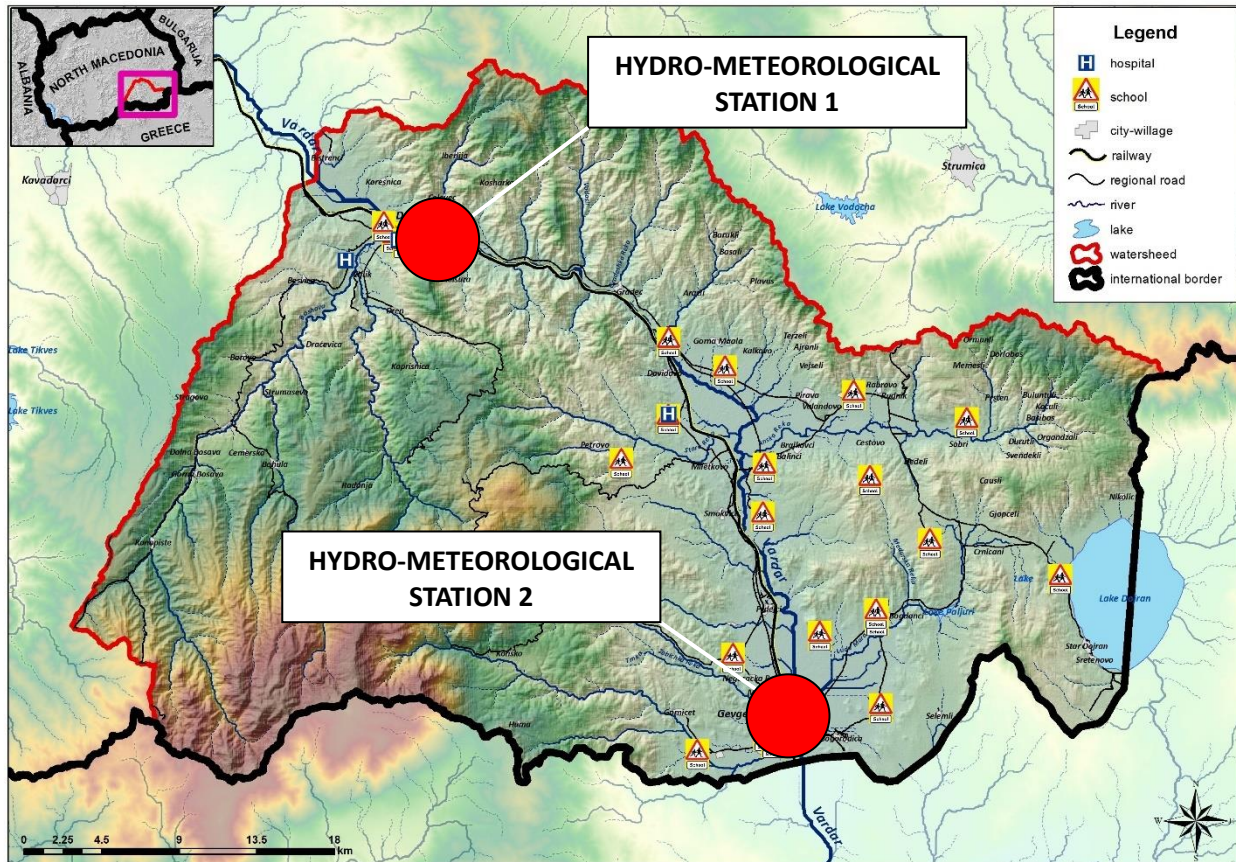
Natural Environment and Water – of the Ministry of Environment and Energy was important.

The ultimate objective of this report was to identify further network needs to clarify, in conjunction with the "Draft Vulnerability Analysis Report for the sites located in the Axios River Basin", deliverable B.5.1, the location of the installation and more generally the specifications of the additional stations foreseen in the project.

The approximate locations of the newly installed stations are shown in the following pictures, for both Partners.



Picture 8: Map of the locations of the newly installed hydro-meteorological stations in the catchment area of the Axios/Vardar in Greece.



Picture 9: Map of the locations of the newly installed hydro-meteorological stations in the catchment area of the Axios/Vardar in North Macedonia.

4.6 Development of Data Platform and EWS

The platform is a user-friendly tool that is expected to be used by all those involved in civil protection in their area, be it project partners, civil protection clarifications, water, fire brigade, and executed teams and any other actors active in this context. This is a collaborative environment where civil protection and all relevant actors can integrate all the functions needed for training, preparation and response to flooding events from an overflow of the Axios River or heavy rainfall.

In this context, a single software was developed, consisting of the following subsystems:

- Common Operational Picture (COP) in 3D GIS environment, where data from cameras and sensors, static data and interface with the early warning system are combined.
- Training and preparedness planning for response to any Emergency, an environment for creating and executing exercises on a map, with support for action logging, scenario development and data management, and finally,

- A collaborative communication environment using chat - written and verbal, video conferencing and interactive map, to achieve the dissemination of information during incidents to all stakeholders (collaborative response). (And separate communication channels should be supported for the operator's management and operations team, for the management team and their involved/cooperating agencies, for the operations team and their involved/cooperating agencies). The exchange of this information should be subject to rules/restrictions based on each user's role, hierarchy, location, etc., and should be based on international standards.

For the needs of the project, it is proposed to secure at least 2 licenses for desktop users & 10 smart mobile application licenses.

More specifically, the Incident Management and Cross Border Collaboration Platform (IMCBC) is a Command & Control (C2: Command & Control) software, multi-tier architecture (Web-tier) with support for at least the following 3 layers:

- Client tier / presentation tier / User Interaction, which is related to the end-user interface and data presentation. Users access the available services through a single technological platform that provides the user with personalization and access authorization capabilities.
- The application tier - business logic tier, which integrates the application logic, i.e., all the business rules governing the operation of each application
- The data tier, which is responsible for the storage of data. It concerns the systems for storing and managing information, whether it is transactional data (transactions), master data (customer), or analytical data (aggregate data). Application layer subsystems may share common models and data infrastructure.

The software will support multiple users and roles, with the ability to capture all information related to an incident.

The system:

- Allows users to record incident related information, pass this information to the appropriate Operational Management Unit and assist in resolving the incident in accordance with its Standard Operating Procedures (SOPs).
- Integrates all data - alerts from the flood early warning system and corresponding data on the resources - resources and equipment moved.
- It has two-way communication with users in the business sector through interconnected mobile applications.

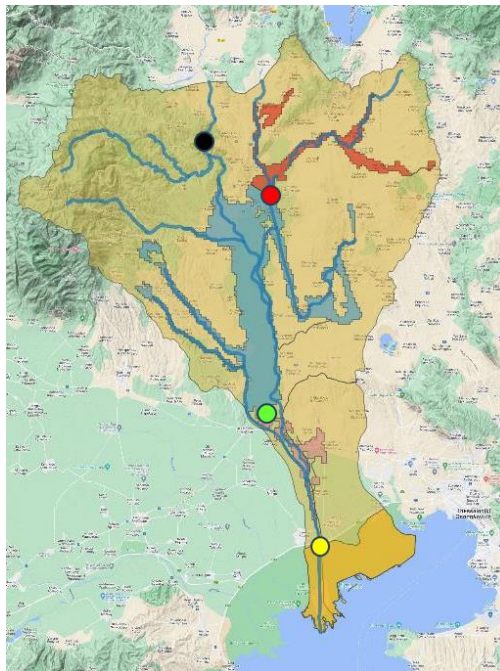
The information is visualized on a digital map to create the operational picture. It is managed and managed by a dedicated software user located at the Operations Centre (HQs) where the servers are installed.

Mobile smartphone users can receive commands from the Operations Centre and vice versa to send field information, in text, image and video format.

4.7 Vulnerability Analysis

The objective of the deliverable was to highlight the vulnerabilities of the areas to prioritize flood prevention needs and to facilitate the emergency response mechanism and the reconstruction of the area after a catastrophic flood.

This report presented the current situation of parts of the Axios/Vardar River basin in Greece, in terms of their vulnerability. The floodplain of the Axios River in Greece was divided into five (5) sub-basins.



Picture 10: Map of the dividing locations of the catchment area of the Axios/Vardar in Greece and the relative possibly inundated areas.

The vulnerability analysis of the selected areas was carried out using the Flood Vulnerability Index (FVI), which consists of 4 sub-elements: social, economic, environmental and physical. The basic data used for the sub-indices and the overall, were extracted either from primary data or from available information and data, with the assistance of Geographical Information Systems.

The most vulnerable area in the Greek part of the Axios River was found to be the area upstream of the Elli dam up to Polykastro.

In this example, the FVI vulnerability calculation method of the inundated areas of entire sub-basins, can be used to prioritize resources and means at the level of a Municipality (sub-basins) or Region (catchments of different rivers) or even Ministry (different Water Departments) when available resources are limited.

5 Proposals for a common strategy

5.1 Memorandum of Understanding

The JFRM makes an important contribution to strengthening cross-border cooperation on flood risk management, enhances information exchange and creates the right conditions for joint intervention procedures at operational level.

It also promotes the exchange of knowledge, experience and know-how in order to enhance joint monitoring and assessment of flood risks.

It communicates the results of the meetings and scientific research to the local community by organizing open workshops for the public, and by producing information material aimed at effectively informing and raising awareness of the community about flood risk in the area.

It contributes to the improvement of means and equipment in the cross-border zone, with a view to effectively dealing with extreme flood events in the area.

Effectively enhance the assessment of flood risks and vulnerability. It also enhances operational preparedness to deal with flood events when they are underway.

The main objective of the group is to minimize cross-border flood risks and to strengthen cross-border cooperation between Greece and Bulgaria at organizational, social and technological level. An important objective is to achieve better assessment, monitoring, prevention and response to flooding. Raising awareness among the public and civil groups, so that they can protect themselves and actively participate in activities related to flood prevention and response.

In the context of cross-border cooperation, a Memorandum of Understanding was prepared. Its aim is to minimize the cross-border flood risks and disasters by strengthening the cross-border cooperation organizational, technological and social levels. The Partners shall cooperate in the field of flood risk management, on the basis of equity, reciprocity and mutual benefit within the framework of international legal obligations and the relevant legislation of each Party.

This document is set out in full in Annex I.

5.2 Open line of communication

A direct open line of communication between the two countries refers to a direct and unimpeded channel for the exchange of information, dialogue, and coordination between the relevant agencies of the two neighboring nations. This communication link is established to facilitate swift and efficient bilateral communication in time of emergency (such as an upcoming flood incident) when immediate collaboration is required.

Key characteristics of such a direct line include:

Unrestricted Access: The communication channel should be accessible without unnecessary obstacles or delays. This may involve the use of dedicated hotlines, secure email systems, or other direct communication tools.

Real-Time Communication: The line of communication is designed to allow real-time exchanges, enabling prompt decision-making and response during flood emergencies.

Security Protocols: To ensure the confidentiality and security of sensitive information, the communication line should incorporate encryption or other security protocols to protect against unauthorized access.

Multi-Agency Coordination: The communication link may involve various government agencies, including those responsible for national security, emergency management, health, and border control. This multi-agency coordination ensures a comprehensive approach to cross-border issues.

Protocol for Activation: There should be a clear protocol outlining when and how the direct open line of communication is activated. This could be triggered by specific events, such as natural disasters, security threats, or public health emergencies. This protocol may also be included in the Memorandum of Understanding.

Regular Testing and Training: To maintain effectiveness, the communication system should undergo regular testing and training exercises. This helps ensure that relevant personnel are familiar with the procedures and that the technology is functioning optimally.

Cultural Sensitivity: Recognizing the cultural nuances and diplomatic considerations between the two countries is crucial for effective communication. Understanding each other's communication styles and preferences contributes to successful collaboration.

Mutual Trust and Transparency: A direct open line of communication thrives on mutual trust and transparency. Countries involved must be confident in sharing information and collaborating for the greater good of both nations.

Such a direct open line of communication could be particularly valuable for addressing shared challenges, such as floods and it can contribute to building stronger and more resilient cross-border relationships. It could be an essential component of diplomatic and strategic efforts to enhance cooperation between the neighboring nations.

5.3 Data exchange

The exchange of water quality and meteorological data between the neighboring countries is crucial for effective flood management and response. Such collaboration enhances the ability of countries to anticipate, monitor, and mitigate the impacts of floods. Shared meteorological data is fundamental for the development and operation of Early Warning Systems. Real-time information on precipitation, river levels, and weather patterns helps in forecasting potential flood events, allowing for timely alerts and preparedness measures.

Concerning river flow and water quality monitoring, the neighboring Partners can collaborate to monitor river flow and water quality in the Axios/Vardar River. This involves the exchange of data on water levels, discharge rates, and the quality of water parameters such as pollutants and contaminants.

Standardizing data formats and quality control procedures ensures seamless data exchange and facilitates the integration of information from different sources. Harmonization of data allows for a more comprehensive and accurate understanding of the shared hydrological system. Collaborative research initiatives and joint monitoring programs can be established to study the hydrological characteristics of shared river basins. This may involve the deployment of research teams, the sharing of data collected from various monitoring points, and the development of common flood risk models.

In the event of a flood, shared data enables coordinated emergency responses. The neighboring Partners can align their efforts, share resources, and implement joint response strategies to minimize the impact of the flood on both sides of the border. Bilateral or multilateral agreements, guided by regional or international frameworks, can formalize the commitment to data exchange and collaborative flood management. Such agreements provide a legal and institutional basis for cooperation.

By fostering collaboration in the exchange of water quality and meteorological data, neighboring Partners can enhance their resilience to floods, protect shared ecosystems, and contribute to regional stability and sustainable development.

Lastly, the creation of bonds among services at the operational level may enhance the know-how and way of operation and facilitate certain procedures or even ensure more instant reactions and effective collaboration beyond the political environment.

5.4 Next steps

The results of the project are very important at national and international level. It is necessary to continue the Floodshield's goals and to strengthen its role even further.

Through this project, the neighboring Partners have set the basis for information and methods exchange, in mutual understanding, all in the common purpose of dealing with sudden flood events.

It is of mutual interest for the project - at least its operational part - to go a step further through the funding of a new INTERREG IPA CBC Programme.

The continuation of FLOOD SHIELD is expected to increase the technical and administrative capacity for a more effective and timely response to flood events. Supporting interoperability of national systems and better coordination in Prevention, Control and Improved Response to natural disasters will enhance effectiveness.

Some suggestions for improving the functioning of the JFRM team, since that is the core team - product of the project - ensuring its continuation, effective implementation and sustainability in the long-term, are as follows:

- To further strengthen the scientific character of the team, already the team has an interdisciplinary character, but it is proposed to integrate other expert scientists, knowledgeable in specialized tools, on the fields of earth sciences, climatology, geostatistics and humanities.
- The group should be more flexible in terms of meetings and smaller working groups should be set up to collaborate on individual Floodshield issues.
- At the level of meeting operation, web-based meetings can be held earlier than the formal meetings of the group, to define topics and designate member representatives.
- It is suggested that the meetings take place every three months, so that the group can interact more and more meaningful conclusions can be drawn.
- Many meetings could be held online to reduce the operational costs and the environmental footprint of the group.
- It is proposed to reinforce the group with expert communicators who can organize meaningful information and awareness-raising meetings with the community and edit additional FLOOD SHIELD information material.
- Complete and strengthen the flood early warning System for the cross-border area.
- Finally, a key objective is to improve and strengthen the role of the group. And its conclusions should be published and taken seriously by the stakeholders.

References

- European Union Website (https://european-union.europa.eu/index_en)
- Flood Risk Management Plans (<https://floods.ypeka.gr/>)
- General Plan for Emergency Response and Immediate/Rapid Management of the Consequences of the Flood Event "DARDANOS 2"
(<https://civilprotection.gov.gr/sxedia-politikis-prostasias/2i-ekdosi-toy-genikoy-shedioy-antimetopisis-ektakton-anagkon-kai>)
- River Basin Management Plans (<http://wfdver.ypeka.gr/>)
- United Nations Website (<https://www.un.org/en/>)

Annex I: Memorandum of Understanding

Interreg - IPA CBC



Greece - Republic of North Macedonia

FLOOD SHIELD



Влада на Република Северна Македонија
Government of the Republic of North Macedonia
ДИРЕКЦИЈА ЗА ЗАШТИТА И СПАСУВАЊЕ
PROTECTION AND RESCUE DIRECTORATE

INTERREG IPA Cross Border Cooperation Programme "Greece - Republic of North Macedonia 2014-2020"

The project FLOOD SHIELD aims to minimize the cross-border flood risks and disasters by strengthening the cross-border cooperation, organizationally, technologically, and socially.

FLOOD SHIELD implementation will result in more effective joint actions and coordination activities against floods, in terms of:

- **Management:** Establishment of a Joint management group in the field of flood risks, definition of the procedures needed to overcome the barriers in the cross-border cooperation and elaboration of a cross border flood reaction strategy.
- **Response:** staff training of the authorities, services volunteer groups participating in the interventions during floods, mapping of flood risks and vulnerable sites, identification, and accessibility modeling of means and equipment in the neighboring areas and operation of an Incident Management and Collaboration Platform for local Civil protection and other stakeholders to train, prepare and respond in case of flooding.
- **Prevention:** Introduction of an early warning system and implementation of awareness raising and information activities for citizen to protect themselves from flood hazards
- **Mitigation:** Measures for mitigation of flood risks will be included in the flood reaction strategy

In addition to the main objective, the project combines different aspects to achieve the following sub-objectives:

1. Strengthening the flood risk governance at the Cross-border area to better assess, plan, monitor, prevent & react against floods.
2. Improving the technical capacity for effective cross-border flood risk assessment, monitoring, preparedness & response.
3. Promoting the role of citizens and voluntarism groups in the civil protection actions in case of flood disasters to protect themselves and actively involved in prevention and reaction activities.



The Project is co-funded by the European Union and national funds of the participating countries.