



CLIMAAX
climate ready regions

Deliverable Phase 2 – Climate risk assessment

"Towards Climate Resilience: Assessing Silistra's Climate Challenges and Solutions"

(TOR: Towards Climate Resilience)

Bulgaria, Silistra

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1. Document Information

Deliverable Title	Phase 2 – Climate risk assessment
Brief Description	Phase 2 of the CLIMAAX project for Silistra Municipality focuses on refining and expanding the Climate Risk Assessment developed in Phase 1, with the aim of producing more robust and decision-relevant results. The phase deepens the analysis of priority hazards, particularly river flooding and heavy rainfall, while extending the assessment to additional climate risks relevant for the municipality, such as drought and extreme temperatures. The analysis explicitly considers short-, medium- and long-term time horizons in line with the CLIMAAX Handbook. By combining European climate information with local data and knowledge, Phase 2 delivers a refined multi-risk picture tailored to Silistra’s specific socio-economic and territorial context. The results provide a solid evidence base for prioritising climate risks and directly support the identification of adaptation options in Phase 3.
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5. Abbreviations and acronyms

Abbreviation / acronym	Description
BGN	Bulgarian Leva
CLIMAAX	CLIMAtE risk and vulnerability Assessment framework and toolbox project
CRA	Climate Risk Assessment
EEA	European Environmental Agency
EU	European Union
IFP	Individual Follow-up Plan
IME	Institute of Market Economics
MIDP	Municipal Integrated Development Plan
RCP	Representative Concentration Pathway
SPA	Spatial Planning Act

6. Executive summary

This Deliverable presents the Phase 2 climate risk assessment for Silistra Municipality under the CLIMAAX FSTP framework. Building upon the baseline hazard identification conducted in Deliverable 1, Phase 2 introduces methodological refinement through climate-change integration, local dataset calibration, stakeholder-driven prioritisation, and quantitative risk aggregation.

Unlike Phase 1, which applied standardised CLIMAAX workflows using generic datasets, Phase 2 incorporates:

- Selected appropriate climate-change projections (RCP4.5, RCP8.5 and RCP2.6 scenarios),
- Local meteorological observations from NIMH stations,
- Agro-meteorological drought indicators (SPI),
- Danube water-level data for hydrological validation,
- Stakeholder-informed risk weighting adjustments,
- Explicit threshold justification for heavy rainfall and drought hazards.

The assessment confirms that agricultural drought constitutes the most critical long-term climate risk for Silistra Municipality. Climate model ensembles project significant yield reductions under high-emission scenarios, particularly for maize (up to 50–60% in several model configurations), with corresponding economic losses potentially exceeding €1 million annually under rain-fed conditions. Local SPI observations (2022–2025) confirm the occurrence of severe to extreme drought episodes (SPI < -2), validating model-based hazard projections.

Heavy precipitation represents the second most significant risk category. Return-period analyses indicate increasing exceedance probability of locally calibrated daily thresholds (50 mm/24h), consistent with regional observational trends of intensifying extreme precipitation. Exposure analysis highlights vulnerability in the Aydemir lowland and Danube-adjacent industrial areas.

River flood risk remains spatially concentrated in the Aydemir lowland and eastern industrial zones, with projected economic losses ranging from €66 million (RP100) to €78 million (RP500) under current climate conditions. Flood hazard mapping was cross-validated with Danube River Basin Directorate data to ensure consistency with national flood management planning.

Wind and snow hazards were assessed as comparatively low structural risks. Historical cyclone-track analysis indicates maximum gusts below structural damage thresholds, while snow and blizzard frequency remains low and projected to decline under warming scenarios. Both hazards are associated primarily with short-term operational disruptions rather than large-scale economic loss.

Stakeholder engagement (N=25) directly influenced methodological refinement. Agricultural drought was identified as highest priority risk by 84% of respondents. Reported data gaps prompted expansion of local dataset integration and recalibration of hazard thresholds. Drought weighting within the composite multi-risk index was increased to reflect both model outputs and local institutional perception.

Overall, Phase 2 demonstrates a transition from generic workflow application toward a locally calibrated, stakeholder-informed and decision-relevant multi-hazard risk assessment for Silistra Municipality.

The final phase of the project (Phase 3) will build on these findings by exploring and assessing potential adaptation options. It will focus on translating prioritized risk assessment outcomes into concrete, feasible and locally appropriate adaptation measures, in close cooperation with stakeholders and competent authorities.

1 Introduction

1.1 Background

Silistra Municipality is located in northeastern Bulgaria, along the southern bank of the Danube River, forming part of the Danube macro-region. Its predominantly flat topography, extensive agricultural land, and direct exposure to one of Europe's largest river systems define both its development potential and its structural sensitivity to climate-related hazards.

The municipality has a predominantly rural and agricultural economic profile, combined with unfavorable socio-economic trends, including population decline, aging demographics, limited economic diversification, and comparatively low income levels. According to national and regional socio-economic indicators, Silistra is among the more vulnerable districts in Bulgaria in terms of economic resilience and adaptive capacity. These structural characteristics amplify the potential impacts of climate hazards—particularly floods, droughts, heavy precipitation, and extreme seasonal events—on livelihoods, infrastructure, and public services.

Observed climate tendencies in the region include increasing temperature extremes, prolonged dry periods, and episodes of intense precipitation. The municipality's proximity to the Danube River and the presence of low-lying floodplains create structural exposure to river flooding, while its strong dependence on rain-fed agriculture increases sensitivity to drought and precipitation variability. At the same time, limited financial and technical resources constrain proactive adaptation capacity.

Within this context, Silistra Municipality joined the CLIMAAX initiative to establish a structured, science-based, and locally calibrated Climate Risk Assessment (CRA) that supports informed decision-making and long-term climate resilience planning.

Methodological Evolution from Phase 1 to Phase 2

During Phase 1, Silistra Municipality applied the CLIMAAX Common Methodological Framework for the first time, focusing on two pilot hazards—river flooding and heavy rainfall. This phase validated the operational applicability of the CLIMAAX workflows in the local context, tested data accessibility, and generated preliminary hazard and exposure estimates.

However, Phase 1 relied primarily on standardized datasets and generic workflow parameters embedded in the CLIMAAX Jupyter notebooks. While methodologically consistent, this initial application did not yet incorporate locally calibrated thresholds, extended climate-change projections, or systematic stakeholder-driven weighting adjustments.

Phase 2 represents a methodological refinement and expansion. It moves beyond pilot testing toward:

- Integration of appropriate climate-change scenarios (RCP4.5, RCP8.5, RCP2.6);
- Explicit justification and recalibration of hazard thresholds (e.g., heavy rainfall exceedance levels);
- Inclusion of additional high-relevance hazards (agricultural drought, wind, snow);
- Incorporation of local meteorological, hydrological and sectoral datasets;

- Stakeholder-informed prioritisation and risk weighting adjustments;
- Improved synthesis of decision-relevant outputs.

This progression reflects the iterative logic of the CLIMAAX Handbook and directly addresses the need to transition from generic workflow implementation toward locally validated and policy-relevant risk assessment outputs.

1.2 Main objectives of the project

The main objective of Phase 2 is to strengthen the analytical robustness, spatial relevance, and decision utility of the Climate Risk Assessment for Silistra Municipality.

Specifically, Phase 2 aims to:

- Refine risk estimates for river floods and heavy precipitation through improved local dataset integration and climate-scenario expansion;
- Extend the CRA to additional priority hazards identified through stakeholder consultation, including agricultural drought, wind, and snow-related events;
- Improve hazard characterization by incorporating locally observed meteorological indicators (e.g., SPI drought index, Danube water levels);
- Strengthen exposure and vulnerability assessment by integrating socio-economic characteristics, agricultural structure, land-use patterns, and critical infrastructure data;
- Explicitly address short-, medium-, and long-term time horizons relevant for municipal planning;
- Enhance cross-hazard comparability through multi-risk synthesis and prioritisation.

The added value of Phase 2 lies in the transition from generic modelling outputs to calibrated, evidence-based, and stakeholder-validated risk findings that better reflect Silistra's specific territorial and socio-economic context.

Ultimately, Phase 2 serves as the analytical bridge between hazard identification and adaptation planning, ensuring that future resilience measures are grounded in a transparent and locally contextualized evidence base.

1.3 Project team

The project is implemented by a multidisciplinary team from Silistra Municipality and external experts from "D and D Consulting" Ltd. The team combines administrative, financial, environmental, and climate-risk expertise.

Municipal representatives ensure institutional ownership and integration into local planning processes, while external climate specialists and subcontracted experts provide technical support in applying and refining the CLIMAAX methodology.

This hybrid structure guarantees both scientific robustness and local administrative applicability of the assessment results..

1.4 Outline of the document's structure

The structure of this Deliverable reflects the analytical progression of Phase 2 and clearly distinguishes it from the pilot application in Phase 1.

Following this introduction, the report presents:

- A refined methodological description, including data sources, climate scenarios, and threshold calibration;
- Expanded hazard analyses covering river floods, heavy precipitation, agricultural drought, wind, and snow;
- Enhanced exposure and vulnerability assessment integrating socio-economic and sectoral data;
- Multi-hazard synthesis and prioritisation results;
- Stakeholder engagement outcomes and traceable analytical impacts;
- Policy-relevant conclusions supporting subsequent adaptation planning.

The final sections outline how the Phase 2 findings feed directly into Phase 3 activities focused on identifying, evaluating, and prioritizing adaptation measures.

2 Climate risk assessment – phase 2

2.1 Scoping

Phase 2 of the Climate Risk Assessment (CRA) for Silistra Municipality builds upon the pilot application conducted in Phase 1 and represents a structured expansion and methodological refinement of the assessment scope.

While Phase 1 focused on validating the CLIMAAX methodological framework through the analysis of two pilot hazards (river flooding and heavy precipitation), Phase 2 broadens the scope to a comprehensive multi-hazard assessment. The current phase integrates additional climate hazards of high local relevance—agricultural drought, wind and snow-related events—while also refining previously analysed hazards through climate-scenario expansion and local dataset calibration.

The scoping stage explicitly defines:

- **Territorial scope:** Entire administrative territory of Silistra Municipality, with enhanced analytical focus on identified high-risk zones such as the Aydemir lowland, Danube-adjacent areas, major agricultural zones and settlements with vulnerable infrastructure;
- **System scope:** Population, agriculture, infrastructure, critical services, economic activities and environmental assets;
- **Governance scale:** Municipal decision-making level, aligned with regional (Danube River Basin) and national policy frameworks;
- **Temporal scope:** Current climate conditions (baseline), mid-century projections and end-of-century scenarios, depending on data availability within CLIMAAX workflows.

Phase 2 explicitly integrates climate-change scenarios (RCP4.5, RCP8.5 and RCP2.6) to assess not only present-day hazard characteristics but also projected changes in frequency, intensity and spatial distribution. Particular attention is paid to:

- Hazard intensification trends (e.g., extreme precipitation),

- Increasing drought severity under high-emission scenarios,
- Potential shifts in seasonal hazard patterns,
- Cross-hazard comparability.

The scoping process also incorporates feedback and prioritisation signals from Phase 1 stakeholder engagement. Stakeholder input influenced:

- Selection of additional hazards (notably agricultural drought),
- Refinement of heavy rainfall thresholds,
- Emphasis on agricultural exposure and water scarcity,
- Increased attention to vulnerable population groups.

This ensures that the assessment scope reflects both model-based hazard exploration and locally perceived risk priorities.

The identification, prioritisation and analytical refinement process was conducted in close cooperation with stakeholders, ensuring institutional relevance and traceability of methodological choices. The accumulated experience from Phase 1 allowed more precise selection of workflows, climate scenarios and calibration parameters, directly enhancing the analytical depth of Phase 2.

Stakeholder engagement in the scoping process involved representatives from municipal administration, public infrastructure and service operators, emergency and civil protection authorities, regional and national institutions, economic and agricultural sectors, the scientific community, civil society organisations, and vulnerable population groups residing in high-risk areas.

The scoping stage therefore moves beyond hazard screening and establishes a clearly defined, policy-relevant analytical framework that guides the subsequent hazard, exposure, vulnerability and risk analyses.

2.1.1 Objectives

The main objective of Phase 2 of the Climate Risk Assessment (CRA) is to provide a robust, locally calibrated and decision-relevant analytical basis for climate risk management in Silistra Municipality.

Building upon the pilot results of Phase 1, Phase 2 aims to deepen the understanding of climate risks by:

- Expanding the range of analysed hazards;
- Integrating climate-change scenarios and future projections;
- Refining hazard thresholds and exposure estimates through local data calibration;
- Strengthening cross-hazard comparability and prioritisation.

The assessment seeks not only to identify and quantify climate hazards, but also to evaluate their practical implications for population, infrastructure, agriculture, economic activities and environmental systems. Particular emphasis is placed on the identification of vulnerable groups and high-risk territorial zones.

A core objective of Phase 2 is to prioritise climate hazards based on combined model outputs, local observations and stakeholder input, thereby enhancing the policy relevance of the results. The findings serve as an analytical foundation for reviewing and updating municipal strategic

documents, sectoral development plans, and future adaptation initiatives. In this context, the CRA functions as a structured decision-support tool for long-term strategic planning and climate resilience governance.

At the same time, the scope of the assessment is influenced by several structural constraints. These include limitations related to data completeness, differences in spatial resolution between climate and geospatial datasets, and restricted availability of long-term local historical damage records. Certain datasets are heterogeneous in format and coverage, requiring harmonisation within the CLIMAAX analytical framework.

These challenges are addressed through:

- Integration of European-scale datasets with national and local data sources;
- Explicit documentation of data gaps and uncertainty;
- Iterative refinement of workflows based on Phase 1 experience;
- Progressive expansion of stakeholder participation.

Where limitations affect the robustness of specific risk estimates, this is transparently stated in the relevant sections of the report, ensuring methodological clarity and integrity of the assessment.

2.1.2 Context

The Climate Risk Assessment (CRA) Phase 2 for Silistra Municipality is developed within the existing national, regional and local strategic framework governing sustainable development, spatial planning and climate policy.

At the local level, the assessment aligns with the Integrated Development Plan (IDP) of Silistra Municipality 2021–2027 (updated 2024), adopted under the Regional Development Act. While the IDP identifies priorities related to climate risk management, ecological agriculture, infrastructure resilience and social sustainability, it does not provide a systematic multi-hazard climate risk assessment integrating climate projections, socio-economic vulnerability and spatial exposure into a single analytical framework. Phase 2 of the CRA addresses this gap by providing structured, evidence-based analysis to support policy refinement and prioritisation of interventions.

The Disaster Protection Plan of the Municipality and sectoral planning documents recognize risks related to floods, droughts, extreme temperatures and other climate phenomena. However, these documents focus primarily on emergency response and sectoral planning rather than long-term climate projections and cross-hazard synthesis. The CRA therefore complements and strengthens the existing governance framework by introducing forward-looking, scenario-based risk assessment.

At the national level, the assessment is coherent with:

- The National Development Program “Bulgaria 2030”, which identifies climate change as a systemic risk affecting territorial development and social cohesion;
- The Integrated Energy and Climate Plan (INECP) 2021–2030, which recognises adaptation and infrastructure resilience as horizontal priorities;
- The National Strategy for Adaptation to Climate Change and its Action Plan, which emphasises the role of municipalities in implementing adaptation measures.

Within this multi-level governance context, Silistra Municipality functions as a key territorial implementer of national climate priorities, while simultaneously being directly exposed to climate impacts.

Agriculture is the leading economic sector in the municipality of Silistra and the main source of income and employment, but at the same time it is the most exposed to climate risks. The production of cereals, oilseeds, fruits and vegetables is highly dependent on the rainfall regime, temperatures and the frequency of extreme events. The established trends towards more frequent and prolonged droughts, alternating with intense rainfall and hailstorms, lead to direct crop losses, increased production costs and reduced economic stability of agricultural holdings. The climate risk in this sector is further amplified by the limited development of irrigation infrastructure and the decreasing number of active agricultural producers. The Monitoring Survey of Land Use in Bulgaria (BANSIK) 2025 report provides a reliable statistical picture of the structure of land use by districts and statistical regions, with Silistra District falling into the North Central region. The data clearly show that the region in which Silistra is located is characterized by a high share of utilized agricultural area and arable land, with cereals and oilseed crops occupying the majority of the cultivated areas. This type of land use implies a strong dependence on the rainfall regime, temperature fluctuations and extreme climatic events. The concentration of uniform crops on large areas increases vulnerability to intense rainfall and soil waterlogging, periods of drought and erosion processes and loss of soil fertility. In the context of the climate risks identified in Phase 1 (floods and intense rainfall), this land use acts as an amplifying factor of risk, especially in the low-lying and riparian parts of the territory.

Territorial and Socio-Economic Profile

Silistra Municipality and the wider district are characterised by:

- Predominantly flat relief and extensive low-lying areas along the Danube River;
- Strong agricultural specialization;
- High proportion of arable land;
- Demographic decline and population ageing;
- Limited economic diversification.

The district covers 2,846 km², with utilised agricultural land exceeding 1.65 million decares, of which more than 87% is occupied by grain and technical crops, primarily wheat and sunflower. The dominance of chernozem soils and extensive arable land creates both high production potential and increased sensitivity to drought, intense rainfall, soil erosion and river flooding. Land-use structure, characterised by a large share of arable land and limited natural buffer zones, amplifies surface runoff and erosion risks during extreme precipitation events. This profile directly interacts with the flood and heavy rainfall hazards identified in Phase 1.

The land use profile of the municipality of Silistra, characterized by a high concentration of arable land and a limited share of ecologically stabilizing territories, increases the sensitivity of the municipality to the identified climate risks of intense rainfall and flooding./BANSIK 2025, FINAL RESULTS on the use of the territory of BULGARIA, https://www.mzh.government.bg/media/filer_public/2025/12/04/ra_465_publicationbancik2025.pdf/

Separately, data from the 2020 Census of Agricultural Holdings - <https://www.mzh.government.bg/bg/statistika-i-analizi/prebroyavane-na-zemedelskite-stopanstva-prez-2020-g/>, recently published by the National Statistical Institute, provide additional information by showing that sustainable land and soil management is still not evenly distributed, which has a direct impact on the adaptive capacity of the agricultural sector.

The water sector is key for both the population and the economy of the municipality. The risk of river floods identified in Phase 1 affects not only the coastal areas along the Danube, but also the water supply infrastructure and the quality of water resources. At the same time, increasing droughts increase the pressure on available water sources, which may lead to problems with drinking water supply, especially in smaller and peripheral settlements. Municipality-Silistra falls into region BG1_APSFR_DU_001 with a significant potential risk of floods under Art. 146d of the Law on Floods, according to the preliminary assessment of the risk of floods due to the overflow of the Danube River, carried out by the Basin Directorate-Pleven as of 20.12.2011.

In summary, the sectors most relevant to the municipality of Silistra are highly interconnected and vulnerable to climate change. Climate impacts have the potential to exacerbate the region's already existing economic and social vulnerabilities, which highlights the need for an integrated, risk-based approach to planning adaptation measures within the CRA Phase 2.

Demographically, the municipality experiences negative natural growth, outmigration of younger population groups, and an increasing share of elderly residents. These factors heighten social vulnerability to climate extremes, particularly heat waves, service disruption and flood events.

Economically, agriculture and related food-processing activities dominate the local economy. This high sectoral dependence increases systemic vulnerability to drought, rainfall variability and temperature extremes. Limited irrigation infrastructure and relatively low diversification further constrain adaptive capacity.

Infrastructure deficits, particularly in smaller settlements, including aging road, water supply and sewage systems, increase exposure to flood and heavy rainfall impacts.

Transboundary and External Influences

Climate risks in Silistra are shaped not only by local characteristics but also by external drivers.

The municipality's location along the Danube River places it within the broader hydrological dynamics of the Danube Basin. River discharge levels depend on upstream precipitation, snowmelt and basin-wide water management decisions. Silistra falls within a designated area of significant potential flood risk (BG1_APSFR_DU_001), reflecting transboundary hydrological exposure.

The proximity to Romania further introduces cross-border interactions in land use, water management and agricultural practices, potentially amplifying cumulative climate impacts.

National and European policies related to flood risk management, climate adaptation and agricultural development also influence local intervention options and funding mechanisms.

Strategic Relevance of the CRA

Within this context, climate risks in Silistra are not isolated environmental phenomena but structural factors influencing economic stability, social cohesion and territorial development.

The CRA Phase 2 provides:

- Integrated multi-hazard analysis;
- Cross-sectoral vulnerability assessment;
- Climate scenario-based projections;
- Evidence-based prioritisation.

This analytical framework strengthens the ability of the municipality to align local development planning with national and EU climate policy objectives and to integrate adaptation systematically into sectoral strategies.

2.1.3 Participation and risk ownership

The Climate Risk Assessment (CRA) Phase 2 is implemented through a multi-level institutional framework in which Silistra Municipality acts as the lead institution and de facto risk owner.

The leading role in the process is played by:

- **Municipality of Silistra**, responsible for defining objectives, providing access to local data, ensuring coherence with municipal strategic documents (Integrated Development Plan and Disaster Protection Plan), coordinating stakeholders and integrating results into planning processes;
- **Regional Directorate of Agriculture – Silistra**, providing sectoral expertise on climate impacts on agricultural production, land use and rural vulnerability;
- **Regional Directorate of Fire Safety and Population Protection – Silistra**, contributing operational knowledge and data related to disaster response, early warning systems and population protection.

Climate policy formulation in Bulgaria is centralized at the national level, where strategic objectives and regulatory frameworks are adopted by the Council of Ministers and competent state authorities. However, climate impacts manifest territorially, which positions municipalities as de facto risk owners responsible for integrating national climate objectives into local planning, infrastructure management and disaster risk reduction.

This structural imbalance—between centralized policy formulation and localized risk exposure—defines the governance context of the CRA. While national institutions set adaptation and mitigation priorities, municipalities bear the practical responsibility for managing exposure, vulnerability and response capacity.

Table 2.1. Institutional mapping and allocation of responsibilities within the CLIMAAX climate risk assessment process (Municipality of Silistra)

Institutional level	Institution / actor	Role in the CLIMAAX process	Main responsibilities	Linkages and coordination
National level	Council of Ministers of the Republic of Bulgaria	Policy-setting authority	Adoption of national climate change mitigation and adaptation objectives, strategies and implementation frameworks	Provides the overarching policy framework within which local and regional actors operate
National level	Competent national authorities (environment, disasters, spatial planning)	Regulatory and strategic coordination	Development and implementation of sectoral legislation and strategic documents related to climate change, disaster risk management and territorial planning	Vertical coordination with municipalities through sectoral legislation and planning instruments
Local level (lead)	Municipality of Silistra	Lead institution and de facto risk owner	Definition of objectives, access to local data, coordination with municipal strategic documents (PIRO, Disaster Protection Plan), implementation of adaptation measures and communication with local communities	Acts as intermediary between national climate policy and local stakeholders; coordinates all actors involved in Phases 1 and 2
Regional level	Regional Directorate of Agriculture – Silistra	Sectoral expert authority	Provision of expert information on climate impacts on agriculture, support to risk analysis related to agricultural production and land use	Cooperates with the Municipality of Silistra and local farmers; contributes to sector-specific vulnerability assessment
Regional level	Regional Directorate of Fire Safety and Population Protection – Silistra	Disaster risk management authority	Contribution of data and experience related to disaster response, early warning systems and population protection	Supports prevention, preparedness and response components of

				the climate risk assessment
Civil society	Local NGOs, cultural and community organisations (e.g. women’s organisations, environmental NGOs, community centres, schools)	Community intermediaries	Representation of local and social interests, identification of vulnerable groups, dissemination of information on climate risks and adaptation measures	Facilitate two-way communication between institutions and local communities
Private sector	Local enterprises (e.g. agriculture, processing, industry)	Economic stakeholders	Participation in consultations, provision of sector-specific information on climate exposure and impacts	Linked to the Municipality and sectoral authorities through targeted consultations
Local communities	Vulnerable groups and territories (low-lying Danube areas, old neighbourhood, farmers near rivers and ravines, elderly, children, socially vulnerable households)	Risk-exposed actors	Direct exposure to climate risks such as flooding, intense rainfall and disruption of basic services	Included through targeted communication, consultations and stakeholder engagement activities

Table 2.1 presents the institutional structure relevant to the CLIMAAX climate risk assessment in Silistra Municipality, clarifying roles across national, regional and local levels. The Municipality of Silistra functions as the coordinating body, ensuring vertical alignment with national policy and horizontal coordination among sectoral actors.

Regional agricultural and disaster management authorities contribute sector-specific expertise, while civil society organizations, economic actors and vulnerable groups participate through consultation and feedback mechanisms.

Risk Ownership within the Disaster Management and Governance Framework

At the municipal level, the identification and management of disaster risks are regulated through the Municipal Disaster Protection Plan, developed in accordance with the Disaster Protection Act. The Mayor and the municipal administration play a central coordinating role within the Unified Rescue System, ensuring the organisation of prevention, preparedness and response measures in cooperation with regional and national authorities.

The Disaster Protection Plan identifies priority hazards relevant for the municipality, including floods, droughts, extreme precipitation, strong winds and snowfall. It outlines qualitative criteria for unacceptable impacts, particularly where events threaten human life and health, affect residential areas, cause serious damage to critical infrastructure, lead to prolonged disruption of essential public services or generate significant economic losses. In this framework, risk assessment is primarily oriented toward emergency preparedness and operational response.

However, the existing disaster management system is largely reactive in nature and focused on short-term response and recovery. It does not systematically integrate long-term climate projections, cumulative or cross-hazard interactions, or scenario-based prioritisation of risks under changing climatic conditions. As a result, an institutional gap emerges between disaster response mechanisms and forward-looking climate adaptation planning.

The implementation of the CLIMAAX Climate Risk Assessment in Phase 2 contributes to bridging this gap. By introducing structured multi-hazard analysis, integrating future climate scenarios and strengthening stakeholder participation, the assessment extends the understanding of risk beyond emergency regimes. In this way, climate risk ownership evolves from a primarily reactive model based on disaster response toward a proactive, strategic and evidence-based approach embedded in long-term municipal governance.

Participation in the assessment process reflects this broader understanding of risk ownership. Alongside municipal authorities and sectoral institutions responsible for agriculture, infrastructure and water management, the process involves economic stakeholders such as farmers and local enterprises, civil society organisations and representatives of vulnerable population groups. These actors contribute not only through consultation but also through validation of risk perception, identification of sensitive territories and feedback on adaptation priorities. Their involvement strengthens the legitimacy and practical relevance of the assessment.

Within the municipal context, acceptable and tolerable risk levels are not defined through quantitative thresholds but through qualitative evaluation embedded in the Disaster Protection Plan. Risk acceptability is assessed in relation to the frequency and intensity of events, the capacity for prevention and response, and the potential for rapid recovery. The CLIMAAX assessment complements this framework by introducing forward-looking scenario analysis and structured risk comparison, allowing clearer differentiation between risks that can be temporarily tolerated and those requiring long-term adaptation intervention.

2.1.4 Application of principles

The determination of acceptable and tolerable risk levels in the Municipality of Silistra is grounded in the qualitative assessment framework established in the Municipal Disaster Protection Plan rather than in predefined quantitative thresholds. The plan specifies scenarios and impact categories considered unacceptable, particularly where events threaten human life and health, affect residential areas, cause serious damage to critical infrastructure, disrupt essential public services, or generate significant losses for agriculture and the local economy.

Within this framework, acceptable risk is understood as a function of event frequency and intensity, the existing prevention and response capacity, and the potential for rapid recovery. Historical event analysis, identification of critical points and vulnerable territories, and evaluation of preparedness measures collectively form the basis for distinguishing between risks that may be temporarily tolerated and those requiring priority, long-term adaptation interventions. Phase 2 of the CLIMAAX

assessment builds upon this existing logic by introducing a forward-looking, scenario-based perspective that explicitly accounts for future climate dynamics and evolving exposure patterns.

The application of CLIMAAX principles in Silistra is guided by three core considerations.

- First, the assessment incorporates social justice, equity and inclusivity as structuring elements of the analysis. Vulnerability is not treated as spatially uniform. Particular attention is paid to elderly populations, low-income households, rural communities and residents of flood-prone Danube areas, explicitly recognising differences in exposure, sensitivity and adaptive capacity across the municipality. This ensures that prioritisation of risks does not focus solely on economic loss, but also reflects distributional impacts and social consequences.
- Second, quality, rigour and transparency are ensured through the consistent application of the CLIMAAX methodological framework. All data sources, assumptions and modelling choices are clearly documented, and the analysis combines European-scale climate projections with locally available datasets and stakeholder knowledge. Where uncertainties or data limitations exist, these are explicitly acknowledged in order to preserve methodological integrity and analytical credibility.
- Third, the precautionary principle underpins hazard prioritisation and scenario selection. High-impact risks—particularly river floods, heavy precipitation and drought—are analysed across multiple time horizons, including current conditions and long-term projections. Even where uncertainties remain regarding exact magnitudes or spatial distribution of impacts, the assessment adopts a preventive orientation, recognising that delayed action in the face of plausible high-consequence risks would increase long-term socio-economic costs.

Through the integration of these principles, the Climate Risk Assessment moves beyond a purely technical exercise and becomes a governance instrument that supports equitable, transparent and forward-looking decision-making within the Municipality of Silistra.

2.1.5 Stakeholder engagement

Stakeholder engagement within the CLIMAAX project in Silistra Municipality has been designed as a phased and cumulative process, initiated in Phase 1 and further deepened in Phase 2. The objective is not limited to information dissemination but extends to validation of risk findings, identification of vulnerable groups and co-definition of adaptation priorities. Engagement activities are aligned with the iterative logic of the CLIMAAX framework and directly inform methodological refinement.

Institutional and Sectoral Participation

The engagement process has involved representatives from:

- Silistra Municipal Administration (environment, planning, infrastructure, social services and emergency management units);
- Regional Directorate of Fire Safety and Population Protection – Silistra;
- Regional Directorate of Agriculture – Silistra;
- Regional environmental and water authorities;
- Agricultural producers and business representatives;
- Civil society organisations and local community actors;
- Academic and expert community.

Participation was ensured through a combination of formats, including a kick-off meeting, thematic workshops, public presentations, press communication, targeted consultations and structured stakeholder questionnaires. Communication materials were adapted to different audiences, with technical detail provided for expert stakeholders and simplified explanatory formats used for broader community engagement.

Stakeholder Questionnaire – Key Findings

To deepen the participatory component in Phase 2, a structured stakeholder questionnaire was conducted. The survey aimed to:

- Identify perceived priority climate hazards;
- Assess perceived levels of exposure and vulnerability;
- Evaluate institutional preparedness and coordination;
- Collect recommendations for improving local adaptation capacity.

The responses indicate a high level of awareness of flood and heavy rainfall risks, which were consistently ranked among the most significant climate threats to the municipality. Drought and agricultural impacts were also identified as critical concerns, particularly by representatives of the agricultural sector.

1. Приоритизация на климатичните рискове съгласно CLIMAAX Доклад 2 Във Фаза 2 на проекта са идентифицирани следните приоритет...а степен сте съгласни с тази приоритизация?
25 отговора

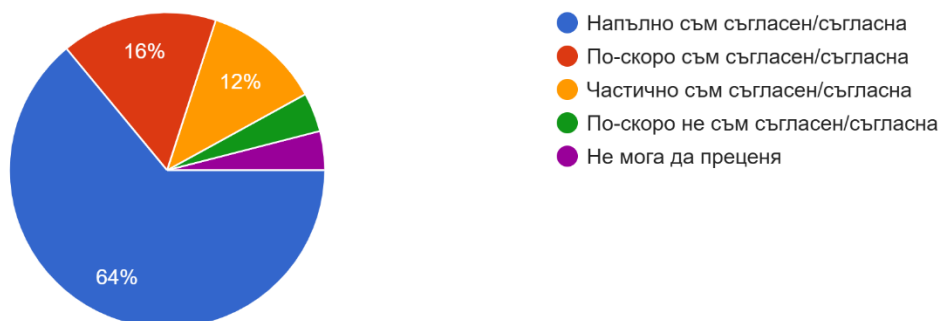


Figure 1 - Prioritisation of climate risks outlined in Deliverable 2

64% of the respondents agree that the highest priority should be given to Agricultural drought, Heavy rainfall and River floods.

2. Собствена приоритизация на климатичните рискове Моля, подредете следните климатични рискове според тяхната значимост за Община Силистра (1 = най-висок приоритет, 5 = най-нисък приоритет):

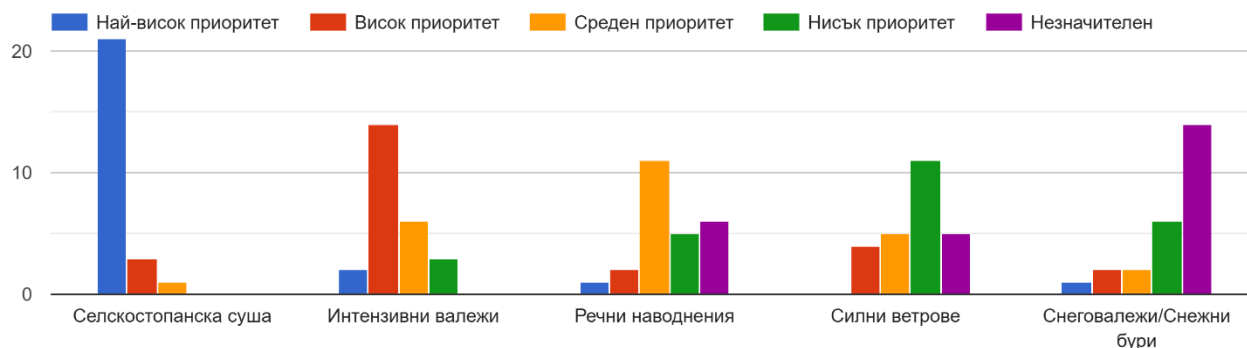


Figure 2 – Own prioritisation

When asked to prioritise the climate risks for Silistra on the basis of their expertise and/or perception, the respondents identified Agricultural drought as the risk with the highest priority and Snow – as the risk with the lowest priority.

3. Адекватност на наличните местни данни Според Вас, доколко наличните местни данни са достатъчни и надеждни за оценка на климатичните рискове в Община Силистра?
25 отговора

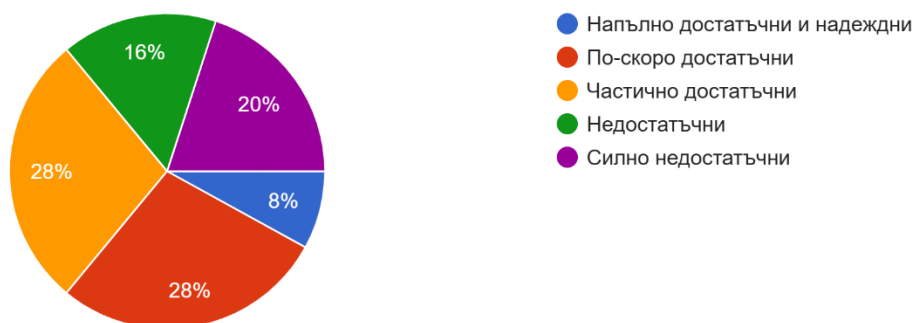


Figure 3 – Availability and reliability of local climate data

Around 64% in total of the respondents consider the availability and reliability of local climate data as sufficient or partially sufficient, whereas the remaining part considers them mostly as severely insufficient (20%).

4. Области с недостиг или фрагментация на данни В кои области според Вас има недостиг или фрагментираност на местни данни? (Възможни са повече от един отговор.)

25 отговора

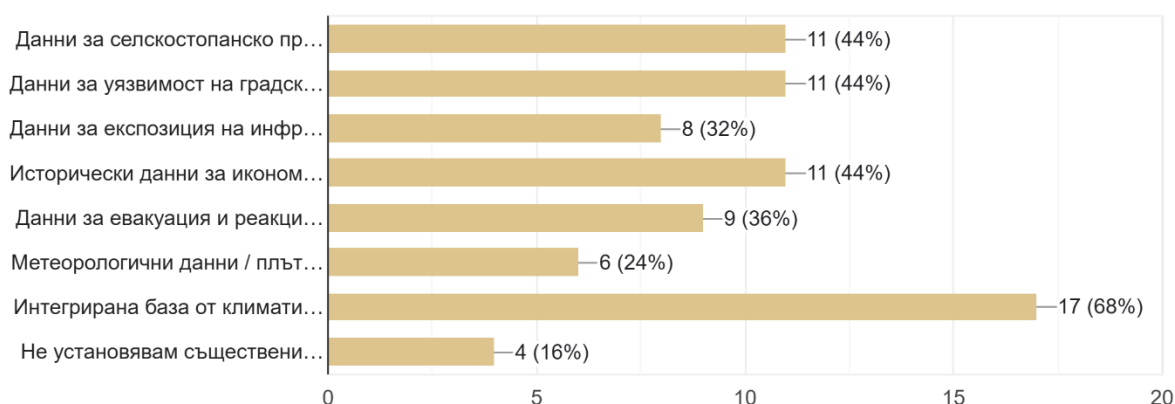


Figure 4 – Areas with lack of data or fragmented data

Most of the respondents (68%) consider the lack of integrated climate database as the major shortcoming, followed by data about agricultural production and irrigation, vulnerability and exposure of the urban infrastructure.

In summary, the key findings from the questionnaire include:

- Increasing concern regarding prolonged drought periods and their impact on agricultural productivity;
- Consensus that river flooding along the Danube remains the most severe and systemic risk
- Recognition of insufficient irrigation infrastructure as a structural vulnerability;
- Perceived gaps in inter-institutional coordination and early warning communication;
- Demand for more detailed, up-to-date local data to support planning and investment decisions.

Several respondents emphasized that socio-economic vulnerability – particularly aging population, rural depopulation and limited financial capacity – amplifies the consequences of climate hazards. This aligns with the analytical findings of the CRA and reinforces the need to integrate social vulnerability indicators into risk prioritisation.

Integration of Feedback into Phase 2

The feedback received has directly influenced the design and implementation of Phase 2. Specifically:

- Greater emphasis was placed on refining local exposure and vulnerability data;
- Agricultural drought was expanded as a priority hazard workflow;
- Additional effort was made to validate results against local sectoral knowledge;
- Cross-hazard interactions were considered more explicitly;
- Stakeholder consultation was extended beyond initial pilot validation.

Stakeholders also recommended establishing a more permanent coordination mechanism for climate risk management. While such a mechanism has not yet been institutionalised, the CRA process has created a foundation for structured inter-institutional cooperation.

Challenges and Lessons Learned

Several challenges were identified during stakeholder engagement:

- Limited availability of detailed and spatially consistent local datasets;
- Uneven levels of technical expertise among participants;
- Fragmented communication between municipal, regional and national institutions;
- Difficulty translating complex climate modelling outputs into practical planning guidance.

These challenges were not treated as procedural obstacles but as analytical insights. They shaped the orientation of Phase 2 toward clearer communication of results, stronger data documentation and enhanced integration of stakeholder knowledge.

From Consultation to Co-Creation

Compared to Phase 1, stakeholder engagement in Phase 2 has evolved from primarily consultative validation toward structured co-creation of knowledge. By combining technical modelling with local expertise and risk perception, the Climate Risk Assessment strengthens institutional ownership and improves the relevance of adaptation planning.

This participatory approach enhances the legitimacy of the CRA findings and increases the likelihood that risk prioritisation will translate into actionable measures within municipal planning instruments and future adaptation strategies.

2.2 Risk Exploration

2.2.1 Screen risks (selection of main hazards)

New Developments Compared to Deliverable 1

Phase 2 builds upon the preliminary hazard screening conducted in Deliverable 1 and moves from exploratory validation toward refined prioritisation and spatial differentiation of risks. While Phase 1 focused on testing selected workflows, Phase 2 strengthens analytical depth through:

- Integration of higher-resolution local exposure and vulnerability datasets, including population density, land-use categories, socio-economic indicators and critical infrastructure layers;
- Use of Copernicus Climate Change Service (C3S) datasets and downscaled climate projections to assess future changes in hazard frequency and intensity;
- Improved spatial overlay analysis identifying intersections between hazard footprints and exposed assets;
- Systematic comparison of current and projected impacts across short-, medium- and long-term horizons.

This refinement allows a more evidence-based prioritisation of hazards relevant to Silistra Municipality.

Observed and Projected Hazard Context

Historical records from NIMH, river gauge stations and municipal emergency reports confirm the occurrence of:

- River flood events associated with Danube water level fluctuations;
- Localised surface flooding caused by short-duration intense rainfall;
- Recurrent drought periods affecting agricultural production;
- Occasional winter snowstorms and wind events disrupting transport and services.

Climate projections from CLIMAAX workflows and Copernicus datasets indicate:

- Projected temperature increase of approximately +2–3°C by 2041–2070 under RCP4.5 and RCP8.5 scenarios;
- Increased variability in precipitation patterns;
- Higher probability of extreme rainfall events;
- Longer and more frequent summer dry periods.

These projected trends reinforce the relevance of the observed hazard profile rather than introducing fundamentally new risk types.

Prioritised Hazards for Phase 2

Based on screening criteria—frequency, observed impact, projected future change, stakeholder concern and sectoral relevance—the following hazards were selected for detailed assessment in Phase 2:

Table 2.2. Phase 2 risks

Risk	Rationale
River flooding	High material damage potential; exposure of residential areas, municipal infrastructure and economic assets in low-lying Danube floodplains.
Heavy rainfall / short-duration intense precipitation	Frequent localised events causing urban flooding, drainage overload and service disruption.
Drought / prolonged dry periods	Direct impact on agriculture, food processing and water resources; high socio-economic relevance.
Snow and strong winds	Recurrent operational disruption of transport networks and municipal services during winter periods.

The selection reflects both current exposure patterns and projected increases in hazard intensity or frequency. Other hazards, such as wildfires, were screened but excluded due to limited relevance given Silistra’s land-use structure, vegetation profile and historical incident records.

Spatial Prioritisation and Hotspots

Phase 2 spatial mapping identifies hazard-specific hotspots:

- **River flooding:** Danube floodplain zones, low-lying residential areas and industrial sites along the river corridor;
- **Heavy rainfall:** Urban neighbourhoods with insufficient drainage capacity;
- **Drought:** Large-scale arable land areas dominated by wheat, maize and sunflower;
- **Snow and wind:** Peripheral transport corridors and exposed rural settlements.

Overlay analysis demonstrates concentration of risk where hazard intensity intersects with high exposure and limited adaptive capacity. Risk matrices further indicate that drought and heavy rainfall show the strongest projected increase in long-term severity, while river flooding maintains high consequence potential even under stable frequency conditions.

Available Data Sources

The screening process relies on a combination of:

- Historical meteorological and hydrological records (NIMH, river gauge data);
- Municipal emergency and disaster response reports;
- Local spatial datasets (population, land use, infrastructure);
- CLIMAAX hazard workflows and downscaled climate projections;
- Outputs from Phase 1 risk exploration.

This combination ensures both consistency with the CLIMAAX methodology and contextualisation within local realities.

Identified Knowledge Gaps

Despite improvements in Phase 2, several knowledge gaps remain:

- Limited high-resolution data on urban drainage system vulnerability;
- Incomplete quantitative assessment of socio-economic impacts for heavy rainfall events;
- Need for updated agricultural vulnerability datasets under changing climate conditions;
- Requirement for continued stakeholder validation of scenario plausibility and acceptable risk thresholds.

These gaps are explicitly acknowledged and will inform future refinement and Phase 3 adaptation planning.

Conclusion of Risk Screening

The refined screening process confirms that river flooding, heavy rainfall, drought and winter-related hazards constitute the most relevant climate risks for Silistra Municipality under current and projected future conditions. The combination of observed impacts, spatial exposure patterns and projected climatic changes justifies their prioritisation for detailed assessment in Phase 2.

The outputs of Risk Exploration provide a structured analytical basis for subsequent vulnerability analysis, risk quantification and adaptation option development in Phase 3.

2.2.2 Choose Scenario

Future climate and socio-economic conditions for Silistra Municipality were selected in accordance with the CLIMAAX Framework and grounded in locally observed trends, regional climate projections and the specific territorial characteristics of the Danube riverine and agricultural context.

The scenario design does not attempt to explore all theoretical climate futures. Instead, it focuses on decision-relevant and plausible developments that are already observable and are expected to intensify under continued warming.

Selection of Future Climate Conditions

The selected future climate conditions reflect the dominant risk drivers for Silistra and correspond directly to the hazards prioritised in Phase 2. These include:

- **Changes in precipitation patterns**, characterised by longer dry periods combined with short-duration intense rainfall events;
- **Increased probability and magnitude of river flooding**, particularly linked to the hydrological regime of the Danube River and upstream basin processes;
- **Rising average and extreme temperatures**, leading to increased drought frequency, heat stress and pressure on water resources.

Climate projections from CLIMAAX workflows and Copernicus Climate Atlas datasets indicate a projected temperature increase of approximately +2–3°C by 2041–2070 under RCP4.5 and RCP8.5 scenarios. In parallel, increased precipitation variability and higher frequency of extreme rainfall events are expected, alongside longer summer dry spells.

These projections are consistent with:

- Observed local meteorological trends;
- The hydrological risk profile of the Danube basin;
- Findings from regional drought and agricultural studies previously referenced in the annexes.

The selected climate conditions therefore represent a continuation and amplification of already documented hazard patterns rather than a speculative shift toward entirely new risk categories.

Selection of Socio-Economic Development Pathways

Future socio-economic developments were defined using national statistical data, demographic projections and the 2025 Institute for Market Economics (IME) report, which provides a detailed socio-economic profile of Silistra district.

The following structural trends were incorporated into the scenario logic:

- Continued population decline and demographic ageing, positioning Silistra among the districts with the most unfavourable demographic indicators in Bulgaria;
- Shrinking labour force and increasing dependency ratios;
- Limited economic diversification and strong reliance on agriculture and low value-added activities;
- Persistently low income levels and constrained municipal investment capacity;
- High dependence on climate-sensitive sectors, particularly cereal and oilseed production;

- Limited prospects for structural economic transformation in the medium term.

These trends significantly influence both exposure and vulnerability. Demographic ageing reduces adaptive capacity, while economic concentration in agriculture amplifies sensitivity to drought and extreme precipitation. Limited fiscal capacity constrains infrastructure upgrading and proactive adaptation investment.

The scenario therefore assumes structural socio-economic vulnerability will remain high or intensify over the coming decades unless targeted interventions are implemented.

Integration of Climate and Socio-Economic Assumptions

Following the CLIMAAX risk logic, risk is understood as the interaction between:

- Hazard (climate-driven events and trends),
- Exposure (population, infrastructure, economic assets),
- Vulnerability (sensitivity and adaptive capacity).

Rather than constructing fully quantitative integrated socio-economic scenarios, the project applies a scenario-consistent analytical approach:

- Climate projections determine future hazard intensity and frequency;
- Socio-economic trends inform changes in exposure distribution and vulnerability structure;
- Combined effects are analysed through sectoral and spatial overlay assessment.

For example:

- Increasing drought frequency, combined with ageing rural populations and limited irrigation infrastructure, heightens vulnerability of agricultural systems;
- Intensified precipitation and flood hazards, combined with constrained municipal investment capacity and ageing infrastructure, increase residual risk in flood-prone settlements;
- Demographic decline may reduce absolute exposure in some areas but simultaneously weaken response and recovery capacity.

This approach ensures internal consistency between climate and socio-economic assumptions while remaining proportionate to data availability and municipal planning scale.

Time Horizons

In line with the CLIMAAX Handbook, the assessment considers multiple time horizons to capture the dynamic evolution of risk:

- **Short-term horizon (up to 5 years)** - Reflects current climate variability and existing socio-economic conditions. Supports immediate preparedness and operational planning.
- **Medium-term horizon (20–30 years)** - Aligns with municipal development cycles and demographic projections. Captures structural socio-economic change and more pronounced climate trends.
- **Long-term horizon (50+ years)** - Explores sustained warming impacts and long-term demographic decline. Supports anticipatory and strategic adaptation planning.

The use of differentiated time horizons enables the municipality to understand not only present and emerging risks but also how risk hierarchies may shift over time. For example, drought-related risks may intensify gradually but systematically, while river flood risk may remain episodic yet high-consequence.

Consistency with Local Studies and Planning Frameworks

The selected scenario assumptions are consistent with:

- The Integrated Development Plan of Silistra Municipality (2021–2027, updated 2024);
- The Municipal Disaster Protection Plan;
- IME 2025 socio-economic analysis;
- Agricultural land-use data (BANSIK 2025);
- Findings from regional drought and extreme precipitation studies referenced in the annexes;
- Basin Directorate assessments regarding Danube flood risk (BG1_APSFR_DU_001).

This ensures that scenario selection is not abstract but anchored in documented local conditions and strategic planning documents.

Conclusion of Scenario Selection

The chosen climate and socio-economic conditions represent a plausible and policy-relevant future for Silistra Municipality. They reflect:

- Intensification of already observed hazard patterns;
- Persistence of structural socio-economic vulnerability;
- Strong interdependence between agricultural, hydrological and demographic dynamics.

This scenario framework provides a coherent analytical foundation for the subsequent risk assessment and prioritisation stages in Phase 2 and supports the development of adaptation options in Phase 3.

2.3 Regionalized Risk Analysis

Due to space limitations within the main body of Deliverable 2, the detailed hazard and risk assessments for the identified priority climate risks in the Municipality of Silistra are provided as separate annexes. These annexes document the full workflow implementation, including hazard modelling, vulnerability and exposure analysis, and quantitative risk estimation. The present section provides a concise synthesis of the applied methodologies and key outcomes for each hazard, with explicit references to the corresponding annexes.

2.3.1 River floods

Methodological approach

The river flood assessment integrates:

- JRC flood hazard maps (baseline conditions),
- Aqueduct Floods climate-adjusted projections (RCP4.5 and RCP8.5),

- Danube River Basin Directorate FRMP 2022–2027 maps,
- Local Danube water-level records,
- CORINE land cover,
- Municipal infrastructure and demographic datasets,
- Depth–damage economic loss functions.

Flood hazard modelling is hydrodynamically driven and depth-based. Economic losses are derived through grid-level flood depth combined with land-cover-specific vulnerability curves.

Hazard characteristics

The analysis confirms that flood hazard in Silistra is structurally controlled by Danube water levels and floodplain geomorphology. The most exposed zone is the **Aydemir lowland**, characterized by minimal elevation above river level and limited drainage gradients.

Return-period modelling shows:

- RP10 events generate 1–2 m inundation in lowland areas.
- RP50–RP100 increase depth rather than spatial footprint.
- Climate-adjusted scenarios show slight depth reductions (~0.2–0.4 m), but **no redistribution of exposure clusters**.

This is a critical finding: flood hazard intensity may not increase, yet structural exposure persists.

Risk characteristics

Economic losses are concentrated in:

- The eastern Aydemir lowland,
- The Danube industrial corridor,
- Railway and port-related infrastructure.

Under RP100:

- Direct building losses ≈ €66 million.
- ~6,600 residents exposed.
- ~5,800 residents potentially displaced.

Under RP500:

- Losses increase primarily through depth intensification, not new floodplain expansion.

Validation

Comparison with official FRMP maps shows strong spatial agreement. The same industrial and agricultural clusters are identified as high-risk zones in both datasets. Minor discrepancies are attributable to modelling resolution differences.

Interpretation

River flood risk in Silistra is **structurally concentrated and persistent**. Even without projected hazard intensification, exposure concentration ensures continued high-impact potential.

Detailed results and maps are presented in **Annex A – River Floods**.

2.3.2 Heavy rainfall

Methodological refinement

Deliverable 2 introduces a major methodological advancement: local threshold calibration.

Instead of using the generic 100 mm / 24h threshold, empirical analysis of municipal damage records (≈15 documented events since 2000) identifies two locally validated impact levels:

- **20 mm / 24h** → localized flooding and minor damage.
- **50 mm / 24h** → municipality-wide impacts and infrastructure damage.

This calibration aligns climate modelling with actual vulnerability conditions.

Hazard dynamics

RCP8.5 projections (2041–2070) show:

- 3-hour extremes increase by ~12–15%.
- 24-hour precipitation increases by ~10–25%.
- The return period for >50 mm events decreases from ~1 in 10 years to ~1 in 5–6 years in northern Silistra.

This represents a **doubling of recurrence frequency** for events already associated with major damage.

Spatial pattern

Repeatedly affected settlements include:

- Aydemir,
- Srebarna,
- Smilets,
- Bogorovo.

Urban drainage limitations and slope instability amplify vulnerability.

Observational support

Regional station data confirm post-1990 intensification of extreme rainfall, especially in summer months, consistent with projections.

Interpretation

Heavy precipitation emerges as the most dynamically intensifying rapid-onset hazard. Unlike river flooding, which is geomorphologically constrained, intense rainfall increasingly stresses urban drainage systems and local infrastructure.

Detailed results are provided in **Annex B – Heavy Rainfall**.

2.3.3 Agricultural Drought

Methodological approach

Agricultural drought assessment uses five independent GCM–RCM combinations under RCP8.5 and evaluates:

- Precipitation,
- Potential evapotranspiration (ET_o),
- Soil water capacity (0–200 cm),
- Crop-specific drought sensitivity,
- Municipal crop distribution.

Drought is defined not as rainfall collapse but as a **persistent negative water balance**:

Evapotranspiration demand exceeds rainfall supply during the growing season.

Physical mechanism

Across all models:

- Soil storage capacity remains relatively high (280–400 mm).
- Growing-season ET_o ranges from 1,080 to 1,440 mm.
- Precipitation remains moderate (400–600 mm annually).

The structural drought driver is rising evaporative demand.

Crop vulnerability differentiation

- **Maize**: 24–64% yield reduction (most sensitive).
- **Sunflower**: 16–36%.
- **Wheat & barley**: ≤20% (winter phenology advantage).

Economic impact

Projected maize losses consistently range between €500,000–1,000,000 across model chains. Sunflower represents the second-highest risk crop.

The analysis demonstrates that rain-fed maize production may become economically marginal by the end of the century without irrigation expansion.

Observational validation

Regional studies confirm:

- +0.5°C per decade warming,
- Longer dry spells,
- Increasing irrigation requirements,
- Increasing evapotranspiration.

Interpretation

Agricultural drought represents the **most structurally consistent and systemic long-term hazard** in Silistra. Unlike heavy precipitation (frequency-driven) or flooding (exposure-driven), drought risk is driven by fundamental climatic water imbalance.

Detailed analyses and results are presented in **Annex C – Agricultural Drought**.

2.3.4 Wind

Wind hazard was assessed through cyclone-track modelling and 3-second gust simulations.

The closest significant historical storm (Dec 1999) generated maximum gusts of ~19 m/s, below typical structural damage thresholds (25–33 m/s).

Flat terrain and absence of orographic amplification limit extreme gust potential.

Municipal records show episodic yellow/orange warnings but no documented large-scale structural damage.

Interpretation

Wind hazard remains a **low-probability, low-impact** risk relative to other assessed hazards. No robust climate-driven intensification signal was identified.

Detailed information is provided in **Annex D – Wind**.

2.3.5 Snow

Snow hazard assessment combines ERA5 reanalysis and RCM projections under RCP2.6.

Findings show:

- Blizzard frequency 1–2% baseline.
- Heavy snowfall (>25 cm) episodic.
- Mid-century projections indicate declining snowfall.

Exposure is municipality-wide due to coarse resolution but impacts are primarily operational (transport disruption) rather than structural.

Municipal records confirm occasional warnings but no major economic losses.

Interpretation

Snow hazard is declining under warming conditions and represents a low structural risk.

Detailed results are included in **Annex E – Snow**.

2.4 Key Risk Assessment Findings

The assessment of key climate risks for the Municipality of Silistra was conducted in accordance with the CLIMAAX Key Risk Assessment Protocol and builds directly on the analytical results presented in Section 2.3 and Annexes A–E. This step does not introduce new hazards; rather, it systematically compares and prioritises previously identified risks by evaluating their relative importance under current conditions and projected climate futures.

The Key Risk Assessment translates modelling outputs into decision-relevant judgments using three complementary evaluation dimensions defined by the CLIMAAX framework:

1. **Severity of impacts** – magnitude of potential damage to population, infrastructure, economic activities and ecosystems;
2. **Urgency of action** – likelihood of risk escalation and time-sensitivity of intervention;
3. **Capacity to respond** – institutional, technical and financial ability of the municipality to manage or reduce the risk.

This structured evaluation was carried out through a combined analytical and participatory logic, incorporating quantitative model outputs, official planning documents, municipal expert input and stakeholder feedback collected during Phase 2.

2.4.1 Mode of engagement for participation

Stakeholder engagement within the Key Risk Assessment phase for the Municipality of Silistra was organised as a targeted, technically structured and evidence-based process, in accordance with the CLIMAAX Key Risk Assessment Protocol. Building on the broader participatory activities conducted during Phase 1 and described in Section 2.1.5, this stage focused specifically on the interpretation and prioritisation of already identified climate risks rather than on the identification of new hazards.

The objective of engagement at this stage was to translate quantitative modelling outputs into informed qualitative judgments regarding three evaluation dimensions: severity of impacts, urgency of action and capacity to respond. The process therefore moved from exploratory consultation toward structured risk evaluation.

Engagement was carried out through focused technical consultations and moderated discussions involving representatives of the municipal administration and sectoral experts directly responsible for climate risk management and adaptation. Participants included experts from municipal units responsible for environmental protection, spatial planning, infrastructure, agriculture, social services and civil protection, as well as specialists contributing climate, hydrological and socio-economic data to the assessment. This configuration ensured that the prioritisation process was grounded in institutional knowledge, operational experience and planning realities.

Priority and vulnerable groups were represented indirectly through the competent municipal departments responsible for social services, disaster protection and territorial planning. These departments incorporate the perspectives of flood-prone communities, agricultural producers, elderly populations and socially vulnerable households identified during earlier assessment stages. Given the municipal scale of the analysis and the institutional structure of representation, this indirect model was considered appropriate and proportionate for the Key Risk Assessment phase.

The CLIMAAX evaluation dashboard was used as the principal facilitation instrument. It provided a transparent framework for reviewing model outputs and systematically comparing risks across hazards. Agricultural drought, heavy rainfall and river flooding were assessed against the three evaluation dimensions, with structured discussion on:

- spatial concentration of impacts (e.g. Danube floodplain, main agricultural areas),
- projected intensification trends,
- cumulative economic implications,
- institutional and financial response capacity.

The dashboard approach supported comparability between hazards and made underlying assumptions, modelling uncertainties and data limitations explicit. Where necessary, model results were clarified through reference to annex-level findings to ensure consistency between quantitative outputs and qualitative scoring.

Feedback from participants confirmed the analytical relevance of the identified key risks and their spatial concentration patterns, particularly in the Aydemir floodplain and the municipality's dominant agricultural zones. Stakeholders emphasised constraints affecting response capacity, including ageing drainage infrastructure, limited financial resources, fragmented investment planning and the need for stronger inter-institutional coordination. These considerations were explicitly incorporated into the evaluation of resilience capacity and influenced the final prioritisation.

Where differences in perception emerged – particularly regarding the urgency of agricultural drought versus heavy precipitation – these were addressed through clarification of climate projections, discussion of ensemble modelling results and review of documented local impacts. The process did not rely on formal consensus voting; instead, it aimed at informed convergence based on shared analytical understanding.

Overall, the engagement process strengthened institutional ownership of the risk findings, improved alignment between modelling results and practical governance considerations, and established a coherent basis for the identification and prioritisation of adaptation measures in Phase 3.

Future project phases will broaden participation beyond institutional actors to include a wider range of stakeholders and affected groups in the co-development and evaluation of adaptation options, ensuring continuity between risk prioritisation and implementation planning.

2.4.2 Gather output from Risk Analysis step

The Key Risk Assessment for the Municipality of Silistra builds directly on the outputs generated during the Risk Analysis stage (Section 2.3 and Annexes A–E). This step does not introduce new quantitative modelling; instead, it systematically extracts, organises and interprets existing analytical results so that they can be evaluated qualitatively against the CLIMAAX criteria of severity, urgency and capacity to respond.

The collection of outputs followed the hazard–exposure–vulnerability structure applied in the risk analysis workflows.

Hazard-related outputs

For each priority hazard – river flooding, heavy rainfall, agricultural drought, wind and snow – the following hazard characteristics were compiled:

- **Intensity indicators** (e.g. flood depth by return period, 3-hour and 24-hour precipitation amounts, projected evapotranspiration levels, maximum wind gusts, snowfall thresholds);
- **Frequency or probability metrics** (e.g. return periods, exceedance frequencies, projected shifts in recurrence under RCP scenarios);
- **Spatial extent of affected zones**, including floodplains, repeatedly flooded settlements and drought-sensitive agricultural areas;
- **Projected future trends**, based on mid-century and end-of-century climate scenarios (RCP4.5, RCP8.5 and RCP2.6 where applicable).

This information enabled a consistent comparison of hazards in terms of both present-day impacts and future climate-driven changes.

Exposure-related outputs

The risk analysis stage generated detailed information on spatial exposure patterns, which were consolidated for the Key Risk Assessment. These include:

- Distribution of population and potentially displaced residents under flood scenarios;
- Location of residential, industrial and commercial zones within flood-prone areas;
- Extent and economic significance of rain-fed agricultural land;
- Transport infrastructure and technical systems exposed to flooding or intense precipitation;
- Settlement-level concentration of impacts (e.g. Aydemir lowland, Danube industrial corridor, main agricultural zones).

These exposure datasets were critical for interpreting hazard intensity in relation to socio-economic relevance. For example, moderate flood depth in sparsely populated agricultural land carries different implications than similar depth within industrial corridors or residential clusters.

Vulnerability-related outputs

Where quantitative indicators were available, vulnerability was derived from:

- Crop-specific sensitivity parameters (agricultural drought workflow);
- Building typology and land-cover-based damage functions (flood workflow);
- Urban drainage limitations identified through municipal records (heavy rainfall workflow).

In addition, qualitative vulnerability considerations were incorporated, including:

- Dependence of the local economy on agriculture;
- Limited irrigation coverage;
- Ageing infrastructure;
- Financial and institutional constraints identified during stakeholder engagement;

- Demographic characteristics such as ageing population and vulnerable households in flood-prone areas.

In cases where formal quantitative vulnerability indices were not available, vulnerability was interpreted through institutional and sectoral expertise, in line with the CLIMAAX Framework's guidance for qualitative supplementation of model-based outputs.

Synthesis for Key Risk Evaluation

All relevant outputs from the Risk Analysis stage were consolidated into a structured summary format suitable for discussion within the CLIMAAX evaluation dashboard. For each hazard, the following consolidated profile was prepared:

1. Current hazard magnitude and documented impacts;
2. Projected change in intensity and/or frequency;
3. Spatial concentration of exposure;
4. Estimated economic consequences;
5. Identified vulnerability drivers;
6. Institutional response constraints.

This synthesis allowed stakeholders to move from raw model outputs to comparative evaluation. Rather than treating hazards independently, the dashboard facilitated cross-hazard comparison under a consistent interpretative structure. Importantly, uncertainties identified during modelling – such as inter-model variability in drought projections or resolution limitations in snow hazard analysis – were explicitly acknowledged in the synthesis phase. These uncertainties were not treated as analytical weaknesses but as contextual factors influencing urgency and confidence levels in prioritisation.

2.4.3 Assess Severity

The assessment of risk severity for the Municipality of Silistra combines quantitative outputs from the Risk Analysis stage (Section 2.3 and Annexes A–E) with expert and institutional judgment, in accordance with the CLIMAAX Key Risk Assessment Protocol. Severity reflects the magnitude, spatial extent and systemic implications of impacts on population, economic activities, infrastructure and ecosystems, taking into account both historical experience and projected future developments. Severity was assessed separately for current and future climate conditions using the four CLIMAAX protocol-defined categories: **limited, moderate, substantial and critical**. The classification considers not only direct physical damage, but also economic disruption, social consequences, recovery time and potential for long-term or irreversible effects.

Severity of Current Climate Risks

Agricultural Drought – Substantial

Under current climate conditions, agricultural drought is assessed as a risk of **substantial severity**.

Historical observations and recent experience confirm recurring impacts on crop yields, particularly for maize and sunflower, which are central to the local agricultural economy. The municipality's strong dependence on rain-fed agriculture amplifies the socio-economic significance of drought impacts. Financial stress for farmers, fluctuating production volumes and reduced income stability have been repeatedly observed. Impacts are spatially widespread across agricultural land, but they

have not yet resulted in irreversible loss of agricultural capacity or large-scale abandonment of land. For this reason, the severity remains below the critical threshold under present conditions.

River Flooding – Substantial

River flooding is assessed as **substantial severity** under current conditions.

Although extreme flood events are episodic rather than annual, the spatial concentration of exposure in the Aydemir lowland and the Danube industrial corridor leads to high-impact scenarios when events occur. Modelled losses under RP100 events exceed €60 million, and thousands of residents may be exposed or temporarily displaced. The combination of concentrated urban and industrial exposure, infrastructure vulnerability and limited financial capacity for large-scale recovery elevates flood risk to substantial severity, even in the absence of frequent catastrophic events.

Heavy Rainfall – Substantial

Heavy rainfall is also assessed as **substantial severity**.

Short-duration intense precipitation events have repeatedly caused surface flooding, damage to buildings, disruption of transport and strain on drainage systems. While individual events may be localised, their recurrence and cumulative economic effects increase their systemic importance. Given the documented doubling of high-impact rainfall frequency in projections and the sensitivity of urban infrastructure, heavy precipitation represents a structurally significant hazard under current conditions.

Wind – Limited

Wind-related hazards are classified as **limited severity**.

Available analyses indicate that maximum gust speeds remain below structural damage thresholds. Documented impacts are rare and generally minor. No significant economic losses or large-scale service disruptions attributable to wind have been recorded at municipal scale.

Snow and Blizzard – Limited

Snow-related hazards are also assessed as **limited severity** under current conditions.

Heavy snowfall and blizzard events occur infrequently and typically result in short-term mobility constraints rather than structural damage. Recovery capacity is adequate, and systemic impacts are limited.

Severity of Future Climate Risks

Severity was reassessed under projected future climate conditions, incorporating mid-century and end-of-century scenarios.

Agricultural Drought – Critical (Future)

Agricultural drought is projected to escalate to **critical severity**.

Model ensembles indicate substantial yield reductions for maize (up to 60% in some configurations) and significant losses for sunflower. Increasing evapotranspiration, longer dry periods and rising temperatures create a persistent negative water balance during the growing season. Unlike flood or rainfall events, drought impacts are cumulative and slow-onset. The potential consequences include:

- Long-term degradation of agricultural systems,
- Declining soil productivity,
- Structural income loss in rural areas,
- Increased socio-economic vulnerability,
- Possible abandonment of marginal agricultural land.

The combination of systemic economic relevance and potential for irreversible consequences justifies classification as critical under future scenarios.

River Flooding – Substantial to Critical (Future)

River flooding is assessed as moving toward the upper bound of **substantial**, potentially reaching **critical severity** under future conditions.

Although some climate projections show slight reductions in flood depth, exposure patterns remain unchanged. The persistence of high-value assets in the floodplain means that even without hazard intensification, the scale of potential damage remains high. If extreme precipitation events intensify and upstream basin dynamics change, the potential for larger or more complex flood events may increase, raising the risk of cascading impacts such as:

- Disruption of transport corridors,
- Interruption of utilities,
- Extended recovery periods.

For these reasons, flood severity under future conditions is assessed as bordering on critical.

Heavy Rainfall – Critical (Future)

Heavy rainfall is assessed as reaching **critical severity** under future conditions.

Projections indicate increased intensity and a doubling of recurrence frequency for locally validated high-impact precipitation events. This implies:

- More frequent urban flooding,
- Increased infrastructure damage,
- Greater cumulative financial burden,
- Higher probability of cascading failures in transport, water and energy systems.

Given the structural limitations of existing drainage infrastructure and limited investment capacity, repeated high-intensity events may produce long-term degradation of urban resilience.

Wind – Limited (Future)

Wind-related risks remain **limited severity** in future scenarios. Available projections do not indicate a significant increase in frequency or intensity sufficient to justify reclassification.

Snow – Limited (Future)

Snow and blizzard risks remain **limited severity**. Projections consistently show declining snowfall frequency under warming conditions.

Cascading Effects and Irreversibility

Several high-severity risks – particularly drought, flooding and heavy rainfall – carry potential for cascading and long-term effects.

- Prolonged drought may lead to soil degradation, biodiversity loss and structural decline in agricultural productivity.
- Floods and intense rainfall can cause damage requiring reconstruction rather than repair.
- Repeated infrastructure damage may weaken municipal finances and reduce adaptive capacity over time.
- Socially vulnerable groups, especially elderly and low-income households, may experience disproportionate impacts and slower recovery.

The potential for cascading economic and social effects was explicitly considered in elevating certain risks to critical severity under future scenarios.

Role of Expert and Stakeholder Perspectives

Institutional and expert input enriched the severity assessment by identifying impacts not fully captured in model outputs. Municipal technical experts highlighted vulnerabilities in drainage systems and infrastructure maintenance. Agricultural specialists emphasised the long-term economic implications of declining yield stability. Social services representatives underlined the disproportionate burden on vulnerable populations. Where uncertainties existed – particularly regarding the pace of drought escalation – a precautionary but evidence-based approach was adopted, consistent with CLIMAAX guidance.

Summary of Severity Assessment

Under current conditions:

- Agricultural drought – Substantial
- River flooding – Substantial
- Heavy rainfall – Substantial
- Wind – Limited
- Snow – Limited

Under future conditions:

- Agricultural drought – Critical
- Heavy rainfall – Critical
- River flooding – Substantial to Critical
- Wind – Limited
- Snow – Limited

The severity assessment confirms that agricultural drought, river flooding and heavy rainfall constitute the dominant climate risks for Silistra, with projected escalation under future climate

scenarios. This provides a robust and evidence-based foundation for the subsequent evaluation of urgency, response capacity and final prioritisation.

2.4.4 Assess Urgency

The assessment of urgency evaluates how soon action is required to prevent, reduce or avoid negative impacts from the priority climate risks identified for Silistra Municipality. In line with the CLIMAAX Key Risk Assessment Protocol, urgency reflects:

- The change in severity between current and future conditions
- The timing and persistence of impacts
- The speed of onset of hazardous events
- The lead time required to implement effective adaptation measures

Urgency was assessed using the four protocol-defined categories:

no action needed, watching brief, more action needed, and immediate action needed.

The evaluation combines analytical outputs from Section 2.3 with institutional judgment and stakeholder feedback gathered through the structured dashboard discussions.

River Flooding – Watching Brief / More Action Needed

River flooding is assessed as **watching brief / more action needed**.

Under current conditions, flood risk is partially mitigated by existing protective infrastructure, particularly Danube dikes and monitoring systems. Flood events are typically slow-onset, allowing early warning and emergency preparedness measures to function effectively. Future projections do not show a clear local increase in flood height, and some scenarios indicate relative stability. However, the Danube basin's large upstream catchment introduces structural uncertainty, as hydrological dynamics depend on climatic processes and water management decisions beyond municipal control. Flood impacts, while episodic, can be extremely high when events occur. Stakeholders confirmed that existing protection systems are generally effective but require continuous maintenance and periodic upgrading. Given the high potential impact but moderate projected change in hazard intensity, urgency is assessed as requiring continued monitoring, infrastructure maintenance and medium-term planning improvements rather than immediate large-scale structural expansion.

Heavy Rainfall – Immediate Action Needed

Heavy rainfall is assessed as requiring **immediate action**.

Intense short-duration precipitation events already cause repeated surface flooding, damage to buildings, strain on drainage infrastructure and disruption of services. Climate projections consistently indicate an increase in both frequency and intensity of extreme precipitation events in the near to medium term. Unlike river flooding, heavy rainfall events are sudden-onset and locally unpredictable. Reaction time once the event begins is extremely limited. Although each event is short in duration, recurrence throughout the warm season creates persistent pressure on urban systems. Stakeholders emphasised that existing measures have largely been reactive (post-event repairs) rather than preventive (drainage upgrading, nature-based solutions, spatial planning

adjustments). Given the increasing trend in severity, short warning times and structural drainage limitations, heavy rainfall justifies classification as immediate action needed.

Agricultural Drought – Immediate Action Needed

Agricultural drought is also assessed as requiring **immediate action**.

Drought impacts are already observable through yield reductions and financial instability for farmers. Future scenarios indicate substantial increases in frequency and duration of dry periods, driven by higher temperatures and reduced soil moisture availability. Although drought is a slow-onset hazard, its impacts are cumulative and persistent across growing seasons. Unlike sudden hazards, drought progressively undermines agricultural productivity, soil quality and economic viability. Importantly, adaptation measures such as irrigation development, crop diversification, soil management improvements and institutional support mechanisms require long planning and investment horizons. Delayed action increases the risk of irreversible structural decline in agricultural systems. Stakeholder consultations, particularly with agricultural representatives, highlighted limited irrigation infrastructure and increasing crop vulnerability, reinforcing the need for early and proactive intervention. For these reasons, despite its gradual onset, agricultural drought is classified as immediate action needed.

Wind – No Action Needed / Watching Brief

Wind-related hazards are assessed as **no action needed / watching brief**.

Current impacts are limited in scale and duration. Available projections do not indicate a significant future increase in frequency or intensity sufficient to alter the severity classification. While wind events are sudden-onset, they remain episodic and manageable within existing emergency response frameworks. Routine infrastructure maintenance and monitoring are considered sufficient at this stage.

Snow and Blizzard – No Action Needed / Watching Brief

Snow-related hazards are also assessed as **no action needed / watching brief**.

Extreme snowfall and blizzard events occur infrequently and are generally manageable with current response systems. Future projections suggest decreasing frequency due to warming trends. Preparedness mechanisms are already embedded in municipal winter maintenance procedures, and no structural escalation of risk is anticipated.

Comparative Interpretation of Urgency

Urgency differs significantly across hazards and is driven primarily by projected severity escalation and implementation lead times.

- **Heavy rainfall:** Immediate action needed due to increasing frequency, sudden onset and insufficient preventive infrastructure.
- **Agricultural drought:** Immediate action needed due to cumulative impacts and long implementation horizons for effective adaptation.
- **River flooding:** Watching brief / more action needed, given existing protection but high-impact potential and external basin-level uncertainties.

- **Wind and snow:** No action needed / watching brief, given limited impacts and stable or declining projections.

The urgency assessment highlights that risks with gradual onset (drought) may require more immediate strategic intervention than sudden-onset hazards (floods) when long-term systemic consequences are considered. This differentiated urgency classification provides a structured basis for the subsequent evaluation of resilience capacity and final prioritisation of climate risks in Silistra Municipality.

2.4.5 Understand Resilience Capacity

The assessment of resilience capacity for the Municipality of Silistra was conducted in accordance with the CLIMAAX Key Risk Assessment Protocol, using four qualitative categories: **low, medium, substantial and high capacity**.

Resilience capacity reflects the municipality's ability to **anticipate, prevent, absorb, respond to and recover from climate-related impacts**, taking into account institutional arrangements, financial and human resources, physical infrastructure, social structures and natural systems.

The assessment integrates documentary review, outputs from the Risk Analysis stage (Section 2.3 and Annexes A–E), expert judgment and structured stakeholder feedback gathered through the CLIMAAX evaluation dashboard. Both current capacity and expected developments were considered.

Existing Climate Risk Management Framework

At institutional level, Silistra benefits from a structured disaster risk management system. The Municipal Disaster Protection Plan is aligned with national legislation and the Unified Rescue System. Operational response capacity is supported by the Regional Directorate "Fire Safety and Population Protection" and sectoral coordination mechanisms.

Flood monitoring, meteorological warning systems and emergency procedures are in place and functional. Flood protection infrastructure along the Danube provides significant baseline protection.

However, climate adaptation as a long-term strategic function is not yet fully integrated across sectoral planning. Infrastructure systems—particularly drainage networks, irrigation facilities and parts of the urban water system—include ageing or capacity-limited components that constrain physical resilience under future climate extremes.

This creates a differentiated capacity profile: strong operational emergency response, but weaker structural and preventive adaptation capacity.

Capacity Across Key Dimensions

Financial Capacity – Limited to Medium

Financial capacity is assessed as **limited to medium**.

The municipality can mobilise resources for emergency response and short-term recovery. However, own-source revenues are insufficient for large-scale preventive investments such as drainage system modernisation, irrigation development or major nature-based solutions.

Long-term adaptation depends heavily on national and EU funding programmes. This external dependency constrains proactive investment and creates uncertainty regarding implementation timelines.

Human and Institutional Capacity – Medium

Human and institutional capacity is assessed as **medium**.

The municipality benefits from experienced disaster management personnel and functioning administrative coordination. However, structured climate risk governance—particularly in relation to long-term scenario interpretation, cascading risks and cross-sectoral integration—remains under development.

Stakeholder discussions revealed uneven levels of climate literacy and limited technical expertise in integrating long-term climate projections into spatial and sectoral planning. Capacity-building needs were explicitly identified.

Physical and Technical Capacity – Medium

Physical capacity is assessed as **medium**.

Existing flood protection infrastructure, early warning systems and emergency services provide a solid foundation. However:

- Urban drainage systems are insufficient for projected increases in extreme rainfall intensity.
- Irrigation infrastructure is largely absent, increasing agricultural vulnerability.
- Parts of the road and utility networks are ageing and sensitive to flood or heat stress.

These structural weaknesses limit the municipality's ability to absorb intensifying climate impacts.

Social Capacity – Medium

Social capacity is assessed as **medium**.

Municipal social services, community centres and local organisations provide channels for communication and assistance to vulnerable populations, including elderly and low-income households.

However, systematic public participation in climate adaptation planning is still emerging. Community-level preparedness and private sector engagement remain limited in scope, reducing broader societal adaptive capacity.

Natural and Ecosystem Capacity – Moderate

Natural capacity is assessed as **moderate**.

Agricultural land, river ecosystems and surrounding natural areas provide ecosystem services that can buffer climate impacts. However:

- High share of arable monoculture increases sensitivity to drought and intense rainfall.
- Soil degradation and water stress reduce natural buffering functions.
- Limited ecological infrastructure (e.g., buffers, wetlands, green corridors) constrains ecosystem-based resilience.

Thus, while natural systems offer adaptation potential, current land-use patterns reduce their effective buffering capacity.

Capacity by Key Risk

Resilience capacity varies significantly by hazard:

River Flooding – Substantial Capacity

Capacity to manage river flooding is assessed as **substantial**.

Existing dikes, monitoring systems and emergency coordination provide structured preparedness. However, long-term adaptation (e.g., upgrading protection standards, integrating nature-based solutions) remains dependent on external financing and basin-level coordination.

Heavy Rainfall – Medium Capacity

Capacity to address heavy rainfall is assessed as **medium**.

While emergency response is functional, preventive drainage infrastructure is insufficient for projected intensification. Urban surface runoff management and green infrastructure remain underdeveloped.

Agricultural Drought – Low to Medium Capacity

Capacity to cope with agricultural drought is assessed as **low to medium**.

The absence of irrigation systems, strong reliance on rain-fed agriculture and limited crop diversification significantly constrain adaptive capacity. Institutional agricultural advisory capacity exists, but structural adaptation mechanisms are limited.

Wind and Snow – Substantial to High Capacity

Capacity related to wind and snow hazards is assessed as **substantial to high**.

Impacts are limited in scale, and preparedness mechanisms are well established through routine emergency and maintenance procedures. Existing systems are adequate relative to the projected hazard level.

Planned and Emerging Interventions

Several initiatives may strengthen resilience capacity over time:

- Integration of climate risk considerations into strategic and spatial planning documents
- Improvement of water management and irrigation planning
- Capacity-building activities for municipal staff
- Participation in CLIMAAX and related analytical networks

However, most interventions remain in planning or early development phases. At present, they are insufficient to elevate overall resilience capacity to a high level across critical risks.

Overall Assessment

Overall resilience capacity in Silistra is assessed as **medium to substantial**, depending on hazard type and capacity dimension.

Strengths:

- Structured disaster response system
- Flood protection infrastructure
- Institutional coordination mechanisms

Weaknesses:

- Limited financial autonomy
- Ageing infrastructure
- Insufficient drainage and irrigation capacity
- Partial integration of long-term climate adaptation into planning

These capacity constraints significantly influence final risk prioritisation. High-severity and high-urgency risks—particularly agricultural drought and heavy rainfall—are amplified by medium or low resilience capacity, increasing their strategic importance.

2.4.6 Decide on Risk Priority

The prioritisation of climate risks for the Municipality of Silistra was conducted qualitatively, in accordance with the CLIMAAX Key Risk Assessment Protocol. Rather than applying numerical aggregation, risk priority was determined through structured expert judgement, supported by stakeholder input and guided by the CLIMAAX evaluation dashboard.

The prioritisation integrates the three assessment dimensions examined in Sections 2.4.3–2.4.5:

- **Severity** (current and future),
- **Urgency** (timing and need for action),
- **Resilience capacity** (institutional, financial, physical, social and natural).

The evaluation follows the CLIMAAX logic whereby risks characterised by:

- high or increasing severity,
- high urgency of action,
- and low to medium resilience capacity

are assigned higher priority for intervention.

Particular attention was given to distinguishing between current and future risk profiles. Hazards that may appear manageable today but show escalation toward critical severity under future climate scenarios were identified as strategic priorities requiring anticipatory adaptation planning.

The CLIMAAX dashboard was used as the main synthesis instrument. For each hazard, qualitative ratings for severity (current and future), urgency and resilience capacity were entered together with short, context-specific justifications. This ensured transparency and comparability across risks and made explicit the trade-offs between impact magnitude, timing of intervention and existing response capacity.

Final Risk Priority Determination

Very High Priority Risks

Agricultural Drought and **Heavy Rainfall** are identified as *very high priority risks* for Silistra.

These hazards combine:

- Substantial current severity escalating to critical under future conditions,
- Immediate action needed in terms of urgency,
- Low to medium resilience capacity.

Both risks affect multiple systems simultaneously—agriculture, population livelihoods, infrastructure, water resources and ecosystems—and have strong potential for cascading socio-economic consequences.

Agricultural drought represents a structural threat to the municipality's dominant economic sector. Heavy rainfall poses growing risks to urban infrastructure and service continuity. In both cases, adaptation measures require long planning and investment horizons, reinforcing their prioritisation.

High Priority Risk

River Flooding is classified as a *high priority risk*.

Although current and projected severity remains substantial (with potential to approach critical in extreme scenarios), resilience capacity is relatively stronger due to existing flood protection and early warning systems.

The risk remains strategically significant due to:

- Concentration of exposure in the Danube floodplain,
- High potential economic losses under extreme events,
- External hydrological uncertainty linked to upstream basin dynamics.

However, given the existing infrastructure and monitoring capacity, priority is focused on maintenance, preparedness and long-term upgrading rather than immediate large-scale expansion of defences.

Lower Priority Risks

Snow-related hazards and **Strong Winds** are assessed as *lower priority risks*.

Their severity is limited under both current and future conditions, urgency is low, and resilience capacity is substantial to high. These hazards are best addressed through routine preparedness, monitoring and targeted maintenance measures rather than strategic adaptation investment.

Table 2.3 – Key Risks Dashboard

Risk Workflow	Severity		Urgency	Capacity	Risk Priority
	C	F		Resilience/ CRM	
River flooding	Critical	Substantial	Immediate action needed	Substantial	HIGH
Heavy rainfall	Critical	Substantial	More action needed	Substantial	VERY HIGH
Drought	Critical	Substantial	More action needed	Substantial	VERY HIGH
Snow	Limited	Limited	Watching brief	Substantial	LOW
Wind	Limited	Limited	Watching brief	Substantial	LOW

Severity

- Critical
- Substantial
- Moderate
- Limited

Urgency

- Immediate action needed
- More action needed
- Watching brief
- No action needed

Resilience Capacity

- High
- Substantial
- Medium
- Low

Risk Ranking

- Very high
- High
- Moderate
- Low

Interpretation of the Dashboard Results

The final prioritisation reflects not only projected climate impacts but also the municipality's realistic capacity to respond.

- Risks with **high severity + immediate urgency + weak capacity** rise to the top (drought, heavy rainfall).
- Risks with **high impact potential but stronger existing protection** remain important but comparatively lower (river flooding).
- Risks with **limited impact and adequate capacity** are monitored but not prioritised for strategic investment (snow, wind).

The prioritisation therefore integrates both climate science and governance constraints, ensuring that Phase 3 adaptation planning is grounded in:

- Local socio-economic vulnerability,
- Infrastructure realities,
- Institutional capacity,
- And future climate projections.

This Key Risk Assessment provides a transparent and defensible foundation for directing adaptation measures, investment planning and policy integration in the subsequent phase of the CLIMAAX process for the Municipality of Silistra.

Table 2.4. CLIMAAX Key Risk Assessment – Final prioritisation for Silistra

Risk Workflow	Hazard description	Affected areas / sectors	Severity – Current	Severity – Future	Urgency	Resilience capacity	Capacity justification
River flooding	Flooding caused by high water levels of the Danube River and tributaries	Danube floodplain, Aydemir lowland, residential and industrial areas, agricultural land, transport and utilities	Substantial	Substantial–Critical	Watching brief / More action needed	Medium–Substantial	Existing flood protection, early warning and emergency response systems are in place, but ageing infrastructure, maintenance needs and exposure of assets constrain long-term adaptive capacity
Heavy rainfall	Short-duration and daily extreme precipitation events causing surface flooding	Urban areas, drainage systems, transport infrastructure, agriculture	Substantial	Critical	Immediate action needed	Medium	Limited drainage capacity, insufficient preventive infrastructure and reliance on reactive measures
Agricultural drought	Prolonged low precipitation combined with rising temperatures	Agricultural land, rural settlements, water resources, local economy	Substantial	Critical	Immediate action needed	Low–Medium	Absence of irrigation systems, high dependence on rain-fed agriculture, limited financial and technical capacity
Snow	Heavy snowfall and frost events	Transport infrastructure, rural settlements, agriculture	Limited	Limited	No action needed / Watching brief	Substantial	Established winter response procedures and declining future hazard
Wind	Strong winds and storm events	Agricultural land, buildings, power supply	Limited	Limited	No action needed / Watching brief	Substantial	Limited exposure and impacts; adequate operational preparedness

2.5 Monitoring and Evaluation

Section 2.5 reflects on the outcomes of Phase 2 of the Climate Risk Assessment (CRA) and establishes a structured monitoring and evaluation (M&E) framework to ensure that the results remain operational, updateable and policy-relevant over time.

This section addresses:

- Lessons learned from Phase 2;
- Data gaps and analytical limitations;
- Stakeholder feedback and governance implications;
- A structured monitoring framework for priority risks;
- Mechanisms for future updating and policy integration.

Particular attention is given to risks identified as **very high and high priority** in Section 2.4—namely agricultural drought, heavy rainfall and river flooding.

2.5.1 Lessons Learned from Phase 2

Phase 2 confirmed that climate risks in Silistra are **structural and cumulative**, rather than isolated events. Droughts, Danube flooding and intense rainfall interact with:

- The municipality's agricultural economic structure;
- Demographic decline and ageing;
- Ageing and capacity-limited infrastructure.

These interactions generate cumulative and sometimes cascading impacts.

A key added value of Phase 2 was the structured application of the CLIMAAX Key Risk Assessment Protocol. Unlike Phase 1, which focused primarily on hazard identification and methodological implementation, Phase 2 demonstrated that **limited resilience capacity—particularly financial and structural capacity—is a decisive factor in overall risk level**.

The prioritisation process clarified that risk in Silistra is driven not only by hazard intensity, but by the interaction between exposure, vulnerability and constrained adaptive capacity.

2.5.2 Challenges and Data Gaps

The most significant challenges encountered include:

- Limited availability of high-resolution, locally calibrated climate and hydrological data;
- Inconsistencies between datasets at different spatial scales;
- Gaps in detailed infrastructure vulnerability mapping;
- Limited quantified economic loss data;
- Partial engagement of rural and agricultural stakeholders.

These limitations were addressed through:

- Qualitative expert interpretation;
- Iterative consultations with municipal specialists;
- Triangulation of quantitative modelling and local knowledge;

- Explicit documentation of assumptions and uncertainties.

However, structural data gaps remain and must be addressed through future monitoring and institutional strengthening.

2.5.3 Role of Stakeholders in Monitoring

Stakeholders play a central role in monitoring and evaluation.

Feedback from municipal departments, agricultural representatives, social services and civil society highlighted:

- The need for clearer communication of future climate scenarios;
- Stronger linkage between CRA findings and municipal strategic documents;
- Integration of climate risk indicators into investment planning;
- Continued involvement beyond the assessment phase.

Monitoring is therefore not treated as a purely technical exercise, but as a governance process embedded in:

- Strategic planning,
- Budget prioritisation,
- Funding applications,
- Public communication.

2.5.4 Adaptive and Iterative Monitoring Approach

The CRA is treated as a “living process”.

Monitoring and evaluation are designed to allow:

- Periodic reassessment of priority risks (recommended every 5–10 years);
- Event-triggered reassessment after major climate events;
- Integration of new datasets (e.g., satellite-based land use, vegetation, soil moisture);
- Updating of vulnerability indicators.

Existing disaster protection and early warning systems provide a baseline, but a more integrated climate risk monitoring framework is required to link:

- Hazard indicators,
- Socio-economic vulnerability,
- Institutional capacity.

2.5.5 Monitoring Framework for Priority Risks

The monitoring framework focuses particularly on:

- Agricultural drought,
- Heavy rainfall,
- River flooding.

These risks require structured tracking of both hazard intensity and socio-economic impacts.

Table 2.5. Core Monitoring Framework for Priority Risks

Risk Workflow	Indicator Category	Indicator	Measure / Unit	Baseline / Observed	Monitoring Plan	Data Source / Frequency
Drought & High Temperatures	Temperature extremes	Days \geq 35°C	Days/year	~15–25 days/year; peak 39–40°C; increasing post-2020	Track annual exceedance of historical mean; 5-year trend analysis	NIMH / Annual
	Soil moisture deficit	Seasonal soil water deficit	Index / season	Increasing variability	Integrate agrometeorological monitoring	NIMH / Seasonal
River Flooding	River water levels	Days above critical Danube level (785 cm)	Days/year	Recurring exceedance events	Monitor frequency and duration; assess trend	Basin Directorate / Annual
	Flood exposure	Population / assets in flood zone	Persons / €	Concentrated in Danube floodplain	Update exposure maps every 5–10 yrs	Municipal GIS / 5–10 yrs
Heavy Rainfall	Extreme precipitation	Events > 50 mm/24h; track >80 mm	Events/year	~50 mm threshold linked impacts	Track frequency of >80 mm events	NIMH / Annual
	Urban flooding incidents	Reported local flood events	Events/year	Recurring surface flooding	Event-based documentation	Municipal emergency reports

Table 2.6. Monitoring Indicators for Vulnerability and Capacity

Indicator Category	Indicator	Baseline / Observed	Monitoring Approach
Drought	Years with prolonged dry periods	Increasing frequency post-2020	Annual agrometeorological review
Flooding	Flood incidents along Danube	Periodic flooding local	Event-based reporting
Agriculture	Damaged agricultural land	Documented crop losses	Annual statistics agricultural

Vulnerability	Elderly population in risk zones	High demographic share	Census + risk maps (5–10 yrs)
Institutional Capacity	Climate risk training sessions	Ad hoc	Annual review of training & knowledge exchange

Remaining Critical Data Needs

Despite improvements in Phase 2, critical needs remain for:

- High-resolution precipitation and drought datasets;
- Infrastructure vulnerability mapping;
- Economic damage quantification models;
- Social vulnerability and secondary impact analysis;
- Integrated GIS-based monitoring of risk hotspots.

These gaps should be addressed through:

- Cooperation with national institutions;
- Use of Copernicus and satellite-derived datasets;
- Targeted local data collection initiatives;
- Future project funding.

Strategic Implications

Resources in Phase 2 were used effectively within constraints. The focus on priority risks improved clarity and policy relevance, though it limited modelling depth for secondary hazards.

The impact of the CRA on Silistra is expected to be significant due to:

- Increased institutional awareness;
- Improved understanding of structural climate vulnerability;
- Clear prioritisation of adaptation investment;
- Strengthened alignment with funding opportunities.

The monitoring framework established here provides:

- A structured mechanism for tracking priority risks;
- A basis for evaluating adaptation effectiveness in Phase 3;
- A foundation for periodic updating of the CRA.

Concluding Reflection

Phase 2 has shifted the municipality from hazard awareness to structured climate risk governance. Monitoring and evaluation now form the bridge between risk assessment and implementation.

The next step is ensuring that the monitoring indicators are formally integrated into:

- Municipal strategic documents,
- Annual reporting processes,

- Budget planning cycles,
- Funding applications.

This will transform the CRA from an analytical exercise into a continuous decision-support tool for climate resilience in Silistra.

2.6 Work plan Phase 3

The objective of Phase 3 is to translate the refined Climate Risk Assessment results from Phase 2 into a structured and prioritised portfolio of adaptation options tailored to the specific territorial, socio-economic and institutional context of the Municipality of Silistra.

Phase 3 focuses on identifying measures that are:

- Directly linked to the high and very high priority risks identified in Section 2.4;
- Feasible under conditions of limited demographic, financial and administrative capacity;
- Capable of strengthening both risk reduction and adaptive capacity.

The work plan follows a structured sequence designed to ensure coherence between risk analysis and adaptation planning.

Activity 3.1 – Consolidation of Key Risk Findings

The first activity in Phase 3 will consolidate and operationalise the results of the multi-risk assessment conducted in Phase 2.

This step will synthesise:

- Risks related to river flooding and intense precipitation in the Danube floodplain and low-lying areas;
- Increasing drought and heat stress affecting agricultural production and water resources;
- Combined impacts on ageing populations, rural settlements and critical municipal infrastructure.

The purpose of this consolidation is to translate analytical outputs into clearly defined adaptation planning priorities. It ensures that adaptation measures are grounded in verified risk drivers and exposure patterns, rather than addressing hazards in isolation.

This step will also formalise traceability between:

- Identified hazards,
- Affected systems and vulnerable groups,
- Documented resilience capacity gaps.

Activity 3.2 – Identification of Context-Specific Adaptation Measures

Based on the prioritised risks, Phase 3 will identify adaptation options tailored to Silistra's local conditions.

The identification process will draw upon:

- CLIMAAX guidance on adaptation pathways;
- National and regional climate adaptation strategies;
- Relevant good practices from comparable agricultural and riverine regions;
- Stakeholder input from municipal departments and sectoral representatives.

Measures will address both structural and non-structural adaptation, including:

- Risk reduction (e.g., drainage improvement, water management solutions, ecosystem restoration);
- Institutional strengthening (e.g., integration into planning documents, coordination mechanisms);
- Capacity building (e.g., training, awareness and sectoral guidance).

The emphasis will be on realistic measures compatible with Silistra's administrative scale and financial constraints.

Activity 3.3 – Screening and Prioritisation of Adaptation Options

Identified measures will be screened using qualitative criteria aligned with the CLIMAAX methodology, including:

- Relevance to the specific risk drivers identified in Phase 2;
- Feasibility under current institutional and financial conditions;
- Implementation timeframe (short-, medium-, long-term);
- Potential co-benefits for local development, ecosystem resilience and social inclusion;
- Contribution to reducing vulnerability of priority groups.

This screening will result in a prioritised portfolio of adaptation options, distinguishing between:

- **Short-term “no-regret” measures** that can be implemented with limited resources;
- **Medium-term structural measures** requiring planning and external funding;
- **Long-term strategic interventions** addressing systemic vulnerabilities.

Ensuring Coherence Between Phases

Phase 3 explicitly builds on Phase 2 by:

- Linking each adaptation option to specific hazards, exposed systems and vulnerable groups;
- Documenting how proposed measures address underlying risk drivers, including land-use patterns, water stress, ageing infrastructure and demographic vulnerability;
- Maintaining traceability between the CLIMAAX Key Risk Assessment dashboard and the adaptation portfolio.

This ensures methodological continuity and strengthens the usability of the results for municipal decision-making.

Scope Limitations

Phase 3 does **not** include:

- Detailed engineering design of infrastructure measures;

- Technical feasibility studies at project level;
- Budget-level implementation planning.

These aspects fall outside the scope of the CLIMAAX framework and require separate technical studies, additional datasets and dedicated funding instruments. Phase 3 focuses on strategic prioritisation and structured exploration of adaptation pathways, providing a bridge between risk assessment and future investment planning.

Expected Outcomes of Phase 3

The outcome of Phase 3 will be a context-sensitive, prioritised portfolio of adaptation options for Silistra Municipality, directly linked to:

- The most critical climate risks identified in Phase 2;
- Identified resilience capacity gaps;
- Territorial and socio-economic specificities.

This portfolio will provide:

- A structured foundation for integration into municipal planning documents;
- A basis for preparing funding applications at national and European level;
- A strategic roadmap for strengthening long-term climate resilience.

Phase 3 therefore completes the analytical cycle initiated in Phase 1 and deepened in Phase 2, transforming climate risk knowledge into actionable governance guidance for the Municipality of Silistra.

3 Conclusions Phase 2 - Climate risk assessment

Phase 2 of the Climate Risk Assessment confirms that the Municipality of Silistra is highly exposed to water-related and temperature-related climate hazards, with agricultural drought, heavy rainfall and river flooding emerging as the dominant climate risks under both current and future conditions.

The municipality's location along the Danube River, its predominantly agricultural economic structure and its unfavourable demographic profile jointly shape its exposure, sensitivity and adaptive capacity. Climate risk in Silistra is therefore not only hazard-driven but structurally embedded in territorial, economic and social conditions.

Structural Nature of Priority Risks

A central conclusion of Phase 2 is that **agricultural drought represents a systemic and long-term structural risk** for Silistra.

Under future climate scenarios, drought severity is projected to escalate to critical levels due to:

- Increasing temperatures;
- Longer and more frequent dry periods;
- High dependence on rain-fed agriculture;
- Absence of irrigation infrastructure;
- Limited financial and institutional adaptive capacity.

Unlike episodic hazards, drought exerts cumulative and persistent impacts. Its long-term effects include reduced yields, soil degradation, economic stress for farmers and increased vulnerability of rural settlements. Without proactive adaptation, the risk of irreversible economic and ecological degradation increases significantly.

Heavy rainfall is identified as a **very high priority risk** due to its sudden onset, increasing intensity and insufficient local drainage capacity. Projected exceedance of critical precipitation thresholds poses growing risks to urban areas, transport networks and municipal infrastructure. The short reaction time and recurrent nature of these events justify urgent preventive and adaptive measures.

River flooding along the Danube remains a **high-priority risk**. Although existing flood protection infrastructure and early warning systems provide an important level of protection, exposure remains high in floodplain areas such as the Aydemir lowland and riverfront zones. Uncertainty related to upstream hydrological processes and potential cascading impacts necessitates continued monitoring, maintenance and preparedness.

Uneven Distribution of Risk

The assessment demonstrates that climate risks are unevenly distributed spatially and socially.

- Low-lying settlements and river-adjacent areas face higher exposure to flooding and intense rainfall.
- Agricultural zones are highly sensitive to drought and temperature extremes.
- Elderly populations, rural communities and low-income households exhibit lower adaptive capacity.

Demographic decline and ageing amplify sensitivity to climate impacts and reduce recovery potential, reinforcing the need for socially targeted adaptation planning.

Overall ranking of priority climate risks

Table 3.1. Overall prioritisation of climate risks for the municipality of Silistra

Rank	Climate risk	Overall priority level	Key drivers of risk	Main affected receptors
1	Agricultural drought	Very high	Increasing duration and frequency of dry periods; high dependence on rain-fed agriculture; limited irrigation and adaptive capacity	Agricultural production, farmers' income, rural economy
2	Heavy rainfall	Very high	Increasing intensity and frequency of extreme precipitation; sudden-onset events; insufficient drainage capacity	Urban areas, transport and drainage infrastructure, buildings
3	River flooding	High	Exposure of floodplain areas; concentration of population and assets; reliance on ageing flood protection infrastructure	Population, buildings, critical infrastructure, agricultural and industrial land
4	Snow	Low	Low historical frequency; declining future occurrence; limited spatial extent	Population, transport (episodic disruptions)
5	Wind	Low	Limited intensity and impacts; adequate operational preparedness	Built environment (minor, localised impacts)

Key Findings

Phase 2 generates several overarching conclusions:

- **Escalation of risks over time:** Agricultural drought and heavy rainfall show a clear upward shift in severity under future scenarios.
- **High exposure of critical assets:** Agricultural land, residential zones and technical infrastructure located in low-lying and river-adjacent areas are particularly vulnerable.
- **Social vulnerability as a multiplier:** Demographic decline, ageing and limited economic capacity significantly amplify climate risk.
- **Sudden vs. slow-onset dynamics:** Heavy rainfall requires rapid-response systems; drought requires early and sustained structural adaptation.
- **Cascading impacts:** Risks can trigger secondary effects such as infrastructure failure, economic disruption and prolonged recovery periods.
- **Institutional constraints as a core factor:** Limited financial and structural capacity plays a decisive role in overall risk levels.
- **Stakeholder alignment:** Municipal experts and sector representatives confirm prioritisation of drought, heavy rainfall and flooding.

Methodological and Practical Challenges

Phase 2 addressed several methodological and operational challenges, including:

- Integrating European-scale climate datasets with local exposure and vulnerability data;
- Applying a consistent risk prioritisation framework at municipal scale;
- Interpreting uncertainties and scenario variability.

Limitations remain and are explicitly acknowledged:

- Constraints in high-resolution socio-economic data;
- Limited modelling of compound and cascading risks;
- Focus on selected priority hazards;
- Incomplete infrastructure vulnerability datasets.

These limitations do not undermine the assessment but highlight areas for future refinement.

Overall Conclusion

Phase 2 successfully delivered a robust, transparent and policy-relevant Climate Risk Assessment for the Municipality of Silistra.

The analysis demonstrates that:

- Climate risks are structural and cumulative rather than episodic;
- Agricultural drought, heavy rainfall and river flooding constitute the most significant current and future threats;
- Risk levels are shaped not only by hazard characteristics but by exposure patterns and limited resilience capacity;
- Institutional and financial constraints are decisive risk multipliers.

The results provide a clear, justified and evidence-based foundation for Phase 3, where adaptation options will be developed and prioritised in direct response to the identified risks. Phase 2 therefore represents a critical transition from hazard identification toward strategic climate risk governance, strengthening the municipality's ability to align future investments, planning instruments and policy decisions with its evolving climate risk profile.

4 Progress evaluation

Table 4.1 Overview key performance indicators

Key performance indicators	Progress
1 climate multi-risk assessment report published (month 6 and Month 16)	Deliverable 1 submitted on 31.03.2025 Deliverable 2 submitted on 19.01.2026
10000 residents, key local and regional authorities, and stakeholders reached through awareness campaigns (Month 22)	Pending
2 workshops, one final conference and meetings conducted for decision-makers (Months 2, 6, 15, 22)	Organized and conducted kick-off meeting with the project team, municipal stakeholders and external experts. Workshop 1 for stakeholders – 28.03.2025 Workshop 2 for decision makers – 15.01.2026
Municipal strategic documents on disaster management and environmental management reviewed and revised (Month 21)	Pending
At least 1 risk management measure integrated into local development planning (Month 21)	Pending
Preparing outline for a long-term climate resilience strategy (Month 21)	Pending
1 media/press conference (Month 2)	Initial press-conference – 24.10.2024
5 publications on the website of the municipality for the project (Months 2, 6, 16, 21, 22)	Press releases on the website of Silistra Municipality (Months 2, 6, 16): https://silistra.egov.bg/wps/portal/municipality-silistra/actual/news/vstupitelna-preskonferenciya-proekt https://silistra.egov.bg/wps/portal/municipality-silistra/administration/projects/pokana-seminar https://silistra.egov.bg/wps/portal/municipality-silistra/actual/news/seminar-klimaks https://silistra.egov.bg/wps/portal/municipality-silistra/actual/news/seminar-doklad-proekt

Key performance indicators	Progress
	https://www.facebook.com/municipality.silistra/?locale=bg_BG
2 communication actions taken to share results with stakeholders – 1 workshop and 1 final conference (Months 15, 22).	Workshop 2 for decision makers – 15.01.2026

Table 4.2 Overview milestones

Milestones	Progress
M1: Completion of the review of local legal, financial, and administrative frameworks with recommendations for improvement (Month 5)	Completed on 14.03.2025
M2: Kick-off meeting of the project team with municipal and external experts (Month 2)	Completed
M3: Press conference to announce the project and its goals (Month 2)	Completed on 24.10.2024
M4: Completion of the workshop on the application and adaptation of the CLIMAAX framework (Month 6)	Completed on 28.03.2025
M5: Submission and acceptance of the report on the application and adaptation of the CLIMAAX framework (Month 6)	Submitted on 31.03.2025
M6: Attend the CLIMAAX workshop held in Barcelona (Month 10)	Completed on 10-11.06.2025
M7: Completion of the desktop research on municipal, regional, and national data related to climate risks and vulnerable sectors (Month 14)	Completed by 31.12.2025
M8: Workshop with local and national stakeholders to gather additional data and insights (Month 15)	Completed on 15.01.2026
M9: Submission and acceptance of the report on multi-risk assessment results (Month 16)	Submitted on 19.01.2026

<i>Milestones</i>	<i>Progress</i>
M10: Completion of the review and revision of the municipal disaster risk reduction program based on multi-risk and vulnerabilities identified (Month 19)	Pending
M11: Amendments to the Ordinance on Disaster and Accidents Management and municipal strategic documents (Month 21)	Pending
M12: Attend the CLIMAAX workshop held in Brussels (December 2026)	Pending
M13: Final conference on project results to disseminate findings and recommendations (Month 22)	Pending

5 Supporting documentation

Annexes

1. *Detailed hazard and risk analysis*
 - *Annex A – River Floods*
 - *Annex B – Heavy Rainfall*
 - *Annex C – Agricultural Drought*
 - *Annex D – Wind*
 - *Annex E - Snow*

2. *Archive of customized Jupyter Notebooks*

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21. **Republic of Bulgaria (2014, as amended).**
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