Interreg Co-funded by the European Union

IPA Croatia – Serbia

RETFOR

Technical data on pilot locations

Strengthening climate resilience measures for protection and revitalisation of ecosystems in the Spačva-Bosut Basin

RETFOR

COOPERATING FOR GREENER AND CLIMATE CHANGE RESILIENT PROGRAMME AREA

HRVATSKE ŠUME

ВОЈВОДИНАШУМЕ VOJVODINAŠUME

HRVATSKE VODE

ВОДЕ ВОЈВОДИНЕ

Centar kompetencija d.o.o. za istraživanje i razvoj

Fund for European Affairs and Development of the Autonomous Province of Vojvodina

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Deliverable title: D.1.2.1 Technical data on pilot locations presented on project partners web sites

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Deliverable description: This document contains data on identified pilot locations (geographical, ecological, and biological) that will serve as reference sites for implementation and monitoring activities within the RETFOR project.

Partner responsible for creation: Croatian Forests ltd. (LP)

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1. INTRODUCTION

This document contains data about identified pilot locations (geographical, ecological, and biological) that form the foundation for implementation and demonstration activities within the RETFOR project – *Strengthening Climate Resilience of Forest and Water Ecosystems in the Spačva-Bosut Basin*.

The purpose of this document is to systematically organize and present available information about each identified pilot site, including its geographical position, environmental characteristics, and the reasoning behind its selection. It provides an overview of sites that will serve as reference areas for upcoming project interventions but does not include results of field research, measurements, or analytical assessment. Instead, it consolidates verified background data and contextual descriptions that define each pilot location and its role within the project's framework.

The selection of pilot sites was based on their representativeness within the Spačva-Bosut Basin, ecological importance, and potential contribution to project objectives related to restoration, monitoring, and long-term climate resilience. Information presented here was compiled from existing sources, including internal project documentation, publicly available environmental data, and partner inputs.

The RETFOR project includes four main types of physical works to be carried out:

- Piezometric network restoration
- Establishment of cross-border piezometric network
- Meteorological station construction
- Restoration and reconstruction activities
- Equipping the Center for Climate Change monitoring

Deliverable **D.1.2.1** – *Technical data on pilot locations presented on project partners' websites* is part of WP 1– *Status of Spačva–Bosut Basin and long-term plans towards its climate resilience*, and complements other deliverables developed under the same component:

- **D.1.1.1** – *Overview of historical and previously generated data*, which compiles and analyses available data from projects, forest/water management and science that are relevant to the project area;
- **D.1.1.2** – *Study on biodiversity of the Bosut forests*, which provides a detailed overview of species diversity, habitat types, and ecosystem characteristics within the Bosut forest area; and
- **D.1.1.3** – *Pre-feasibility study for the Spačva forests climate resilience and Centre future development*, which defines the strategic, technical, and environmental framework for enhancing the climate resilience of the Spačva forests and outlines future development directions for the Centre for Climate Change Monitoring.

2. METHODOLOGY

The methodology applied in this document follows a structured, partner-specific approach to presenting data **about identified pilot locations** and related **types of physical works** planned within the RETFOR project.

Each project partner responsible for on-site implementation will have a dedicated chapter in this document. These chapters include data and descriptions of pilot locations under their responsibility, focusing on the type of works to be carried out and the specific context of each site. The only partners not covered by individual chapters are **CEKOM** and **FEP**, as their roles are primarily related to coordination, monitoring, and communication rather than direct execution of physical works.

For each pilot location, information is presented in a **standardized table format** to ensure clear and uniform presentation across all partners and activities. Each table includes the following fields:

- **Type of work** – specific intervention or construction activity to be carried out (e.g. piezometric network restoration, meteorological station construction, etc.);
- **Location (Site Name)** – name and administrative area of the site;
- **Coordinates**– precise GPS coordinates of the site;
- **Relevance to Activity / WP** – indication of which activity and WP the work contributes to;
- **Justification for Site Selection -** explanation of the criteria and reasoning behind the selection of the pilot location, including relevance to project objectives and environmental or technical suitability
- **Description of Planned Works** – concise summary of the site's characteristics and the purpose of the planned works.
- **Ecological and Biological Specifics** - brief overview of key ecological characteristics, dominant habitat types, and notable flora or fauna species, including any protected or endangered species if present.

This format allows straightforward cross-referencing between project activities, partners, and pilot sites, providing a clear overview of where and how the RETFOR project's physical interventions will take place.

All information included in this deliverable is based on verified partner inputs, project documentation, and available environmental datasets. No new measurements, analyses, or field research were conducted for the purpose of this document.

3. OVERVIEW OF THE WORKS

This chapter provides an overview of the pilot locations and related physical works that will be implemented within the RETFOR project.

3.1. Croatian Forests ltd. (LP 1)

Croatian Forests Ltd. are responsible for activities that strengthen monitoring capacity and support the implementation of nature-based solutions for forest and water ecosystem restoration in the Spačva–Bosut Basin. CF's role focuses on analysing and restoring existing piezometric infrastructure, installing new piezometers and meteorological stations, and supporting the establishment and equipping of the **Centre for Climate Change Monitoring**, whose facilities are located on CF-owned infrastructure. These activities contribute directly to improving data availability, restoring monitoring functionality, and supporting validation of pilot solutions.

Types of works carried out by Croatian Forests:

- Equipping and opening the Centre for Climate Change Monitoring
- Piezometric network restoration
- Meteorological station construction

3.1.1. Restoration and equipping of Center for Climate change monitoring

Field	Description
Type of Work	Equipping and opening the Centre for climate change monitoring
Location (Site Name)	Vrbanja, Vukovar-Srijem County
Coordinates	X:691464,10 Y:4985154,20
Relevance to Activity/WP	Activity 2.3 – Equipping and opening the Centre for climate change monitoring
Justification for Site Selection	Based on an analysis of available locations within the project area, the selected site was identified as the most suitable for establishing the Centre for Climate Change Monitoring due to its existing infrastructure, accessibility, and proximity to relevant forest and water ecosystems within the Spačva–Bosut Basin. The location allows for efficient coordination of monitoring activities, data management, and technical operations related to both hydrological and ecological parameters.
Description of Planned Works	e.g. Rehabilitation of existing piezometers, installation of monitoring sensors, and calibration of devices for long-term observation of groundwater fluctuations.
Ecological and Biological Specifics	Area is situated within the ecological network, forming part of the Special Protection Area (SPA/POP) HR1000006 and the Special Area of Conservation (SAC/PPOVS) HR2001414. These zones represent habitats of exceptional biodiversity importance, hosting several rare and endangered species such as the stag beetle (*Lucanus cervus*), great capricorn beetle (*Cerambyx cerdo*), European pond turtle (*Emys orbicularis*), and fire-bellied toad (*Bombina bombina*). Due to its ecological richness and habitat diversity, the Spačva Basin plays a vital role in maintaining the overall biodiversity and ecological stability of lowland Croatia.

3.1.2. Piezometric network restoration

Field	Description / Input
Type of Work	Piezometric network restoration
Location (Site Name)	Lipovac, Vukovar-Srijem County
Coordinates	01-A Existing X:7041 Y:4983 01-B Existing X:7041 Y:49829 01-C Existing X:7041 Y:49829 02-D Existing X:69723 Y:49879 03-C Existing X:6901 Y:4996 04-A Existing X:6831 Y:50006 04-B Existing X:6831 Y:49995 04-C Existing X:6834 Y:49896 04-E Existing X:6835 Y:49853 04-F Existing X:6836 Y:49843 10-A Existing X:6562 Y:50103 7-B Existin X:6672 Y:50036 8-B Existing X:6625 Y:50080 N-01 New X:6614 Y:50129 N-02 New X:6790 Y:50132 N-03 New X:6793 Y:50083 N-04 New X:6805 Y:50040 N-05 New X:6853 Y:49943 N-06 New X:6879 Y:49883 N-07 New X:6868 Y:49787 N-08 New X:6845 Y:49725 N-09 New X:6881 Y:50183 N-10 New X:6841 Y:50141 N-11 New X:6897 Y:50087 N-12 New X:6916 Y:49929 N-13 New X:6968 Y:49938 N-14 New X:7018 Y:49887 N-15 New X:6995 Y:49840 (HTRS96 / TM)
Relevance to Activity/WP	Activity 2.1 – Establishments of a joint cross-border groundwater monitoring system
Justification for Site Selection	The establishment of the existing piezometric network began in 1987, when the first 17 piezometric sets were installed in cooperation with the Croatian Forestry Research Institute, Jastrebarsko. By 1998, the current network was established in the area of the Vinkovci Forest Administration (UŠP Vinkovci), which includes piezometric stations across a total of 33 sections. The selected locations are part of this historically developed monitoring system, strategically positioned to capture groundwater fluctuations within the Spačva–Bosut Basin — a lowland forest ecosystem heavily influenced by hydrological dynamics. Their selection is justified by the existing infrastructure, long-term continuity of data collection, and their spatial distribution covering key forest sub-compartments. Restoring these stations will enable the reactivation of a previously functional network essential for understanding the interaction between groundwater levels, forest vitality, and climate variability.
Description of Planned Works	Rehabilitation of existing piezometers, installation of monitoring sensors, and calibration of devices for long-term observation of groundwater fluctuations.
Ecological and Biological Specifics	Area is located situated within the ecological network, forming part of the Special Protection Area (SPA/POP) HR1000006 and the Special Area of Conservation (SAC/PPOVS) HR2001414. These zones represent habitats of exceptional biodiversity importance, hosting several rare and endangered species such as the stag beetle (*Lucanus cervus*), great capricorn beetle (*Cerambyx cerdo*), European pond turtle (*Emys orbicularis*), and fire-bellied toad (*Bombina bombina*). Due to its ecological richness and habitat diversity, the Spačva Basin plays a vital role in maintaining the overall biodiversity and ecological stability of lowland Croatia

3.1.3. Meteorological station construction

Field	Description
Type of Work	Meteorological station construction
Location (Site Name)	Vrbanja, Vukovar-Srijem County
Coordinates	X:6861[redacted] Y:49780[redacted] X:6890[redacted] Y:49922[redacted]
Relevance to Activity/WP	Activity 2.1 – Establishments of a joint cross-border groundwater monitoring system
Justification for Site Selection	The installation and operation of the stations are carried out in line with the guidelines of the World Meteorological Organization (WMO) and applicable ISO standards, ensuring the quality, reliability, and international comparability of the collected data. The selected locations in Forestry offices Otok and Gunja were chosen based on its representativeness for the wider Spačva–Bosut Basin, favorable microclimatic conditions, and accessibility for maintenance and calibration. Its position allows for effective integration of meteorological data with ongoing hydrological, ecological and environmental monitoring, supporting long-term observation of climate parameters relevant for forest and water ecosystem resilience.
Description of Planned Works	The planned works include the construction and installation of two automatic meteorological stations in Otok and Gunja, Vukovar-Srijem County. The stations will be equipped with instruments for continuous measurement of key meteorological parameters such as precipitation, air temperature, relative humidity, temperature of the soil, etc. All equipment and installation procedures will follow the guidelines of the World Meteorological Organization (WMO) and applicable ISO standards to ensure data accuracy and comparability.
Ecological and Biological Specifics	Area is located situated within the ecological network, forming part of the Special Protection Area (SPA/POP) HR1000006 and the Special Area of Conservation (SAC/PPOVS) HR2001414. These zones represent habitats of exceptional biodiversity importance, hosting several rare and endangered species such as the stag beetle (*Lucanus cervus*), great capricorn beetle (*Cerambyx cerdo*), European pond turtle (*Emys orbicularis*), and fire-bellied toad (*Bombina bombina*). Due to its ecological richness and habitat diversity, the Spačva Basin plays a vital role in maintaining the overall biodiversity and ecological stability of lowland Croatia.

3.2. Public Company Vojvodinašume (PP 2)

Public Company *Vojvodinašume* (PP2) work focuses on the Serbian side of the Spačva–Bosut Basin, where it contributes to the establishment and testing of integrated monitoring and restoration systems that strengthen forest and water ecosystem resilience.Within WP2, *Vojvodinašume* leads the installation of piezometers as part of the joint cross-border groundwater monitoring system (Activity 2.1), ensuring collection of data compatible with Croatian monitoring structures. It also leads the development of dynamic groundwater modelling software (Activity 2.2) designed to simulate and predict drought-related scenarios and groundwater deficits, with full integration into the Centre for Climate Change Monitoring. In addition, the company implements restoration works on the Radosava Pond (Activity 2.3) to stabilize the local water regime and support climate-resilient forest management.

Types of works carried out by Public Company Vojvodinašume:

- Piezometric network restoration
- Restoration of the Radosava pond

3.2.1. Piezometric network restoration

Field	Description / Input
Type of Work	Piezometric network restoration

Location (Site Name)	• **FE Sremska Mitrovica**
	• **FU Morović**
	  ○ GJ „Neprečava–Varoš–Lazarica "
	  ○ GJ „Blata Malovanci "
	  ○ GJ „Raškovica–Smogvica "
	  ○ GJ „Vinična–Žeravinac–Puk "
	• **FU Višnjićevo**
	  ○ GJ „Smogva–Grabova greda "
	  ○ GJ „Varadin–Županja "
	  ○ GJ „Vratična–Cret–Carevina "
	• **Gornji Srem**
	• **Bosutske šume**

Coordinates	Vojvodina šume are undertaking the reconstruction of a total of 99 piezometers within the RETFOR project, all situated across the five locations listed above.
Relevance to Activity/WP	Activity 2.1 – Establishments of a joint cross-border groundwater monitoring system
Justification for Site Selection	The selected locations are situated on lowland terrain alongside the Sava, Bosut, and Studva rivers, where groundwater levels and forest vitality are directly dependent on the hydrological regime of these rivers. Over the decades, the natural flow and retention patterns have been altered by embankments, dams, and transport infrastructure, significantly affecting groundwater dynamics. The chosen sites correspond to existing piezometer wells organized into established observation profiles, providing an ideal basis for continued monitoring of groundwater fluctuations and their influence on forest ecosystems.
Description of Planned Works	The planned works include restoring and reactivating existing piezometer wells within the Spačva–Bosut Basin. Activities involve cleaning and repairing wells, replacing damaged casings, installing new measurement tubes where needed, and calibrating instruments to ensure accurate groundwater level recording. Once restored, the piezometers will be integrated into the cross-border monitoring network to provide consistent and long-term data on groundwater behavior and its impact on forest ecosystem stability.
Ecological and Biological Specifics	The area consists of lowland oak forests and moist habitats increasingly affected by invasive species such as Fraxinus americana, Acer negundo, and Amorpha fruticosa. Their control is essential to preserve native vegetation, restore ecological balance, and reduce negative health impacts such as allergies.

3.2.2. Reconstruction of Radosava pond

Field	Description / Input
Type of Work	Restoration and reconstruction activities
Location (Site Name)	Radosava pond
Coordinates	X: 44° 54′ 31″ N ; Y: 19° 13′ 01″ E
Relevance to Activity/WP	Activity 2.3 - Restoration and reconstruction activities
Justification for Site Selection	Bara Radosava is located within the inundation zone of the Sava River and represents a key site for implementing restoration activities under Activity 2.3 – Restoration and Reconstruction Activities within Work Package 2. As the largest wetland depression in the flooded part of the Bosut forests, it provides essential habitat for numerous protected and endangered species of flora and fauna, in line with EU and national conservation directives. Restoration works at this site contribute to improving hydrological balance, preserving biodiversity, and strengthening the overall climate resilience of the Spačva–Bosut Basin.
Description of Planned Works	The planned works include the restoration of the Radosava Pond to improve the water regime and ensure a stable water supply for the surrounding forest area. Activities involve dredging and removal of invasive vegetation from the pond area to secure a permanent water reserve throughout the year. These measures will support forest ecosystem stability, enhance habitat conditions for waterfowl and other target species, and strengthen the overall climate resilience and biodiversity of the Spačva–Bosut Basin.
Ecological and Biological Specifics	The Radosava Pond area is heavily overgrown with woody vegetation, with approximately 90% coverage dominated by the invasive species Amorpha fruticosa. This overgrowth reduces water retention capacity and negatively affects native wetland habitats and biodiversity, highlighting the need for vegetation removal to restore ecological balance and improve habitat conditions for waterfowl and other native species.

3.3. Croatian Waters (PP 3)

Within Work Package 2, Croatian Waters (HV) are responsible for the implementation of key hydro-technical works aimed at improving the water regime and strengthening the resilience of forest ecosystems in the Spačva–Bosut Basin, by undertaking activities of monitoring deep groundwaters regime and reconstruction of water management infrastructure. Therefore, HV will install, monitor and analyze data on two deep piezometers (60 m) to enhance groundwater monitoring within national water management framework and support the cross-border data exchange framework coordinated by the Centre for Climate Change Monitoring, under RETFOR. The structured measures and intervention under responsibility of Croatian Waters (HV) includes the reconstruction and elevation of the Bosut River barrier in Lipovac, a crucial structure for maintaining optimal groundwater levels necessary for forest preservation and biodiversity.

Types of works carried out by Croatian Waters:

• Reconstruction of the Bosut River barrier in Lipovac

• Installation of deep piezometers for groundwater monitoring

3.3.1. Reconstruction of the Bosut River barrier in Lipovac

Field	Description / Input
Type of Work	Restoration and reconstruction activities
Location (Site Name)	Lipovac barrier (Municipality Lipovac, Vukovar-Srijem County; CROATIA)
Coordinates	X: [redacted]; Y: [redacted]
Relevance to Activity/WP	Activity 2.3 - Restoration and reconstruction activities TAKS 1: UPGRADING THE LIPOVAC BARRIER'S CROWN ON THE BOSUT RIVER IN CROATIA
Justification for Site Selection	The Lipovac barrier is located near the confluence of the Spačva and Bosut rivers, within the Spačva Forest — one of the most ecologically valuable lowland forest complexes in Croatia. The site represents a critical hydrological point for regulating water levels across the Spačva–Bosut Basin. Over time, the barrier's crown has been damaged and lowered, reducing its ability to retain sufficient water necessary for maintaining optimal groundwater levels and ensuring the vitality of pedunculate oak forests. Upgrading the barrier's crown by 0.5 meters will restore its original functionality and help establish a balanced water regime essential for preserving forest biodiversity. The site's strategic importance lies in its direct influence on the water regime of the Spačva River and its ecosystems. This intervention complements parallel restoration works on the Serbian side of the basin, including the reconstruction of the sluice on the Bosut River and the restoration of the Radosava Pond, ensuring coordinated cross-border management of shared hydrological systems.
Description of Planned Works	The works include the reconstruction of the Bosut River barrier's crown in Lipovac. The existing overflow barrier, located in the riverbed with a base outlet on the left bank, was found to be damaged at an elevation of 77.24 m a.s.l. The planned intervention foresees raising the crown by at least 0.50 m, reaching an elevation of 78 m a.s.l. This level ensures the minimum water height of 77.5 m a.s.l. required for the preservation of forest biodiversity in the Spačva Basin and contributes to maintaining a balanced ecosystem in the area.
Ecological and Biological Specifics	The project area is part of the Natura 2000 ecological network. Based on the Ministry's decision and the 2024 compliance analysis, the works to upgrade the Lipovac barrier crown will not have a significant negative impact on the conservation objectives, target species, or habitats of the Spačva Basin.

3.3.2. Installation of deep piezometers for groundwater monitoring

Field	Description / Input
Type of Work	Establishment of cross-border piezometric network
Location (Site Name)	Municipality Nijemci, Vukovar-Srijem County; CROATIA
Coordinates	Croatian Waters are undertaking the activities related to deep underground water level monitoring system within the Spačva–Bosut Basin by establishment of two deep piezometers within the RETFOR project, at two locations, in Municipality Nijemci, Vukovar-Srijem County
Relevance to Activity/WP	Activity 2.1 – Establishments of a joint cross-border groundwater monitoring system
Justification for Site Selection	The selected locations for installing two deep piezometers (60 m) are situated within the Spačva–Bosut Basin on cadastral parcels owned by the Republic of Croatia. The sites were chosen to enable continuous monitoring of groundwater quantity and quality and to support analytical assessment of the basin's hydrological status. Final placement will be determined through project activities based on the results of the geotechnical study, ensuring optimal positioning for effective observation of groundwater dynamics
Description of Planned Works	The works include the installation and commissioning of two deep piezometers, each 60 metres in depth, for monitoring groundwater levels and quality in the Spačva–Bosut Basin. The activity, led by Croatian Waters, aims to establish a long-term monitoring system that will provide reliable data on groundwater dynamics as a key ecological factor influencing forest health and climate resilience. The piezometers will be integrated into the monitoring framework of the Centre for Climate Change Monitoring
Ecological and Biological Specifics	According to Decision Class: UP/I-352-05/2024-01/15, Reg. No: 2196-14-0124-4 (20 August 2024) issued by the Spatial Planning, Construction and Environmental Protection Service of Vukovar-Srijem County, the project "Water Exploration Drilling" is deemed acceptable for the ecological network. It was determined that the planned works will not have a significant impact on protected species or habitats, and that a main assessment of acceptability is not required.

3.4. Public Water Management Company „Vode Vojvodine" Novi Sad (PP 4)

Public Water Management Company "Vode Vojvodine" Novi Sad (PWMCVV), is responsible for implementing hydro-technical reconstruction works on the sluice located at the mouth of the Bosut River into the Sava River in Serbia within Activity 2.3 – Restoration and Reconstruction Activities of Work Package 2. The existing sluice, originally constructed in 1923, plays a crucial role in flood protection by preventing backflow of high Sava River waters into the Bosut River basin.

Due to its age and increasing exposure to extreme hydrological conditions, full reconstruction is required to restore its operational capacity. The planned works include the replacement of all operating mechanisms and the repair and modernization of the guiding structure. The reconstructed sluice will improve water regulation, enhance water supply to adjacent forest ecosystems, and contribute to drought mitigation through a nature-based solution that supports balanced hydrological and ecological conditions in the Bosut forest area.

Types of works carried out by Public Water Management Company "Vode Vojvodine":

- Reconstruction of the sluice on the Bosut River in Serbia

3.4.1. Reconstruction of the sluice on the Bosut River in Serbia

Field	Description / Input
Type of Work	Restoration and reconstruction activities
Location (Site Name)	Municipality Sremska Mitrovica, Vojvodina Province; Mouth of Bosut River - SERBIA
Coordinates	X: [redacted]; Y: [redacted]
Relevance to Activity/WP	Activity 2.3 - Restoration and reconstruction activities
Justification for Site Selection	The sluice on the Bosut River, constructed in 1923 near its confluence with the Sava River, is a key hydro-technical structure for regulating water levels and preventing backflow of high Sava waters into the Bosut Basin. Over time, exposure to frequent floods, extreme precipitation, and drought events has caused deterioration of the sluice's mechanisms and guiding structure. Given the area's complex topographical, climatic, and soil conditions, the site was selected for reconstruction to restore its functionality and ensure balanced water management. The renewed sluice will improve the water regime and supply for adjacent forest ecosystems, representing a nature-based solution for mitigating drought impacts and supporting climate resilience in the Bosut forest area.
Description of Planned Works	The planned works include the reconstruction of the sluice on the Bosut River in Serbia, located in the estuary zone where the Bosut flows into the Sava River. The facility, originally built in 1923, consists of five fields approximately five meters high, each containing two shutters operated manually. Due to long-term use, exposure to frequent floods, and increased traffic load, the sluice and its guiding structure are in poor condition and require complete reconstruction. The works will include the replacement of all operating mechanisms and the repair and modernization of the guiding structure to restore the sluice's functionality. The reconstructed facility will ensure effective flood protection from the Sava River and enable stable water regulation and supply to the surrounding forest area along the Bosut River.
Ecological and Biological Specifics	**n/a**