DESCRIPTIVE REPORT
on the conduct of field studies in the transboundary Ugam River basin in the Turkestan region

Project Title:	Enhancing the capacity for safe management of transboundary water resources in Central Asia through the use of innovative information and communication technologies
Location of field studies:	The Ugam River Basin, Turkestan Region, Kazygurt District, Sairam-Ugam National Nature Park
Dates of the field studies:	September 30 – October 8, 2024

General Information

The Ugam River - is a mountain river located in Kazakhstan and Uzbekistan and is the largest right tributary of the Chirchik River. Its length is 68.5 km, and the basin area is 869 km^2. The river is primarily snow-fed, with partial rain contribution. The average discharge is 20.9 m^3/s (during floods in some years it can reach up to 177 m^3/s).

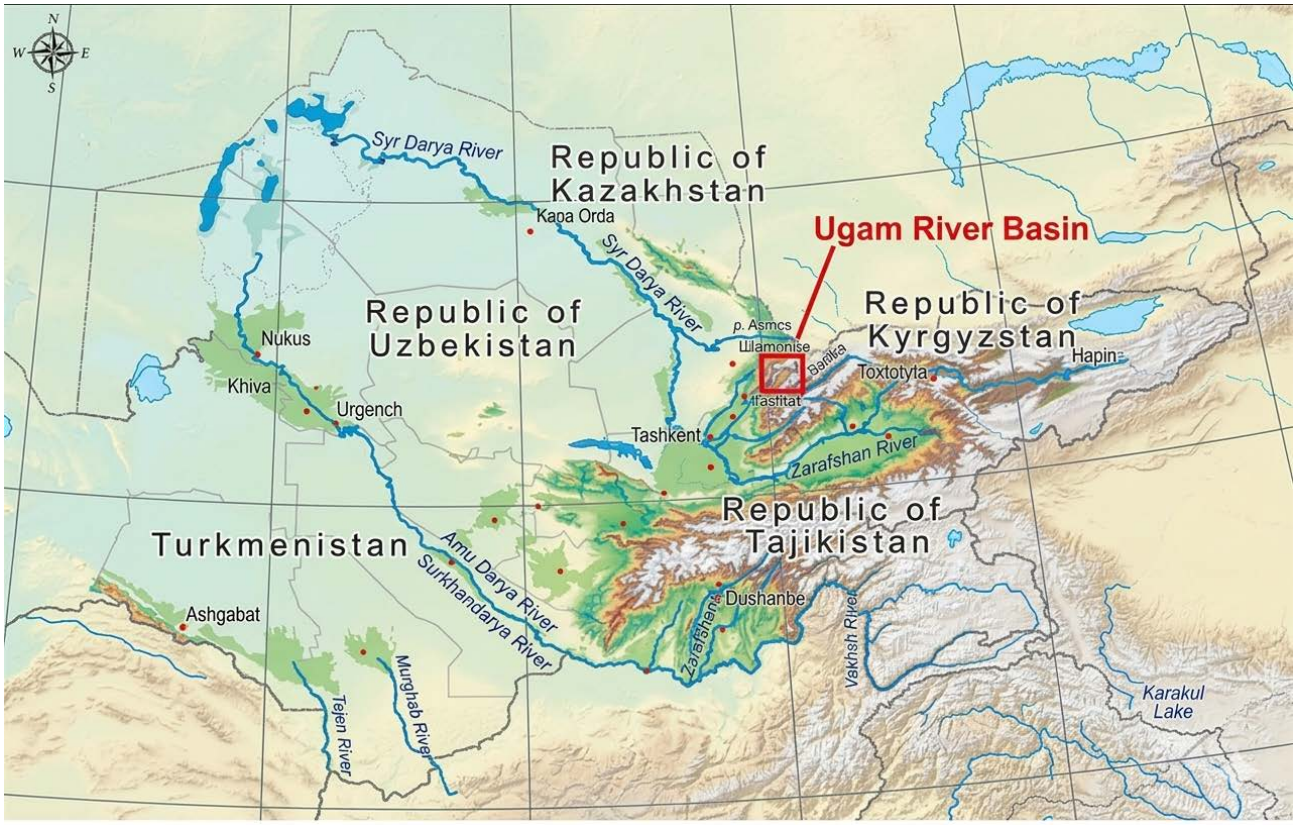

Fig. 1. Location of the Ugam River basin in Central Asia

The Ugam Ridge generally does not exceed an elevation of 3,600 meters. The elevation range of the Ugam River basin varies from 758 to 3,583 meters above sea level. The Ugam River has an eastward orientation, and in its upper reaches, a southeastward direction. The water content of the left tributaries increases upstream due to the rising elevation of the Ugam Ridge and the associated increase in the number and volume of snowfields along the watershed.

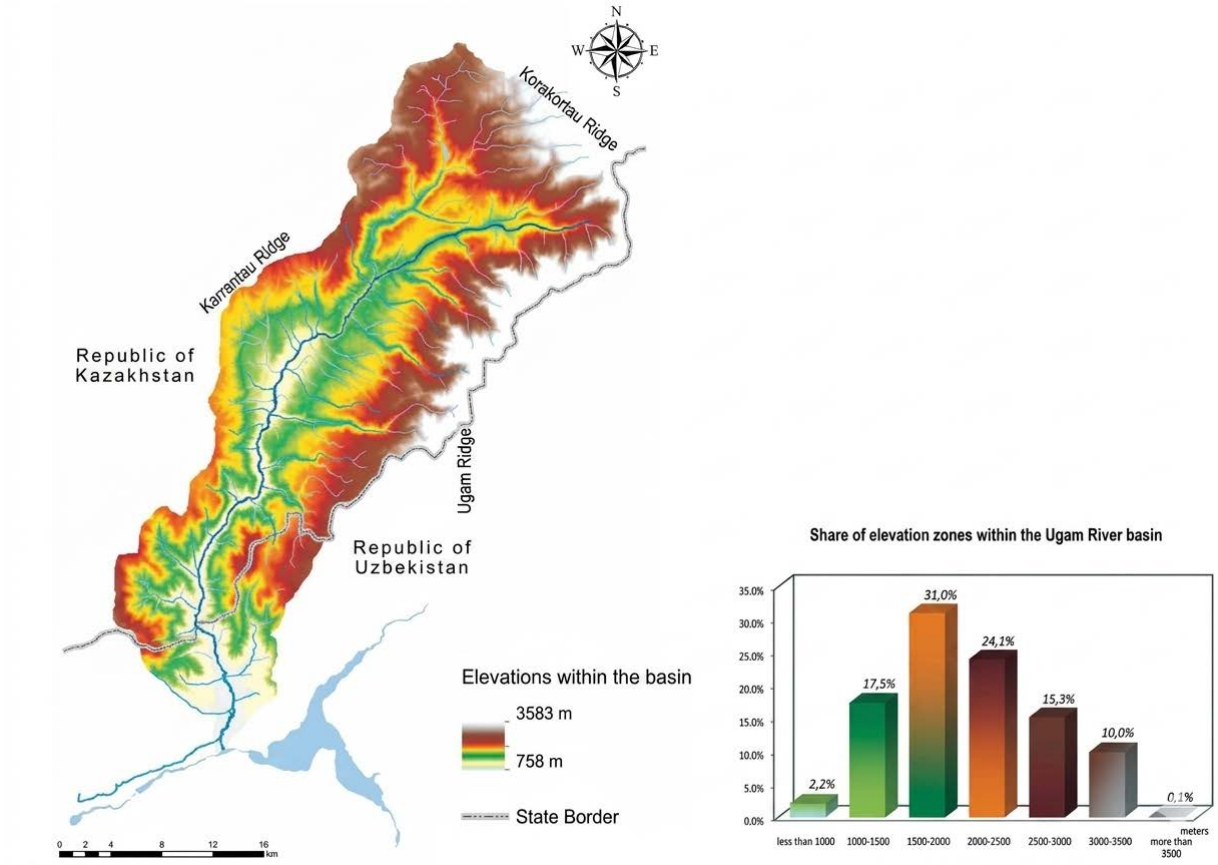

Fig. 2. Physical and geographical map of the Ugam River basin

Administratively, the Ugam River basin covers an area of 890 km^2 and is located within two regions: the Tashkent region in Uzbekistan (Bostanlik district) and the Turkestan region in Kazakhstan (Tolebi and Kazygurt districts). The border between Kazakhstan and Uzbekistan runs across the river basin at a point where it passes through a narrow gorge with steep rocky slopes rising to the watersheds of the Karzhantau Ridge on the right bank and the Ugam Ridge on the left bank. In the Uzbek part, the basin gradually widens up to the confluence of the Ugam River with the Chirchik River, forming gentle slopes. In the Kazakh part, the narrow gorge continues upstream for about 10 km to the Buguchalpik tract.

Existing Risks

The transboundary Ugam River basin, located in Kazakhstan and Uzbekistan, plays a key role in providing water resources to surrounding regions; however, it is also characterized by numerous hydrological hazards that may pose a threat to local ecosystems, agriculture, and the population.

On the territory of Kazakhstan, the level of mudflow hazard in the Ugam River basin, according to civil protection authorities, is assessed as high. The basin includes one mudflow-prone area and two moraine lakes. The settlement of Ugam (**18** residential houses), one school, a bridge, a bath complex of the akimat, a private farm, an apple orchard, and a hunting lodge fall within the potential impact zone. A total of **56** people live in the risk area, and the potential impact zone covers **130,000 m²**. In addition, one landslide-prone area and one avalanche catchment have been identified in the Ugam River basin, posing a threat to six объектов (**4** residential houses, a school, and a hunting lodge), where **11** people live or work.

Transboundary Risks

From a **transboundary perspective**, the greatest threats in the Ugam River basin are floods and high water events. The basin is subject to regular flooding, especially in spring, when intensive snowmelt occurs in mountainous areas. Seasonal increases in river water levels may lead to flooding of coastal areas in both Kazakhstan and Uzbekistan, creating significant risks for agricultural lands and settlements. The highest probability of flooding is observed in the lowland parts of the basin, where floodwaters accumulate.

On the territory of Uzbekistan within the Ugam River basin, the following settlements may be at risk of flooding during spring floods: Khumsan (Tashkent region), Charvak (Tashkent region), Gazalkent (Tashkent region), and others.

In addition, many recreational areas and private housing developments are located in the potential flood zone, as well as the following key economic and infrastructure facilities:

- **Agricultural land**: significant areas near Khumsan and Gazalkent consist of farmland, including crop fields and pastures, located in low-lying areas that may be flooded, leading to crop loss and soil degradation;
- **Irrigation systems:** key irrigation infrastructure, such as canals and reservoirs, is at risk of flooding, especially in the areas of Gazalkent and Charvak. Damage to these systems may disrupt water supply for agricultural lands and worsen conditions during the spring flood period;
- **Charvak Reservoir:** although the reservoir regulates water levels, increased flood pressure may pose risks to surrounding areas, including recreational and tourist zones. In extreme weather conditions, overflow of the reservoir and flooding of downstream areas are possible;
- **Road and bridge infrastructure:** bridges over the Ugam and Chirchik rivers, as well as connecting roads between settlements, may become flooded, disrupting transport links and limiting access to affected regions.

Selection of the Study Area

Based on the analysis of materials provided by subordinate organizations and the territorial division of the Ministry of Emergency Situations of the Republic of Kazakhstan,

GIZ project hydrologist B.D. Moldobekov recommended conducting a study of a section of the Ugam River near the settlement of Ugam (Turkestan region) with a length of more than 5 km. In addition, it was recommended that, when preparing the interactive map, special attention be given to objects located in the mudflow-prone zone, including the representation of their characteristics.

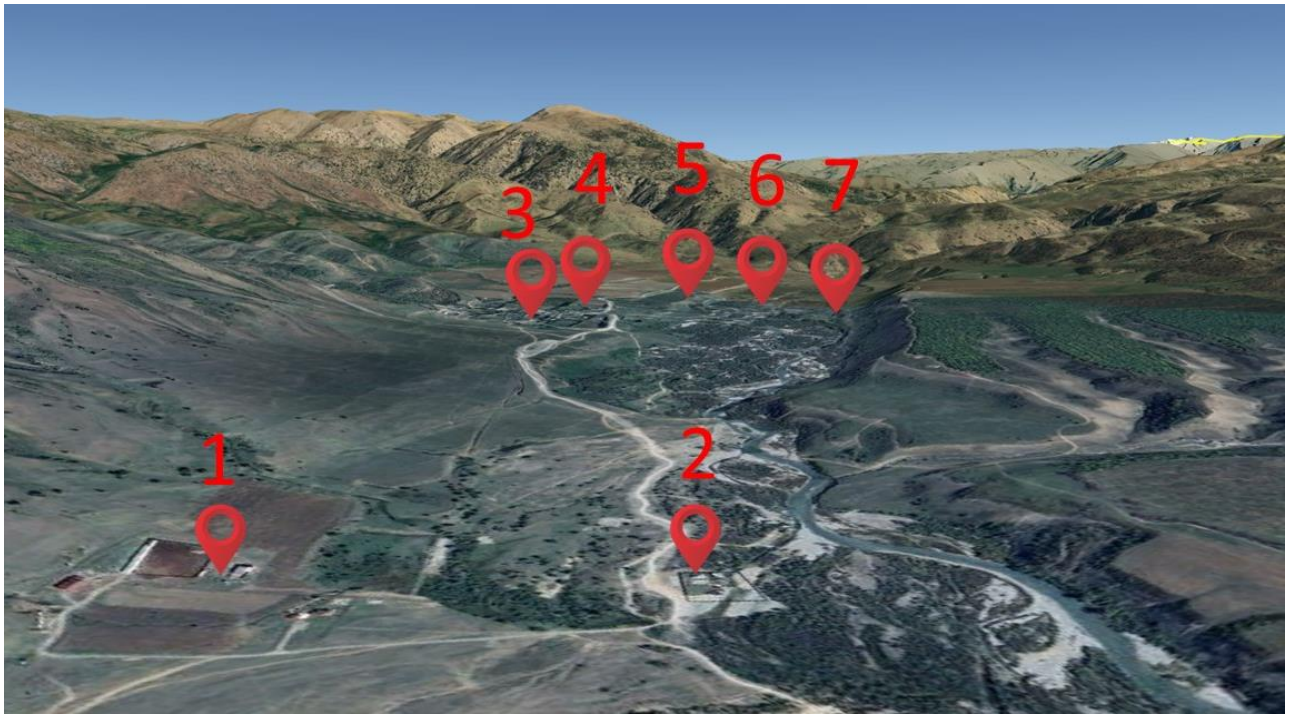

Fig. 3. Objects in the impact zone: 1. Private farm,
2. Akimat Bath complex, 3. Ugam National Park, 4. School, 5. Apple orchard,
6. Hunting lodge, 7. Bridge

Fig. 4. Ugam settlement and school

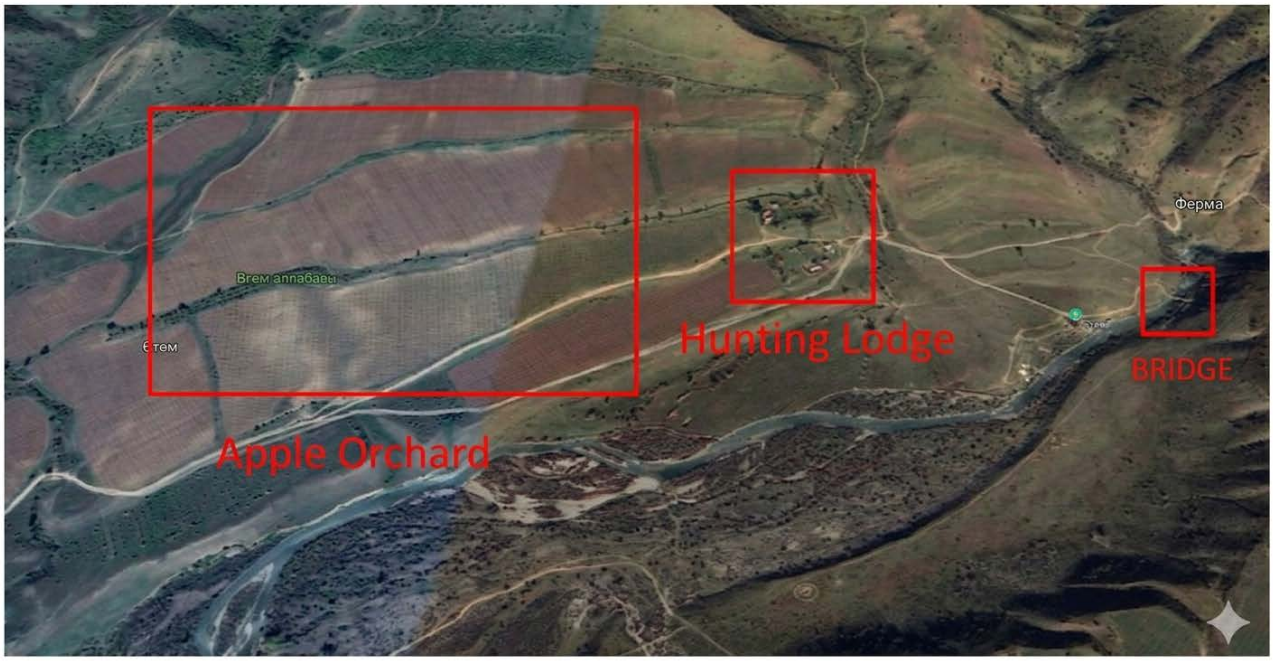

Fig. 5. Objects in the mudflow-prone zone

Field Studies

From September 30 to October 8, 2024, within the framework of the CESDRR and GIZ project "Enhancing the capacity for safe management of transboundary water resources in Central Asia through the use of innovative information and communication technologies," a team of experts—early warning system expert V.V. Kuchkin, Chief Expert of the Center B.M. Ospanov, and System Administrator of the Center A.G. Ospanov—conducted field studies on the transboundary Ugam River located in the Sairam-Ugam National Natural Park of the Turkestan region.

On October 1, representatives of the Center held a working meeting with the head of the Southern Territorial Operational Technical Department (STOTD) of the Kazselezashchita State Institution of the Ministry of Emergency Situations of the Republic of Kazakhstan, E.U. Alzakov. During the meeting, Mr. Alzakov informed that hydraulic engineer Sh.K. Omar, head of the Kazygurt Production and Operational Unit of STOTD of Kazselezashchita E.K. Nursseit, and observer of the Ugam hydrological post O.K. Berkimbaev would also participate in the field studies.

Fig. 6. Working meeting with the head of the Southern Territorial Operational Technical Department (STOTD) of the Kazselezashchita State Institution of the Ministry of Emergency Situations of the Republic of Kazakhstan, E.U. Alzakov

On the same day, the expert group held a number of meetings with the management of the Sairam-Ugam State National Natural Park and the head of the Department for Emergency Situations of the Kazygurt district, Civil Protection Colonel D.K. Talipbaev. During these meetings, representatives of the relevant authorities confirmed the need to conduct studies on the Ugam River to improve the hydrological monitoring system and to develop a transboundary early warning system for hydrological hazards.

The level of mudflow hazard in the Ugam River basin is assessed as high. The settlement of Ugam (**18** residential houses), one school, a bridge, a bath complex of the akimat, a private farm, an apple orchard, and a hunting lodge fall within the potential impact zone. A total of **56** people are at risk.

Puc.7. Fig. 7. Working meeting with the head of the Department for Emergency Situations of the Kazygurt district, D.K. Talipbaev, and the management of the State National Natural Park

Fig. 8. Expert group

Fig. 9. Ugam River valley

Fig. 10. Use of the Center's UAV (drone)

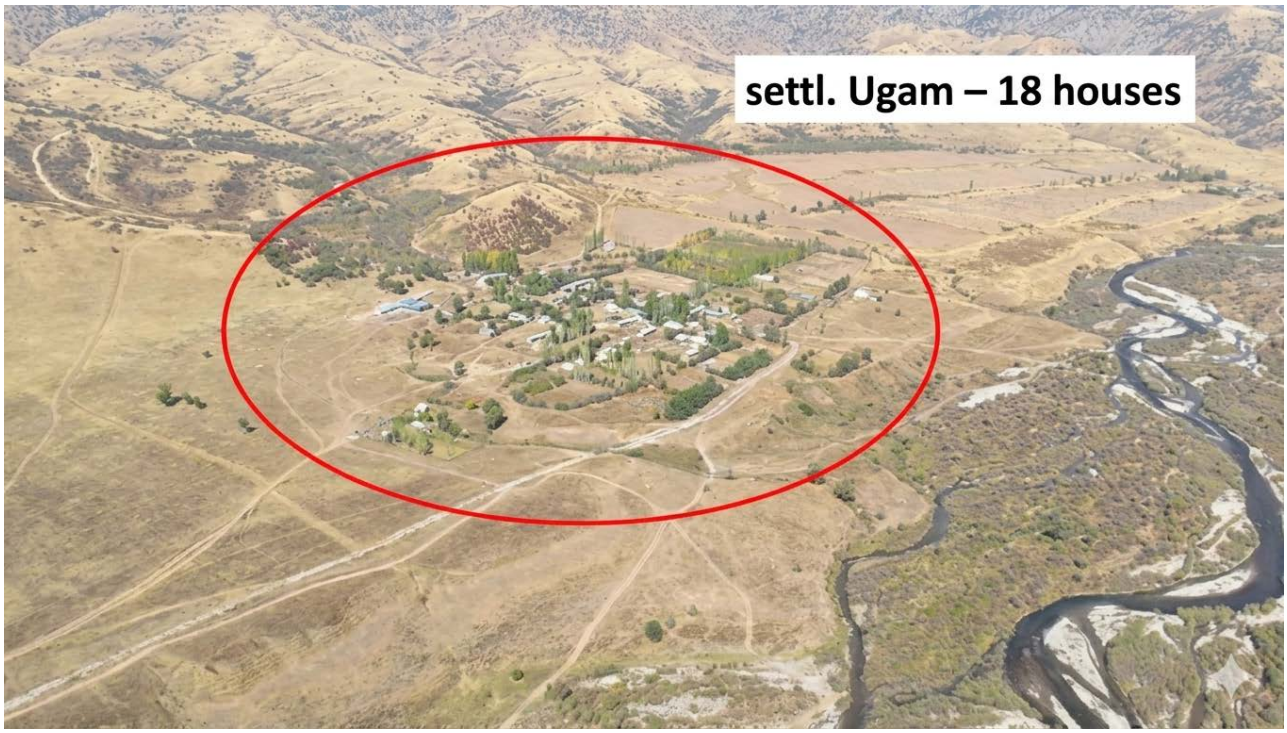

Fig. 11. Ugam National Park

In this regard, over a period of seven days, the expert group, together with representatives of the Kazselezashchita State Institution, the Department for Emergency Situations of the Kazygurt district, and the State National Natural Park, conducted field studies using the Center's unmanned aerial vehicle (UAV).

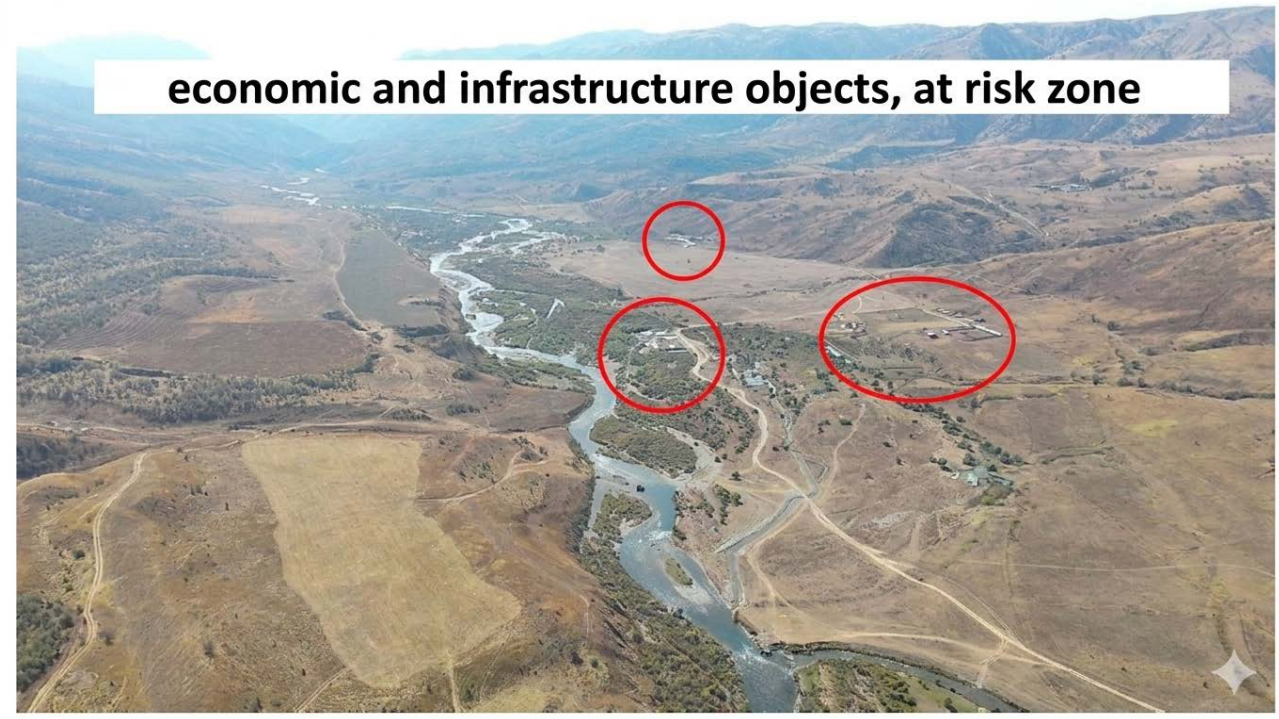

Fig. 12. Economic facilities in the mudflow-prone zone

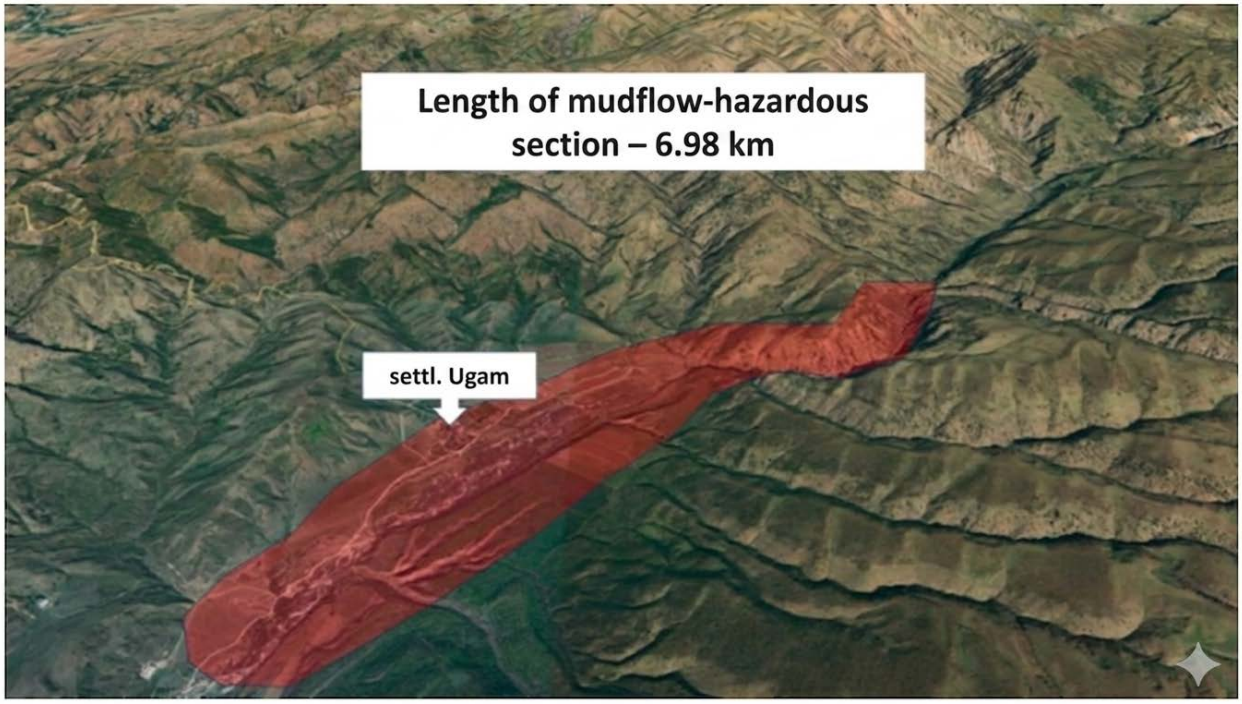

Fig. 13. Mudflow-prone area

Based on the results of the field studies, a survey of the mudflow-prone area near the settlement of Ugam was conducted, and a 3D model of the Ugam River basin with a length of more than 5 km was developed.

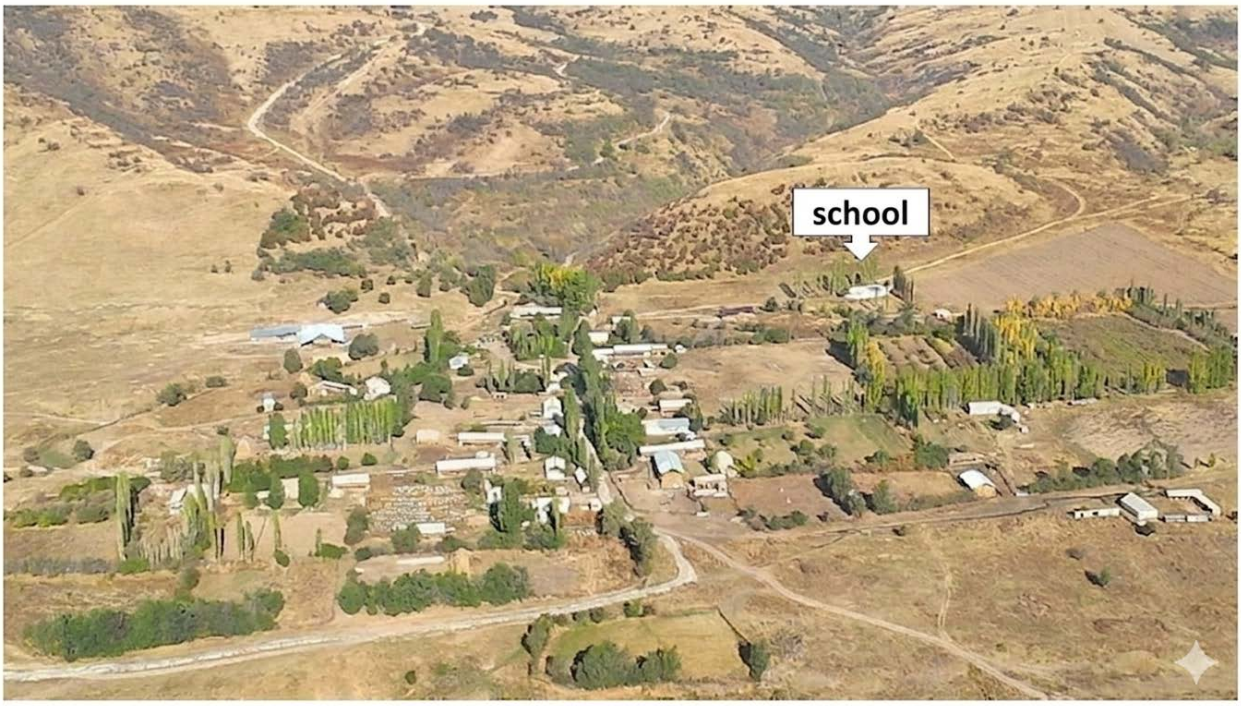

Fig. 14. School

During the study, it was established that the hydrological posts of RSE "Kazhydromet" and the Kazselezashchita State Institution are equipped with vertical staff gauges with scale markings, as well as outdated mechanical meteorological instruments such as a rain gauge, thermometer, and barometer. Due to the absence of telephone communication and internet

access in the settlement of Ugam, the observer transmits hydrological data three times a day to the Kazygurt Production and Operational Unit of the Southern Territorial Operational Technical Department of Kazselezashchita using a radio station. However, in adverse weather conditions in mountainous areas, interruptions in data transmission frequently occur.

Key Issues

During the field studies, experts conducted aerial visual surveys, followed by the development of an orthophoto map and a 3D terrain model. The data were processed and used to create an interactive map showing objects located within potential impact zones in the event of hydrological disasters.

At the same time, representatives of hydrometeorological services, emergency authorities, and other stakeholders expressed interest in gaining access to the developed interactive maps for operational use.

However, due to the absence of a licensed version of ArcGIS software at the Center, it is not possible to publish the developed interactive maps online with open access (the cost of an ArcGIS license from official distributors exceeds 22 million tenge, equivalent to approximately 41,000 euros).

Expert Recommendations

To improve hydrological monitoring by eliminating the human factor and to support the future creation of a transboundary early warning system for hydrological hazards, experts proposed installing an automated monitoring station at the locations of existing hydrological posts of Kazselezashchita and Kazhydromet. The station should be capable of transmitting data in real time to enable rapid response and should be equipped with the following sensors:

- **precipitation sensors (rain gauges / pluviometers) –** to measure the amount and intensity of precipitation;
- **water level sensors –** to measure river water levels;
- **flow sensors –** to measure flow velocity and discharge volume;
- **soil moisture sensors –** to assess soil saturation, which is especially important in mountainous areas for landslide prediction;
- **Meteorological sensors:**
  - **temperature sensors** – to measure air and water temperature (important for snowmelt assessment);
  - **anemometers** – to measure wind speed and direction (important for evaporation and precipitation distribution);
- **water pressure (hydrostatic) sensors** – to determine pressure at the riverbed and detect sudden level changes;

- **turbidity sensors –** to measure suspended particles in water (increased turbidity may indicate the onset of mudflows);
- **snowpack sensors –** to measure snow depth and water content, helping predict meltwater volume;
- **video surveillance cameras –** for visual monitoring of river conditions;
- **tilt sensors (inclinometers) –** to monitor slope movements and predict landslides.

Fig. 15. Proposed locations for the installation of automated monitoring stations

In addition, to verify the data received from automated stations and ensure prompt confirmation, experts recommend equipping the observation post with satellite internet and the necessary computer equipment.

Conclusion

Thus, the installation of an automated hydrological monitoring station on the Ugam River is a key element in the creation of a transboundary early warning system, as it will enable real-time data collection, timely identification of critical conditions, automated data processing and analysis, integration with digital forecasting models, and transmission of information to the servers of RSE "Kazhydromet," the Kazselezashchita State Institution, and the Ministry of Emergency Situations of the Republic of Kazakhstan, as well as to warning systems via satellite internet.

Based on the results of processing the data obtained during the field studies, an interactive map will be developed, including relevant attribute information on affected objects, which will be published on the Center's website.

The Center for Emergency Situations and Disaster Risk Reduction expresses its gratitude to the management of the Kazselezashchita State Institution, the Southern Territorial

Operational Technical Department of Kazselezashchita, the Department for Emergency Situations of the Turkestan region, the Department for Emergency Situations of the Kazygurt district, and the Sairam-Ugam National Natural Park for their comprehensive support provided during the field studies of the transboundary Ugam River basin.