# Analysis of the Impact of the Kakhovka Hydroelectric Power Station Explosion

on the Populated Areas of Kherson and Mykolaiv Regions



KSE Institute

Vox Ukraine



## Table of content



**O1.** Introduction

02. Methodology

**O3.** Analysis of results

04.

Use of collected data and subsequent actions

05.

Conclusions

This report is dedicated to the analysis of the flooding that occurred as a result of the explosion of the Kakhovka Hydroelectric Power Station (HPS) dam. The flooding of a large number of populated areas has become a significant problem, negatively impacting the lives and well-being of the local population.

The objective of this report is to conduct a thorough analysis of the extent of the flooding, determine the level of building inundation, and understand the consequences of the disaster.

## Destruction

The explosion of the Kakhovka HPS dam occurred due to the actions of the Russian Federation's military forces. This devastating act led to the flooding of a significant number of buildings and an ecological catastrophe in the region.

Estimations indicate that as a result of this crime, approximately 60,509 houses were flooded, with a total flooded area of approximately 8,588,175 square meters. These figures reflect the level of impact the disaster has had on the population, housing stock, and infrastructure of the affected region.

## Methodology

This research utilizes data obtained from satellite imagery and open sources to examine the degree of building flooding and calculate the level of inundation in each specific case.

The methodology of analysis includes the processing and interpretation of satellite images as well as the using of geospatial data to determine the height of flooding. These results serve as crucial informational resources for understanding the scale of the flooding and developing further measures for infrastructure restoration and assistance to the affected population.

# THE OBJECTIVE OF THIS REPORT

This report aims to present the research findings and emphasize the importance of taking action to ensure the restoration of infrastructure and assistance to those affected by the explosion of the Kakhovka HPS dam, caused by the actions of the Russian Federation.

The described analytical methods and collected data are used to gain an understanding of the situation and form a basis for decision-making and planning for recovery efforts.



# METHODOLOGY

A comprehensive methodology combining data obtained from satellite images and information from open sources was used to analyze flooded buildings and determine the flood line.

This approach made it possible to obtain a detailed picture of flooding and assess the degree of flooding of houses.



# METHODOLOGY

## Satellite Imagery

During the analysis, satellite images from Sentinel-2 and Maxar, publicly available, were used to obtain visual information regarding the location and scale of the flooded areas. Instead of the original satellite imagery, this report will use descriptive references such as "Image 1", "Image 2" etc.

# 02

#### Software

Specialized software was used for processing and interpreting satellite images, allowing the analysis to gain various aspects of the flooding. The images were processed to identify flooded areas, the intensity of flooding, and the boundaries of the flood line.

03

## Using of Geospatial Data

In addition to satellite imagery, geospatial data from various sources were used to calculate the level of building inundation. The use of geospatial data, including elevation data obtained from NASA DEM (Digital Elevation Model), enabled the determination of the height difference between each building and the point of the flood line. This allowed for the estimation of the flooding height for each building and the determination of its inundation level. The described methodology provides a systematic approach to the analysis of flooded buildings and the determination of the flood line. It combines the use of satellite images, geodata, and information from open sources for reliable and detailed results.



Image 1



Image 2

# ANALYSIS OF RESULTS

As a result of the analysis, a significant amount of data on flooded buildings was obtained, providing us with a detailed overview of the situation.

In total, 60,509 flooded buildings were identified, including residential and non-residential properties, such as residential houses (apartment buildings and private dwellings), industrial and agricultural buildings, infrastructure facilities, educational institutions, and healthcare facilities.



# The flooded buildings were divided into four categories

Using the building elevation data and height difference calculations, we determined the degree of inundation for each building and assigned them to the corresponding category. The flooded buildings were divided into four categories: fully flooded (flooding of 3 meters and above), partially flooded (flooding within the range of 1-3 meters), possibly flooded (flooding up to 1 meter), and not flooded. This classification provided us with detailed information about the degree of building inundation and allowed for a more accurate assessment of the damage in the affected communities.

## What does it look like in an infographic?



The flooded buildings were also distributed across regions and districts. This enables us to assess the geographical distribution of flooded areas and identify the areas that have suffered the most damage.

The analysis revealed that certain regions and districts experienced more extensive damage with higher levels of inundation. Conversely, other regions have a lower level of flooding.

This information is important for further planning and decision-making regarding the rehabilitation and restoration of the affected areas.

Below are satelite images from Maxar, confirm the extent of the flooding and illustrate the distribution of flooded areas in different regions and districts (see Image 1, Image 2, Image 3).





Image 1

Image 2



Image 3

These graphical representations help us better understand the consequences of the flooding, identify key trends, and provide crucial input data for further analysis and decision-making regarding the recovery and rehabilitation of the affected areas.

# USE OF COLLECTED DATA AND SUBSEQUENT ACTIONS

After collecting and analyzing data on flooded houses and their distribution, the obtained information was used to create a public dashboard, providing a convenient way to visualize and review the research findings.



One of the key elements of the dashboard is the usage of a database formed on the collected data on flooded houses.

This database contains comprehensive information on flooded buildings, their inundation levels, and types of buildings, serving as a foundation for constructing charts, diagrams, and interactive maps that display the distribution of flooded houses by regions, districts, and types of inundation. The dashboard created on the basis of this database provides a convenient interactive platform for information visualization.

## **Reviewing Research Findings**

The dashboard allows users to view and analyze the research findings, obtaining detailed information on specific buildings and their conditions.

02

## Assessing the Scale of Flooding

By using this dashboard, users can more effectively assess the scale of flooding, the distribution of damaged buildings, and determine priorities for the recovery of affected areas.

03

#### **Enhanced Information Perception**

Data visualization in the form of charts, diagrams, and interactive maps helps engage a wider audience and facilitates the comprehension of information.

# CONCLUSIONS

The conducted study of the flooding caused by the explosion of the Kakhovka HPS dam provides us with important conclusions about the scale of this disaster and its consequences.

The main results of the analysis make it possible to understand the impact of flooding on settlements and the housing stock.

## **Conclusion 1**

According to the performed research, a total of 60,509 flooded buildings were identified, with a combined area of approximately 8,588,175 square meters. These data demonstrate the significant scale of flooding and its impact on the residential sector.

## **Conclusion 2**

It is important to note that the distribution of flooded buildings occurred across various categories, including fully flooded, partially flooded, possibly flooded, and not flooded buildings. This provides us with an understanding of the degree of building damage and the need for restoration efforts.

# The analysis revealed that the distribution of flooded buildings was uneven across different regions and districts.

Some regions and districts suffered significant damages: with a high number of flooded buildings and extensive inundation areas, while other areas experienced a lower level of flooding.

Evaluating the scale of flooding and its consequences is a crucial step in recovery measures planning and implementation. Our research findings provide valuable information for decision-making and the development of the restoration and rehabilitation of affected areas strategies. The conclusions drawn from our study serve as a foundation for further actions aimed at restoring damaged housing, and infrastructure, and assisting affected communities.



This highlights the need to focus efforts on the affected territories and provide assistance to the affected communities.

# One of the important aspects of our research is the degree of flooding of the buildings.

This parameter indicates the scale of damages. The results show that a significant number of buildings were fully flooded, requiring substantial efforts for their restoration.

Additionally, identified partially flooded or possibly flooded buildings were specifying the need for further damage assessment and implementation of appropriate measures to prevent further destruction.

Overall, the investigation on the scale of the flooding, its distribution, and its impact on settlements and housing is of great importance for decision-making regarding the recovery and rehabilitation of affected territories.

The results of our analysis serve as a valuable informational resource for government bodies, civil organizations, and individuals working towards the recovery and assistance to the affected population.

It is important to focus efforts on the affected areas and provide assistance to the affected settlements.

## We are grateful to Azenzuz Vision for their invaluable assistance in this study.

This publication has been prepared with the financial support of the European Union. Its contents are the sole responsibility of Vox Ukraine / KSE Institute and do not necessarily reflect the views of the European Union.

