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# Environmental consequences of **THE KAKHOVKA DAM** explosion

**WEBINAR #3**



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# Socio-environmental consequences of the destruction of large dams

Breach of Kakhkovka Dam in an historical and social context

**Presenter:**  
**Dr. Eugene Simonov**

UWEC Expert,  
Environmental



*Explosion of the Dnipro Hydropower Plant  
in August 1941*

 [Read the article >>>](#)

Dams and dikes have been used as weapons of war since ancient times.

Generals change the course of rivers to flood enemy fortresses and troops, or vice versa to deprive them of water.

Examples from recent history include:

- Destruction of dams in China on the Yellow River on June 9, 1938 during the Second Sino-Japanese War. The water flooded 70,000 sq km of land, killing between 500,000 and 800,000 peaceful villagers.
- The retreating Soviet Army mined the Dnipro Hydropower Plant in August 1941. The resulting flood claimed 5,000 to 100,000 victims according to various sources.



# Destruction of dams is a war crime



Photo: Vedomosti

*Investigative Committee of the Russian Federation. June 2023.*

*Drainage gallery under the dam*



Photo: @andrew\_barr

Humanitarian and environmental consequences of a dam's destruction are qualifying events for many international laws.

- The International Criminal Court may investigate:
  - 1.1. Deliberate attacks on civilian objects (Article 8 part 2 b point ii of the Rome Statute).
  - 1.2. Infliction of widespread, long-term, and severe environmental damage in excess of the anticipated overall military advantage is a crime under Article 8(2)(b)(iv) of the Rome Statute.
- 2. Additional Protocol 1 to the Geneva Convention prohibits military attacks on dangerous objects (hydroelectric power stations, nuclear power plants, etc.).
- 3. Even if a dam bursts due to negligence, the occupying authorities bear responsibility (Articles 55-56 IV of the Geneva Convention).
- 4. The Security Council or the UN General Assembly can (as Ukraine demands) establish a special Tribunal for the crime of Russian aggression in Ukraine.

**Ecocide is not yet recognized as a crime in international law**





# Consequences of the "peacetime" destruction of dams and their possibilities in a changing climate



*On 7 February 2021, a glacier collapse in India destroyed several hydroelectric power plants downriver. Construction of hydroelectric power plants increases the risks and possibly triggers *disasters* in mountain areas.*



*Break of Sardobinskaya Dam in Uzbekistan 1 May 2020 resulted in a transboundary catastrophe.*

*Screenshot from a photo on an Uzbek government website*

The probability of an accident at any individual large dam in peacetime is relatively small. But that risk is more than exceeded by casualties and destruction in the event of its “unlikely” drawdown.

The possibility of a such a breach of the Dnipro and other hydroelectric dams in Ukraine was discussed repeatedly in peacetime. Responsible agencies invariably avoided the discussion, accusing worried scientists of alarmism.

Accidents resulting in the erosion of large dams occur every year around the world.





# Kakhovka Catastroph

June 2023



- *Breach of the largest dam reservoir in world history*
- *0.5 thousand sq m of land flooded*
- *Draining of 2,000 sq km area of water*
- *Release of 18 cubic km of water into the estuary*
- *Special meeting of the UN Security Council on 23 June 2023*

Images: Sentinels Scientific Data Hub





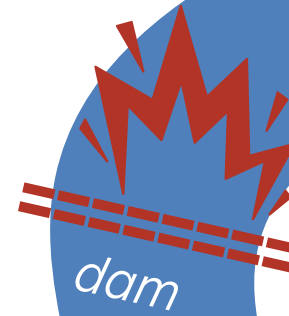
# Downstream impacts of the disaster

- Human loss of life
- Flooding of settlements and loss of housing
- Destruction of infrastructure and businesses
- Pollution of the river and its floodplain
- Public health risks
- Erosion and flooding
- Impact on Black Sea and shoreline (desalination, littering, pollution)

**Kherson**



**Dnipro River**



dam

Photo: Associated Press

# Upstream consequences

- Emptying of the reservoir, dust storms
- Potentially toxic sediments and decaying organics
- Local climate change
- Water supply disruption
- Limits for agricultural irrigation
- Damage to fisheries
- Painful adaptation for near-river residents to a new landscape

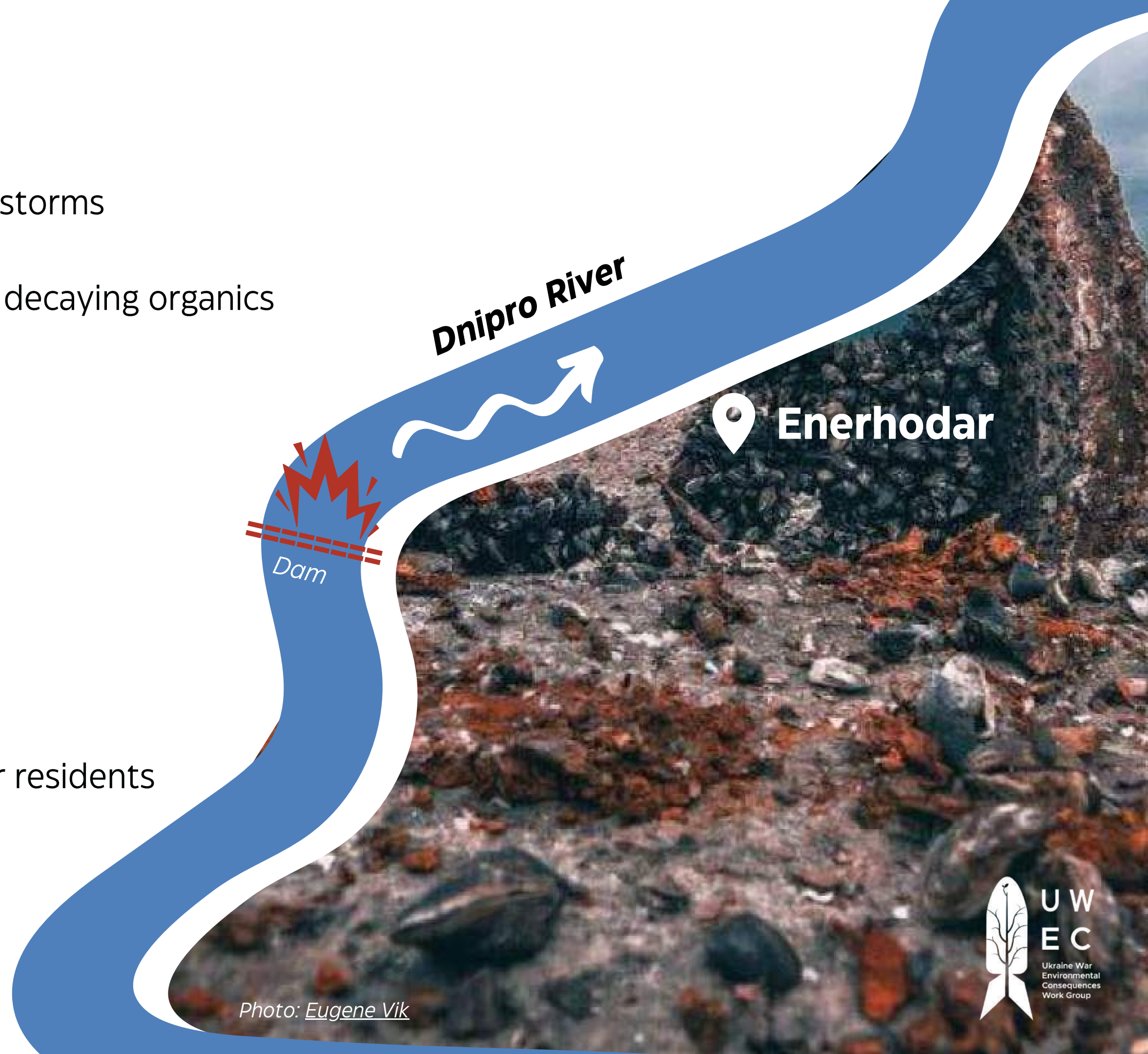


Photo: Eugene Vik



# Socio-environmental issues for the future

- *Landscape and water body changes during the drawdown on the same huge scale as during reservoir's first creation*
- *Reappearance of 2,000 sq. km. of land*
- *Restoration of wetlands (reed beds)*
- *Floodplain restoration*
- *Resumption of fish migrations*

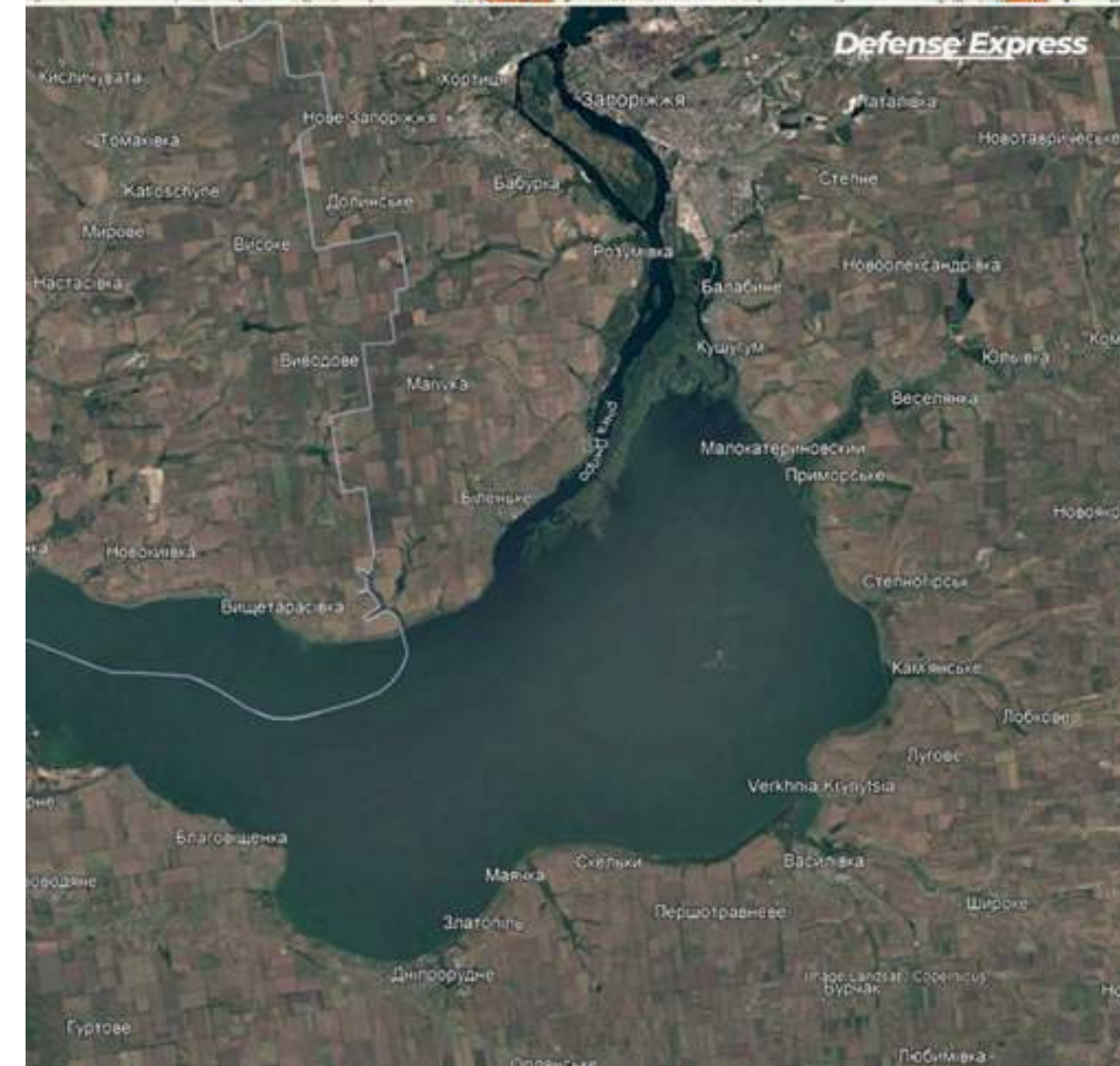


## Rebuild the dam?

*Creating more efficient water supply and irrigation systems does not demand the many years needed to restore the dam*

*A 600 MW solar power plant would occupy less than 1% of the reservoir's surface area at a cost many times less than a new hydroelectric power plant*

 [\*\*Read the article >>>\*\*](#)



*Upper part of the flooded Dnipro River valley (German map, 1943) in comparison with satellite imagery of the reservoir today.*



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# Consequences of Russia's terrorist attack on Kakhovka Dam for wildlife

The destruction of the Kakhovskaya Hydroelectric Power Plant's destruction is the single largest impact of Russia's military invasion on Ukraine's nature.

**Presenter:**  
**Oleksii Vasyliuk**

UWEC Expert,  
Director Ukrainian Nature  
Conservation Group



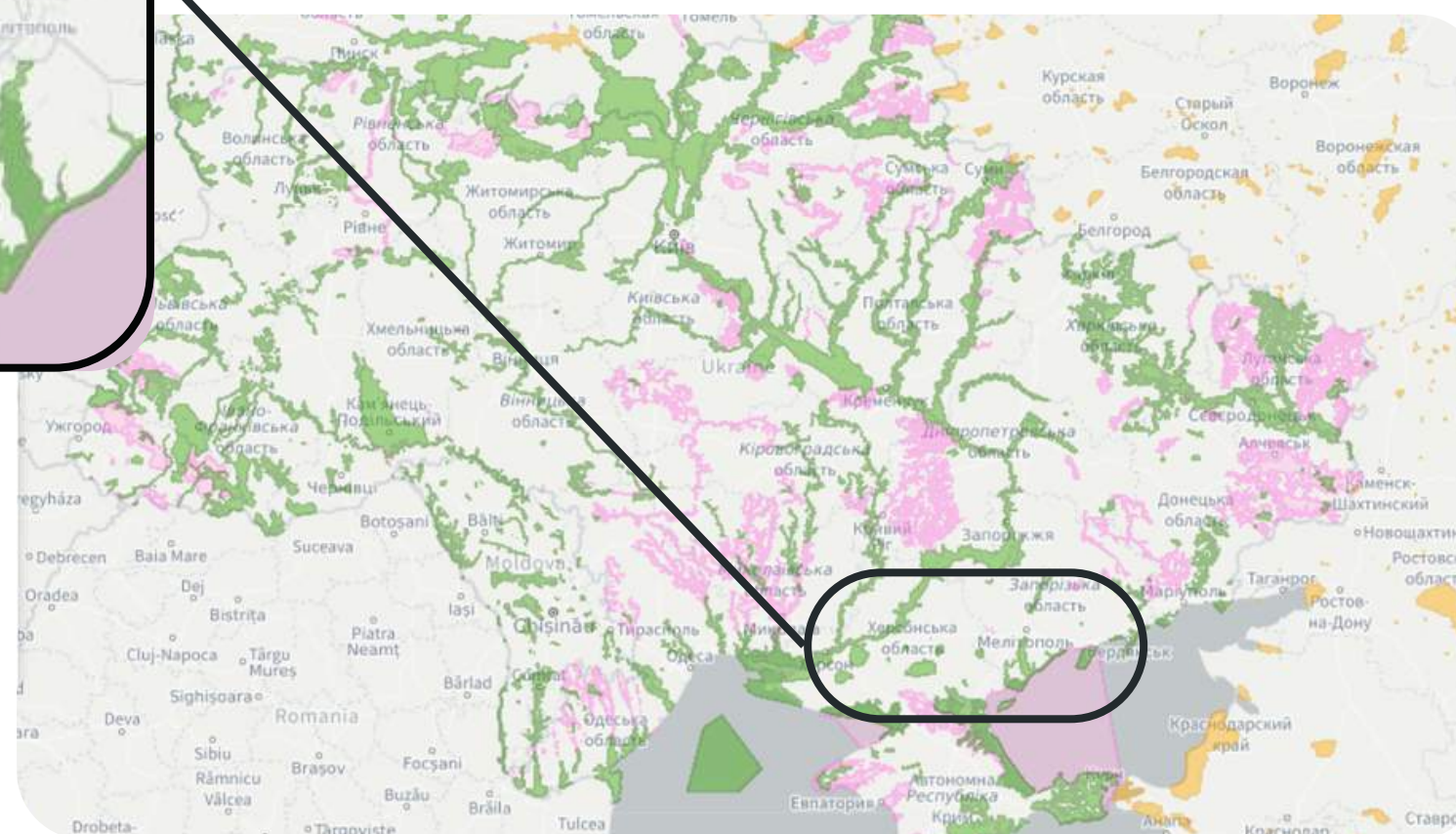
*Emerald Network in Ukraine*

**Attack damaged or destroyed:**

**59** Nature reserve sites

**9** Emerald Network sites

**1** Ramsar site





# Consequences of draining the reservoir



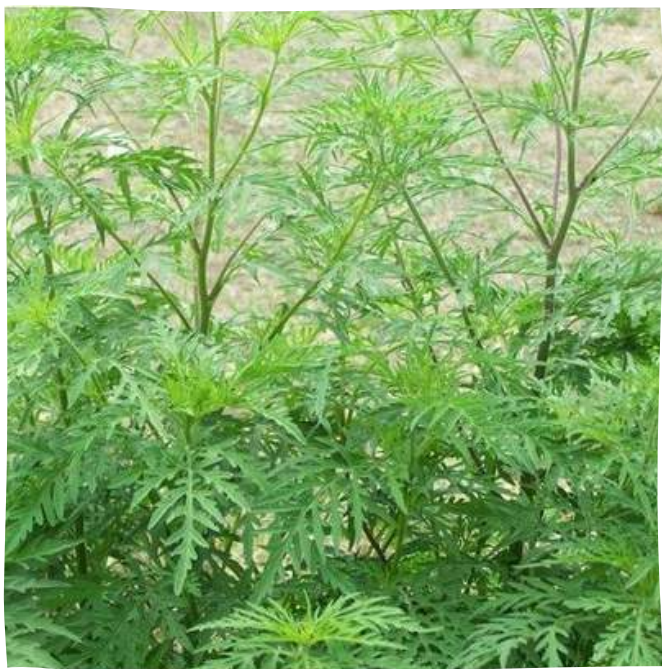
*Impacts to  
**fish populations***



*Impacts to  
**birds***



*Impacts to  
**benthic fauna***



*Impacts to  
**plant world***



*Impacts to  
**rare biotopes***



Photo: Dnipro Oblast Prosecutor, UkrInform, Khmelnytskyi Regional Military Administration, Valerii Kemenov / Facebook



# Consequences for flooded areas downstream



Impacts to **land-based fauna and bird nesting colonies**



Impacts to **vegetation and rare biotopes**



Impacts to the **river** itself



Photo: Ministry of Environmental Protection, Odesa LIVE





Photo: Lower Dnipro National Park



Photo: "Svoboda" News

*Dnipro reed bed*

**Destroyed ecosystems**



Photo <https://tripmustgoon.com/>





# Consequences for the Black Sea's ecosystem

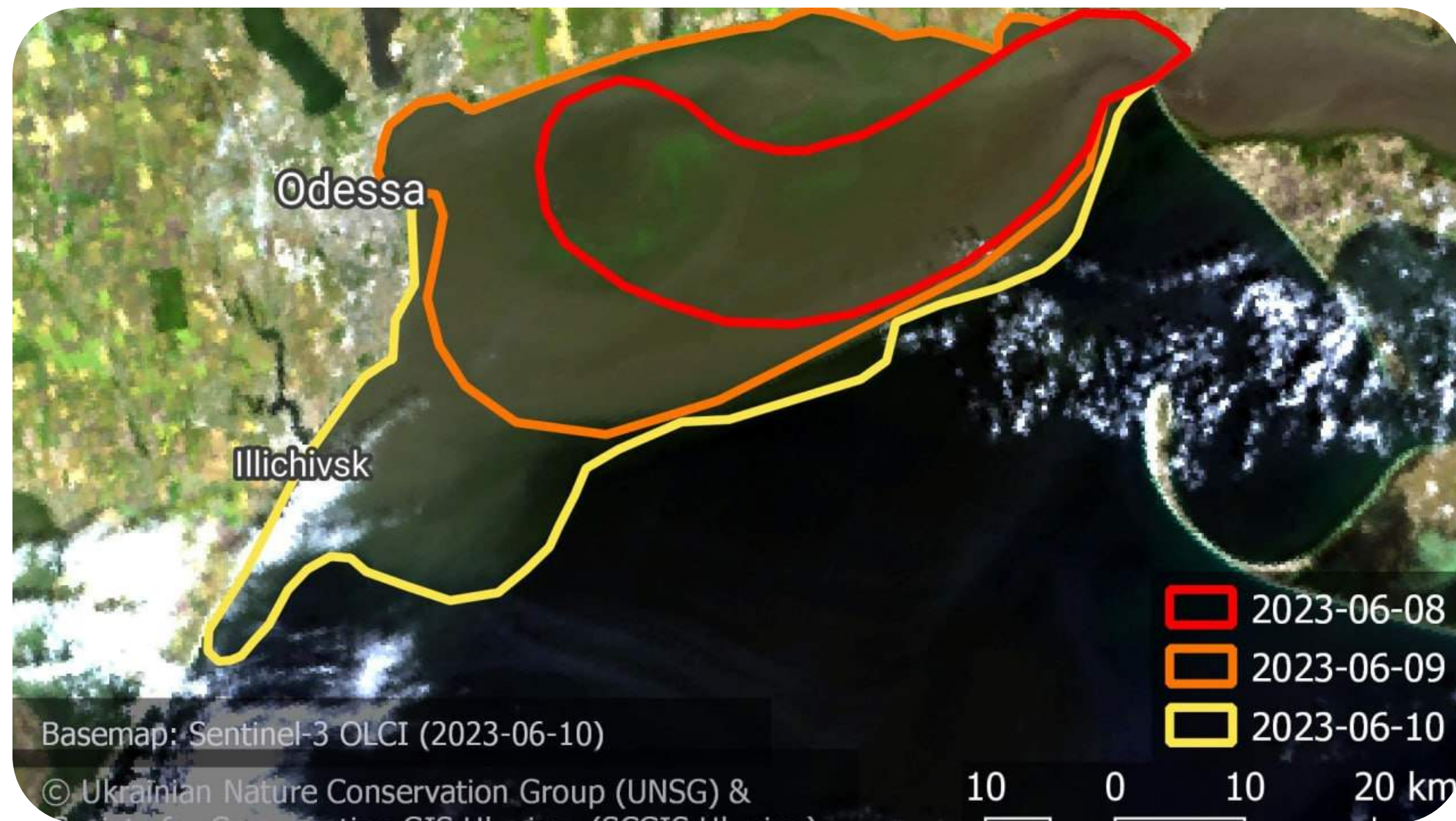


Photo: UNCG, Zeleyony List, Freedom



**Presenter:**  
**Dmitry Gorchakov**  
Nuclear Program Expert  
Bellona



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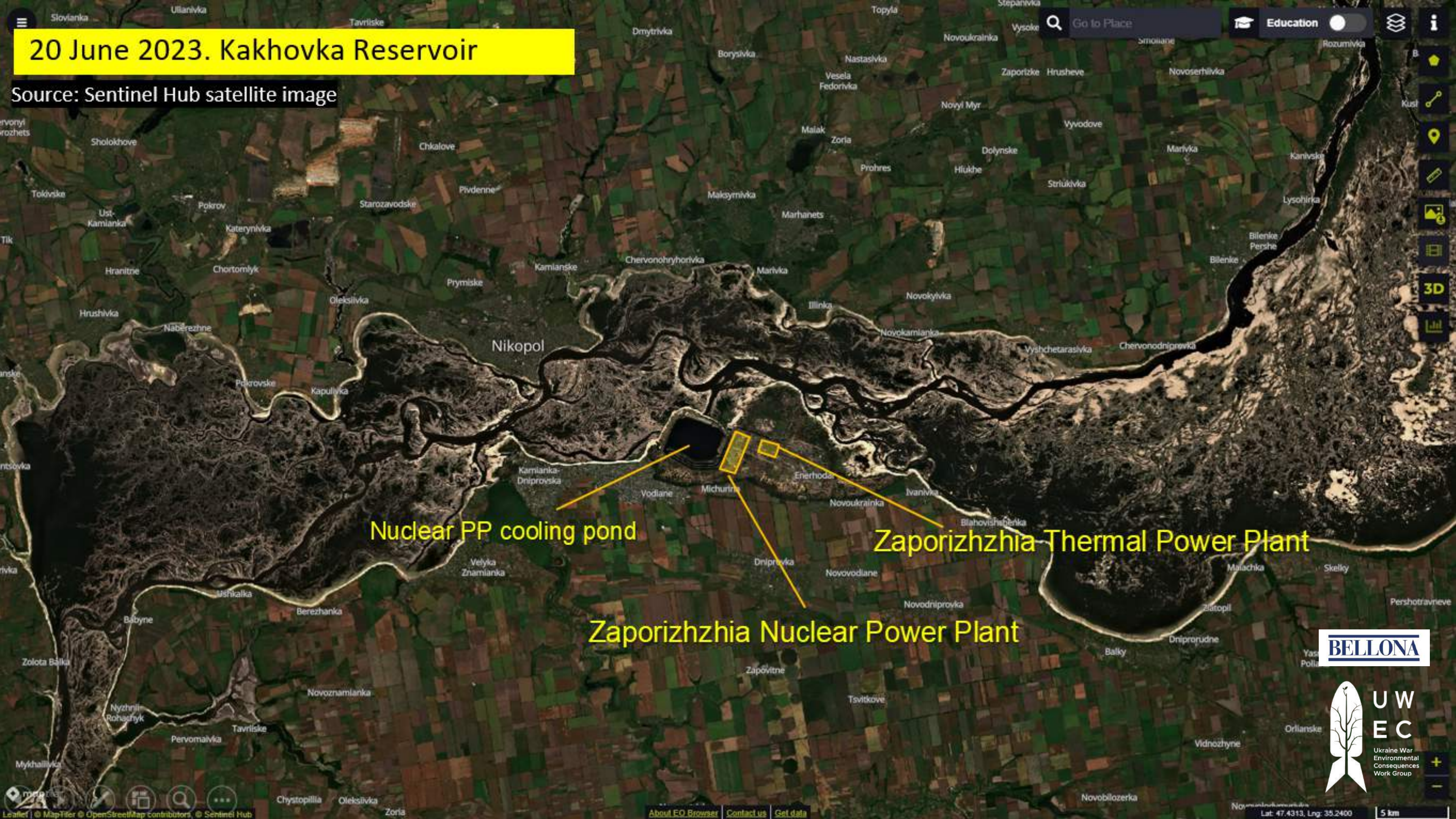
## Consequences of the Kakhovka Dam's destruction for Zaporizhzhia nuclear power plant





20 June 2023. Kakhovka Reservoir

Source: Sentinel Hub satellite image



Nuclear PP cooling pond

Zaporizhzhia Thermal Power Plant

Zaporizhzhia Nuclear Power Plant

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20 June 2023. Area of Zaporizhzhia NPP

Source: Sentinel Hub satellite image



Zaporizhzhia NPP

Service water inlet  
for the hydro-system

Zaporizhzhia TPP

Zaporizhzhia NPP cooling pond

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Enerhodar

Lat: 47.51459, Lng: 34.67045 500 m

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# Water supply when NPP is operating at full power

Source: Archival satellite image, Google Earth/Maxar

NPP Cooling pond (S ~ 10 km<sup>2</sup>)

Water evaporation  
> 100 thousand m<sup>3</sup> /  
day

Feeding channel

ZTPP discharge channel

Zaporizhzhia NPP units (6)

Photo: Energoatom

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Image © 2023 Maxar Technologies

Google Earth

Imagery Date: 4/15/2018 47°30'34.96" N 34°33'44.46" E elev 0 m eye alt 6.08 km



# Operation during reactor shutdown

Source: Archival satellite image, Google Earth/Maxar

Zaporizhzhia TPP  
discharge channel

Unit №6 in cold shutdown

Unit №5 in  
semi hot shutdown

Units №1-4  
in cold shutdown

Spray pools

Water evaporation  
< 1000 m<sup>3</sup> / day

Photo: IAEA 15.06.23

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Image © 2023 Airbus

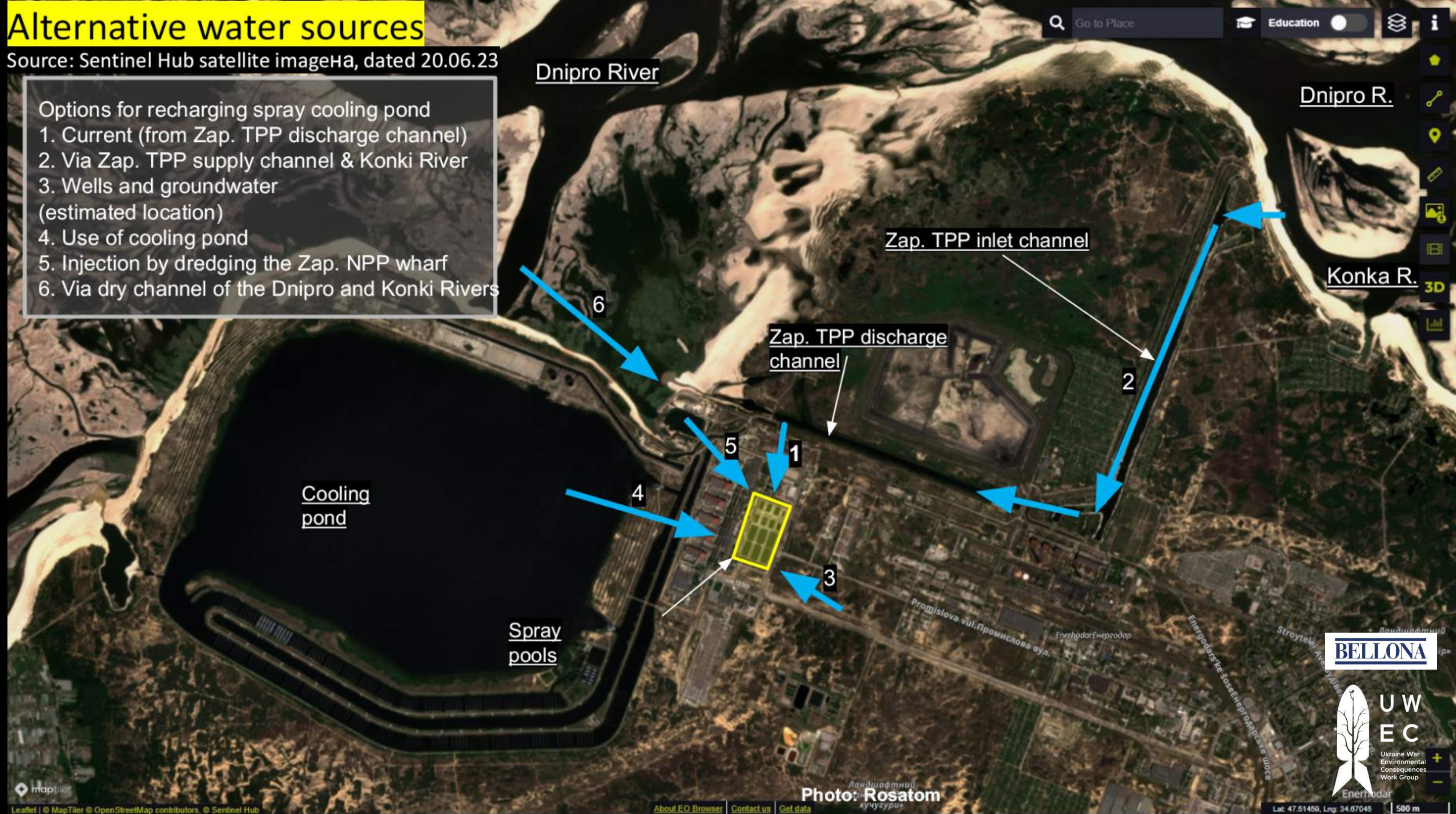
Google Earth



# Alternative water sources

Source: Sentinel Hub satellite image, dated 20.06.23

- Options for recharging spray cooling pond
1. Current (from Zap. TPP discharge channel)
  2. Via Zap. TPP supply channel & Konki River
  3. Wells and groundwater (estimated location)
  4. Use of cooling pond
  5. Injection by dredging the Zap. NPP wharf
  6. Via dry channel of the Dnipro and Konki Rivers





# Weaknesses in Zap. NPP water supply

Source: Sentinel Hub satellite image, dated 20.06.23



Presumed mine deployment

Sluice gate, Zap. TPP discharge channel

Sluice gate, feeding channel

Pump station

EarthCache/SkyWatch

Photo taken during IAEA director's visit  
to Zap. NPP 15 June 2023

Spray pools

Sluice gate, cooling pool discharge  
channel



Photo: Rosatom



Photo: Rosatom

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Photo: IAEA



Photo: Rosatom



# Vulnerabilities with potential for radiation release

Source: Archival Google Earth/Maxar image

## Reactor turbine buildings

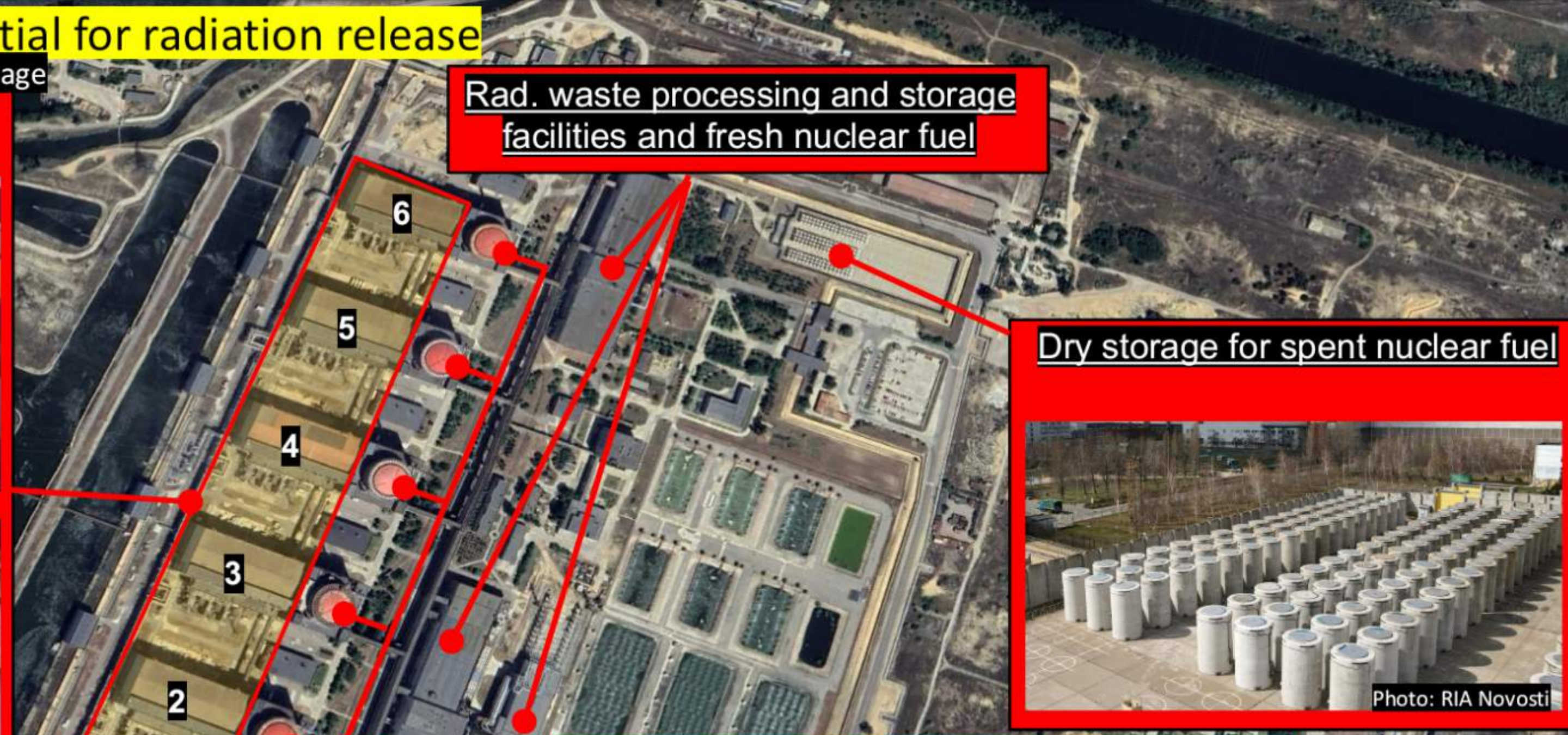


Photo: GUR Ukraine



Photo: tsn.ua video screengrab

## Rad. waste processing and storage facilities and fresh nuclear fuel



## Dry storage for spent nuclear fuel



Photo: RIA Novosti

## Power unit reactor compartments



Photo : Enerhoatom

**Main threat to ZNPP over last 16 months:  
Occupation and unpredictability**

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# Dmitry Gorchakov recommendations

## Bellona report on the risks facing the Zaporizhzhia Nuclear Power Plan



## Bellona nuclear newsletter



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# 4

## How the media is covering the explosion of Kakhovka Dam

There are three main kinds of publications in the media about the dam:

**Presenter:**  
**Viktoria Hubareva**  
*UWEC expert and  
environmental journalist*



### **Predicting consequences**

*As a rule, they point to environmental consequences and rely on on commentary and preliminary conclusions made by environmentalists.*

### **Onsite reporting**

*Videos or photos, mostly highlighting the economic consequences and evacuation of people and animals, comments made by affected residents in Kherson and the region.*

### **Reports by local authorities**

*Current focus on water quality, retreat of flood waters, humanitarian aid deliveries, etc.*





# Where to find information about the situation in Ukraine?



## Official Sources

- [Ukraine Ministry of Environmental Protection](#)
- [Ukrainian Ministry of Health](#)
- [Ukraine State Consumer Service](#)
- [Kherson City Council](#)
- [Kherson Municipal Military Organization](#)



## Community Organizations

- UWEC Work group members
- [Ukrainian Nature Conservation Group](#)
- [Greenpeace: Green reconstruction of Ukraine](#)
- [Environment People Law](#)
- [Let's do it Ukraine](#)
- [UAnimals](#)



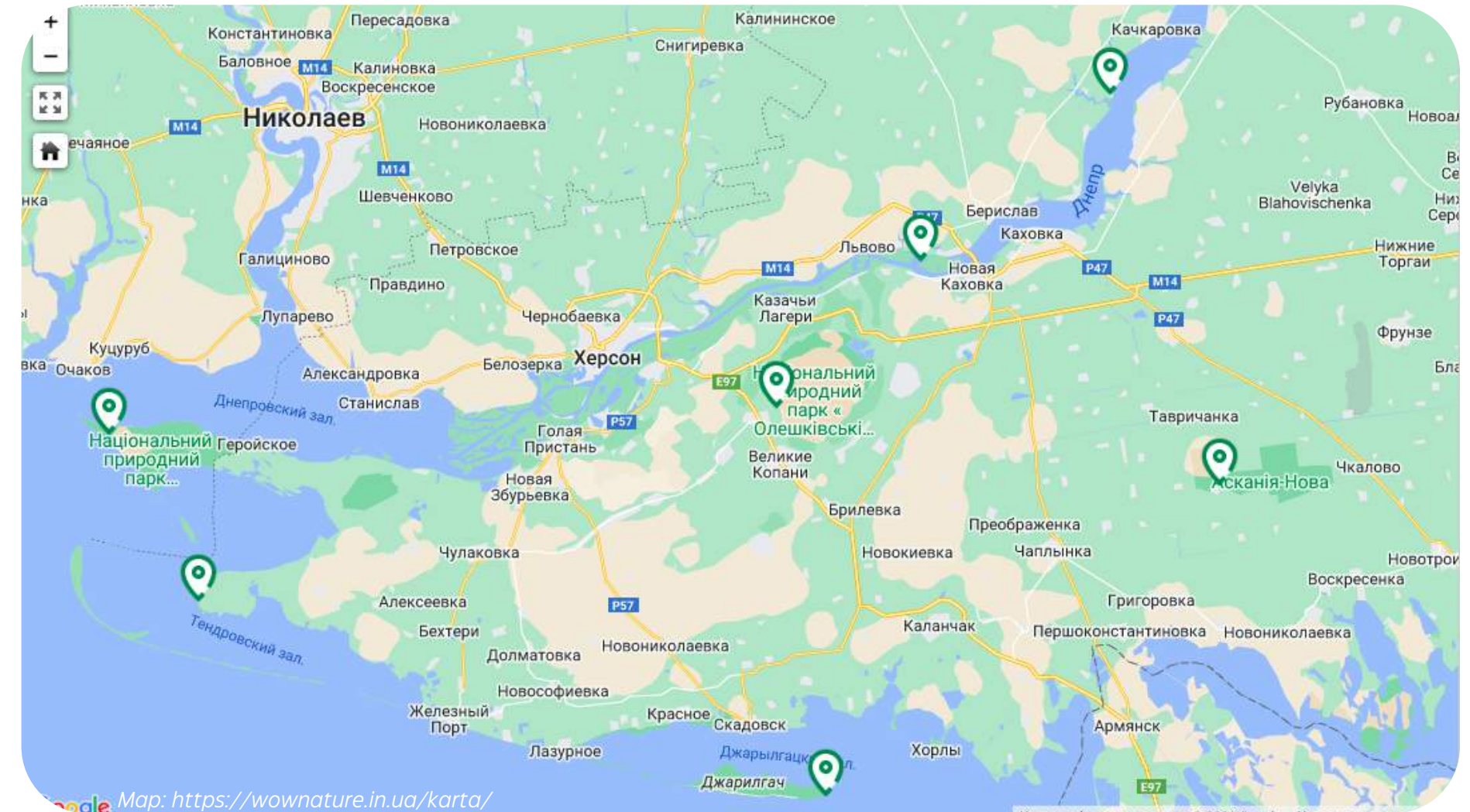


# Where to find information about the situation in Ukraine?

**Protected areas**, that have directly suffered from the accident

- Kamyanska Sich National Park
- Lower Dnipro National Park
- Oleshky Sands National Park
- Black Sea Biosphere Reserve
- Biloberezhia Sviatoslava National Park

*National parks and biosphere reserves in southern Ukraine*





# Thank you for your attention!



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We are happy to hear from you!



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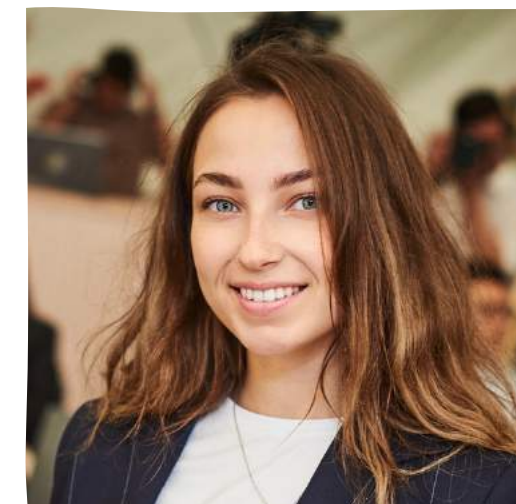


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