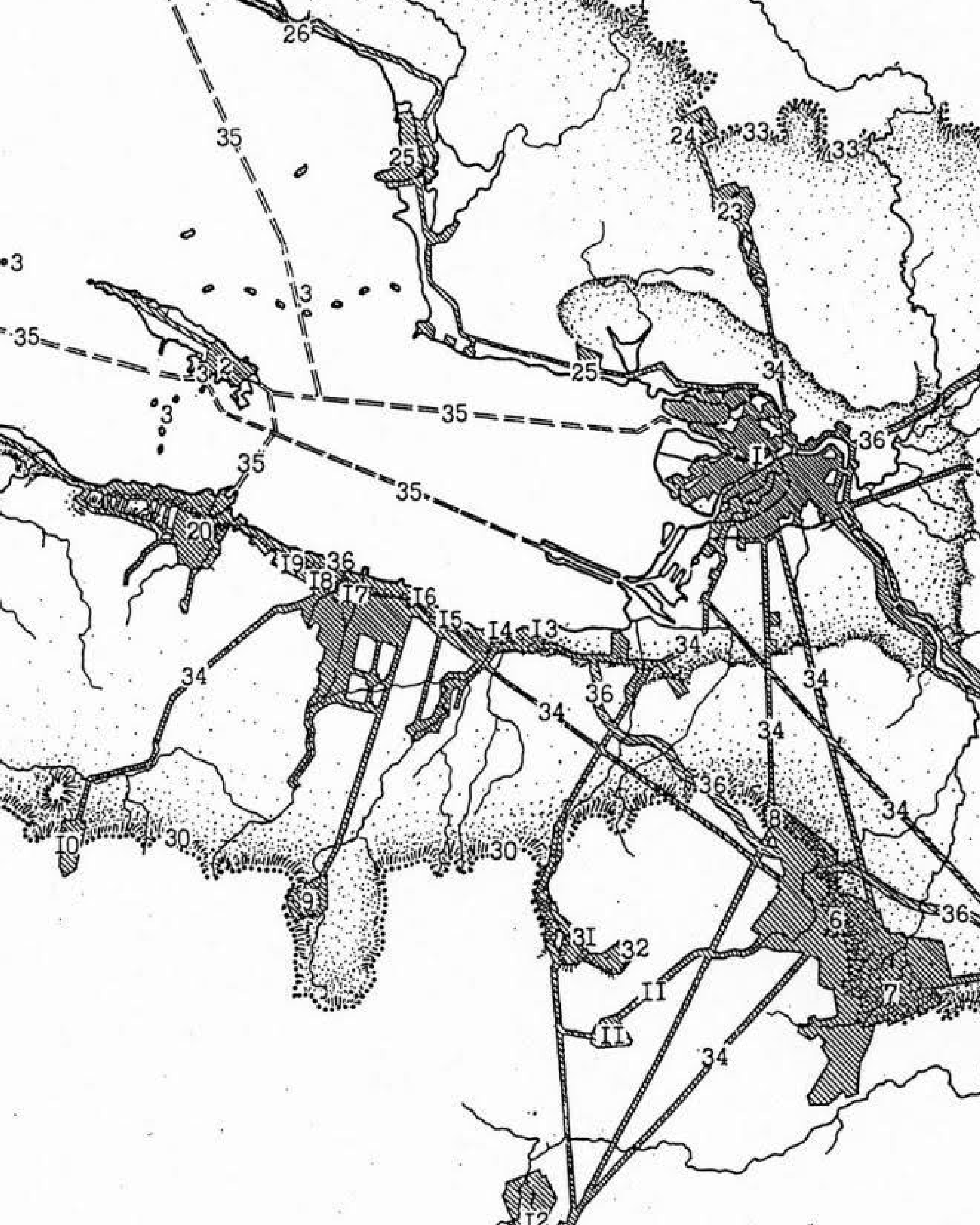
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The Water Spaces of St. Petersburg and its World Heritage: Climate Change and Other Threats

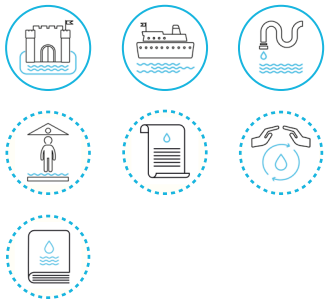
Sergey Gorbatenko

Abstract
St. Petersburg and its surrounding areas have been shaped by their relationship with water. Following the example of Amsterdam, city founder Peter the Great sought to supplement the Neva River Delta with numerous canals. He also aimed to make the new Russian capital the country's primary port and trade center by shifting it toward the open sea, which led to the establishment of the port city of Kronstadt on Kotlin Island. Today, the historic center of St. Petersburg, including the Neva water spaces and the Kronstadt forts and harbors on these islands, is listed on UNESCO's World Heritage List, comprising 116 individual cultural heritage sites. However, with the intensifying impacts of climate change, the property is at risk of flooding. Specialists' calculations have made it possible to make accurate predictions and propose measures to protect the city from such threats. The outcomes were incorporated into St. Petersburg's Regional Climate Change Adaptation Plan; however, the document pays little attention to safeguarding cultural heritage. At the same time, rapid urbanization poses just as serious a threat as climate change to St. Petersburg and its surrounding areas, and for many years has brought harm to the "Historic Centre of St. Petersburg and Related Groups of Monuments."

KEYWORDS

UNESCO World Heritage
climate change
flooding
cultural landscape
urban development

WATER ICONS



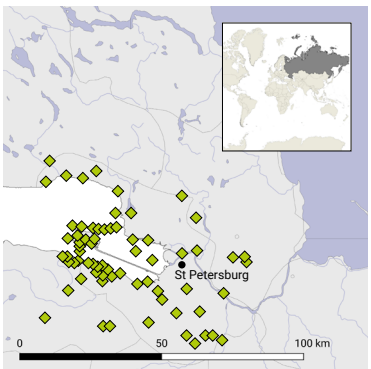
CLIMATE

A B C **D** E

Dfb: Humid continental climate

Policy Recommendations

- Strengthen St. Petersburg's Regional Climate Change Adaptation Plan by placing greater emphasis on protecting cultural heritage sites, which aligns with scientific forecasts of flooding and sea level rise.
- Revise the Law of St. Petersburg on Protection Zones to explicitly address World Heritage concerns and ensure legal protection for vulnerable cultural assets.
- Establish buffer zones and adopt a World Heritage property management plan that incorporates future climate risks.



< Fig. 1 Fragment of the map of the World Heritage property, Historic Centre of St. Petersburg and Related Groups of Monuments, shows the Gulf of Finland, the Neva Bay and the Neva River (Source: Boris Nikolashchenko, 1990).

St. Petersburg: City of Water

Water is fundamental to the Historic Centre of St. Petersburg and Related Groups of Monuments World Heritage property. The city, founded in 1703 by Peter the Great at the mouth of the Neva River, was conceived as "New Amsterdam" and "New Venice." It stretches along the powerful waterway, which feeds numerous ducts of the Neva Delta and canals created in the eighteenth century. Together with the landforms, water systems determine the character of the St. Petersburg urban agglomeration. The Neva River connects the Gulf of Finland and its narrow eastern part, the Neva Bay, separated by Kotlin Island, with the largest lake in Europe, Lake Ladoga. The central part of the Neva water area within the delta forms the main city space – a vast visual pool that encompasses the historic center, providing compositional integrity to the city and a unique unity to its image (fig. 2). This space includes key architectural ensembles such as the Peter and Paul Fortress, the buildings of the Palace Embankment (including the Winter Palace), the Admiralty, Senate Square, the Stock Exchange and University Embankment on Vasilievsky Island.

The "Historic Centre of St. Petersburg and Related Groups of Monuments" World Heritage property, encompasses a vast historic agglomeration. It includes 36 major components, which are further divided into several elements, comprising a total of 116 individual heritage sites. Many are physically connected to water, situated along shorelines or on islands (figs. 1 and 3).

The 1990 nomination emphasized the importance of St. Petersburg's water system, highlighting the way the city's landscape geography, with its vast water area, flat islands, and complex estuary, shaped an unusual urban structure. The Neva River and its network of waterways were described as an extension of the city's squares, creating an exceptional spatial scale and visual richness that significantly contributes to the site's Outstanding Universal Value (OUV) (UNESCO World Heritage Centre 1990; 2015).

At the same time, ICOMOS, as the advisory body in the nomination process, sounded an alarm:

> Leningrad[1] is now a city of nearly 5 million inhabitants and that it covers 200 square kilometers. The existence of a major industrial complex – the largest in the USSR – with its steel, petrochemical and chemical factories poses the difficult problem of the harmonization of development and safeguarding policies. The delimitation of the historic area annexed to the nomination takes major elements of the architectural heritage into account, but not the environment (ICOMOS 1990).

Since then, the property has faced increasing pressure from two major threats: flooding associated with climate change and rapid urban development. Rising sea levels and storm surges pose a threat to the low-lying areas of the site, while construction projects and inadequate regulation compromise the cultural landscape's visual and spatial integrity. Current heritage management and climate adaptation frameworks do not adequately address these threats. Despite nearly 35 years having passed since the city and surrounding areas attained World Heritage status, no management plan has yet been developed. The components and individual heritage sites are located within different adminis-

1. Leningrad was the name of St. Petersburg from 1924 to 1991, during the Soviet period. The city reverted to its original name following a public referendum in 1991.

^ Fig. 2 Main City Space of St. Petersburg (Source: Sergey Gorbatenko, 2008).

trative units of the Russian Federation, specifically the city of St. Petersburg and the Leningrad Region (Leningrad Oblast), which creates additional challenges in organizing the management of the property.

St. Petersburg Under Threat of Climate Change

Throughout the twenty-first century, annual increases of the sea level in the eastern part of the Gulf of Finland have reached approximately 4 mm each year. One area particularly vulnerable to this phenomenon is the historic center of St. Petersburg (fig. 4).

St. Petersburg's surge floods, caused by strong westerly winds generating the so-called long wave, have also become more frequent. The danger of the surge was largely eliminated with the commissioning of a protective structure, the St. Petersburg Flood Prevention Facility Complex (KZS, also unofficially known as the "St. Petersburg Dam"). However, this 25-km-long structure, built between 1979 and 2011,[2] caused great damage to the landscape of Neva Bay. It crossed the chain of historical estates on the southern shore, Kotlin Island, the line of the Northern Batteries, fairways, and underwater barriers – all these sites included in the 1990 nomination, were seperated, disrupting their historical continuity. Although the dam intervention significantly altered the landscape, the overall OUV of the World Heritage property was not formally recognized as affected. This is because, in the official retrospective Statement of OUV adopted in Bonn in 2015 (UNESCO World Heritage Centre 2015), the landscape qualities of the

2. Flood Prevention Facility Complex, https://dambaspb.ru/en/#intro.

3. Federal Law of 02.07.2021 "On Limiting Greenhouse Gas Emissions", http://publication.pravo.gov.ru/Document/View/0001202107020031.

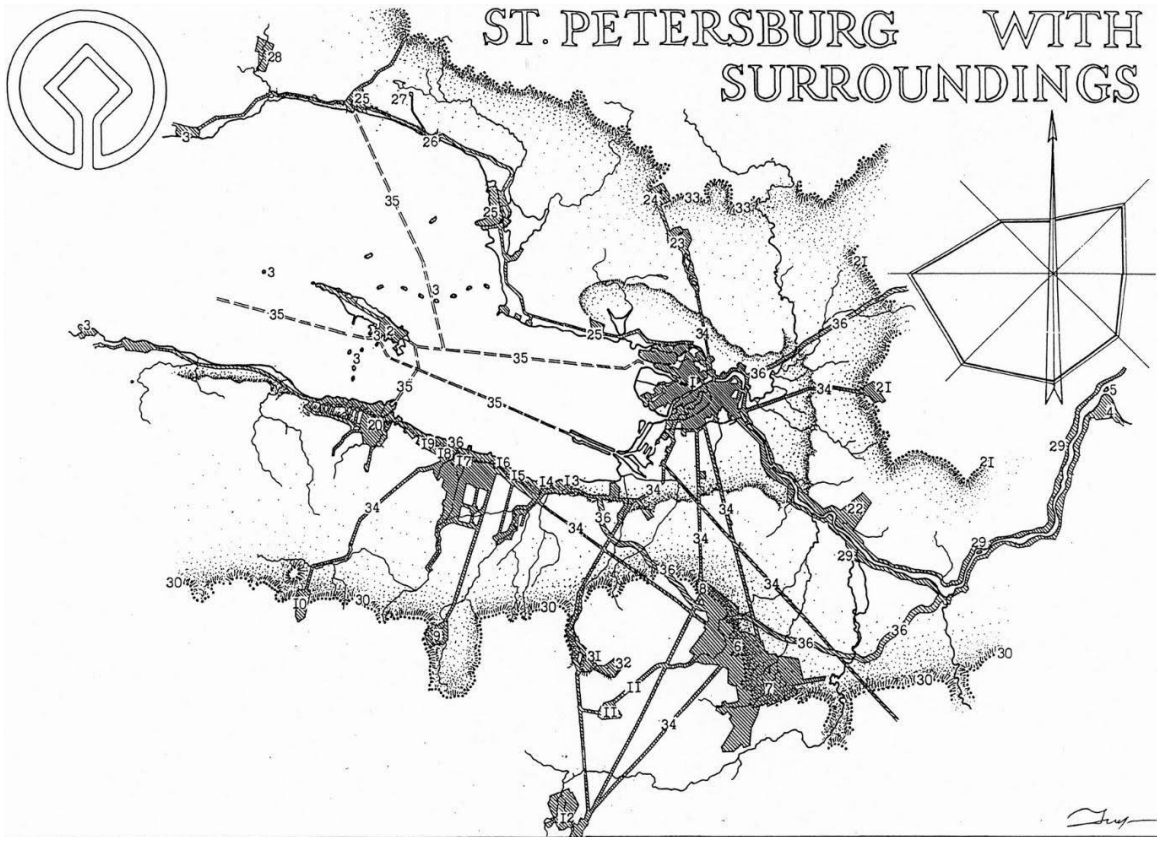
4. https://interactive-atlas.ipcc.ch/.

"related groups of monuments" – particularly their relationship to surrounding water and open space – were entirely overlooked.

St. Petersburg and the Regional Climate Change Adaptation Plan

Undoubtedly, St. Petersburg and the Leningrad region negatively contribute to climate change, primarily due to the intensive burning of fossil fuels. At the same time, the Russian authorities, including the St. Petersburg administration, have taken several measures to correct this situation. In particular, in 2021, the Federal Law "On Limiting Greenhouse Gas Emissions" was adopted.[3] Following this, by the decision of St. Petersburg Governor Alexander Beglov, dated December 21, 2023, the Regional Climate Change Adaptation Plan for St. Petersburg was approved (Government of St. Petersburg 2023).

The Regional Climate Change Adaptation Plan, which was developed by St. Petersburg specialists, indicates that by 2050, the climatic zone of St. Petersburg (according to the Köppen-Geiger climate classification) may change from "humid continental with warm summers" (Dfb) to "moderately warm with uniform humidification" (Cfb) of the "marine" sub-type. Recent climatic observations indicate that the frequency of sea surge floods in the region has increased significantly, with the seasonal peak shifting from autumn to winter. According to projections from the Interactive Atlas[4] of the Intergovernmental Panel on Climate Change (IPCC), the average sea level in

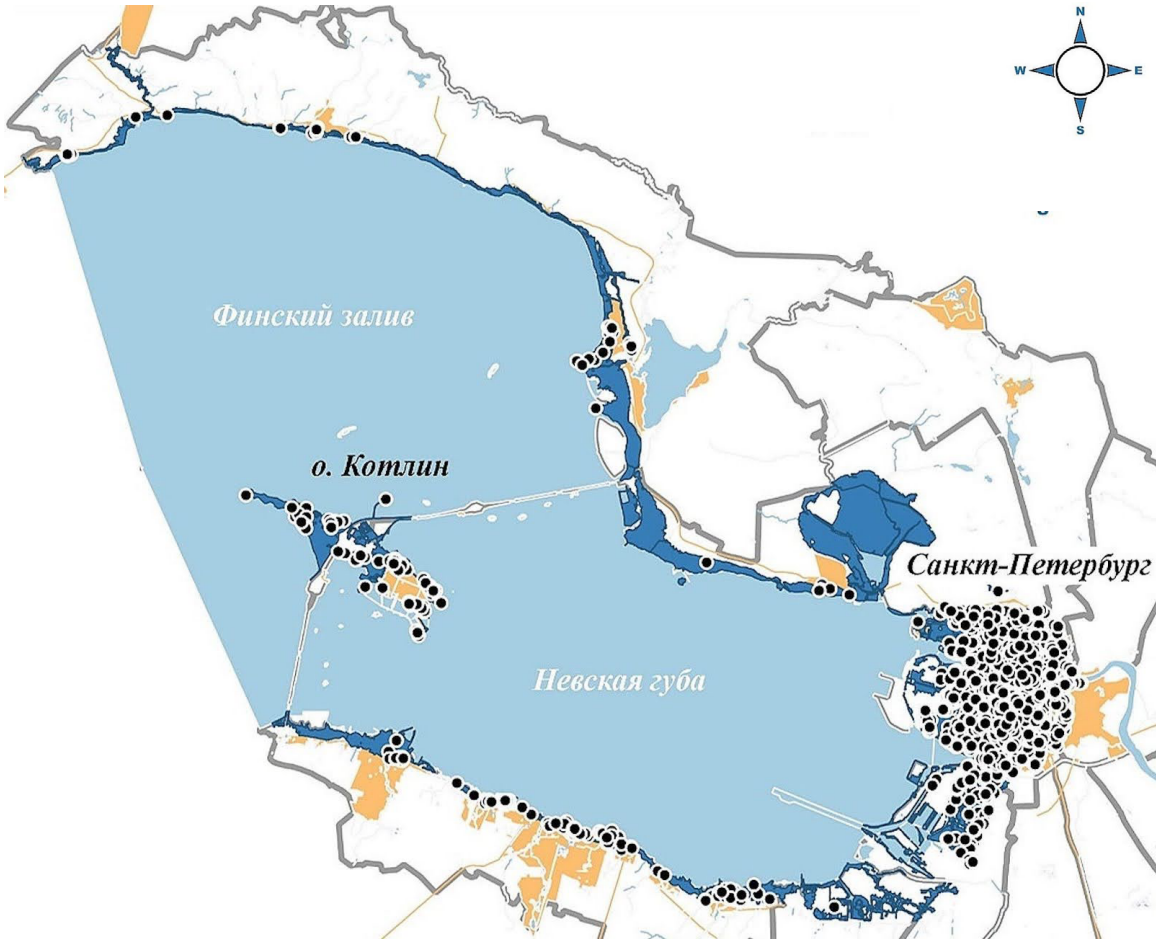


^ Fig. 3 A nomination scheme from the 1990 application, which corresponds conceptually to the present-day layout. The map of the World Heritage property, Historic Centre of St. Petersburg and Related Groups of Monuments, shows the Gulf of Finland, the Neva Bay and the Neva River (Source: Boris Nikolashchenko, 1990).

the eastern Gulf of Finland may rise by 10–40 centimeters between 2041 and 2060, relative to the 1995–2014 baseline, under scenarios SSP2-4.5 and SSP5-8.5. A sea level rise of 40 centimeters could result in flooding approximately 650 hectares of coastal areas in St. Petersburg. Under such conditions, the city's flood zone at peak water levels could expand by a factor of 1.5, posing a severe threat to both the urban fabric and heritage components in low-lying zones (Government of St. Petersburg 2023).

At the same time, the threat to cultural heritage and St. Petersburg's World Heritage property is mentioned only once in the Regional Climate Change Adaptation Plan. In the final chapter, "Description of Predicted Changes in the Distribution of Climate Risks of the Territory," it reads:

> An increase in the average sea level by 30-40 cm will increase the area of the flood zone of St. Petersburg by 1.5 times and the number of historical and cultural heritage sites within its boundaries by four times. This climate risk is expected to become "dangerous" by the middle of the twenty-first century. With a further increase in average sea level of up to 1 m, the impact will become catastrophic (Government of St. Petersburg 2023).



^ Fig. 4 Historical and cultural heritage sites (black dots) in the territory of St. Petersburg that fall in the flood zone (in dark blue), while the average sea level is rising by 80 to 100 cm (Source: Pavlovsky, A. A., and V. I. Shamshurin. 2021b. "The Impact of the Rising Baltic Sea Level on Russia's Historical and Cultural Heritage." Hydrometeorology and Ecology 65: 681–693; used with the author's permission).

^ Fig. 5 Peter the Great's palace in Peterhof, "Monplaisir," on the shore of Neva Bay (Source: Sergey Gorbatenko, 2005).

These forecasts are also reflected in the updated assessment of climate risks posted on the website of the Committee for Nature Management, Environmental Protection, and Environmental Safety (Akhmatovich et al. 2023). According to estimates included in the assessment, with a sea level rise of 80-90 cm by the end of this century, 3,283 such historical and cultural monuments may be flooded (Akhmatovich et al. 2023).

The relevant sections of the Regional Climate Change Adaptation Plan and the 2023 updated assessment were prepared based on research by Doctor of Geographical Sciences Artem Pavlovsky and colleagues. Based on the data from studies of the trends in the rise in the Baltic Sea level (in Neva Bay over the past decades – about 4 mm per year), the assessment identifies boundaries of the possible flooding zone of the Neva Delta, the Neva Bay and the eastern part of the Gulf of Finland (within the administrative boundaries of St. Petersburg). It indicates the factors influencing this process: for Neva Bay, this is a rise in the average sea level, the flow of Neva water, an increase in the frequency of floods, an increase in the duration of the closure of the KZS and a decrease in the water surface due to the intensive reclamation of territories for new residential construction. The juxtaposed boundaries of World Heritage property and individual cultural heritage sites of various protection levels illustrate the extent of the threat facing St. Petersburg's heritage. These risks also extend to coastal and island heritage sites in the Leningrad Region (Oblast).

To counter this threat, the Administration of St. Petersburg proposed that local protective dams be installed in combination with a system of drainage canals (Akhmatovich et al. 2023). Interestingly, at the beginning of the eighteenth century, Peter I proposed similar techniques, borrowed from Holland, for his seaside residences – Catherinehof and Peterhof (fig. 5).

Threats to the Cultural Landscape of St. Petersburg's World Heritage Property

The draft design of coastal protection structures in Neva Bay is given in the updated assessment (Akhmatovich et al. 2023). However, it should not be forgotten that highly protective

dams can alter the traditional character of the landscape and heritage sites, including the views and panoramas that open onto the waters of Neva Bay and the Gulf of Finland. The KZS dam disrupted the natural horizon with a dark stripe and the unnatural silhouette of a bridge in the middle of the water area – an intervention that should serve as a warning not only against similar engineering structures but, more urgently, against high-rise developments and skyscrapers that could further compromise the integrity of the historic waterscape.

The cultural landscape of St. Petersburg has long suffered from intensive urbanization. As a result of lobbying by construction companies and widespread corruption, businesses are building up gap-free territories and waters near historical areas. Assessments on the impact on World Heritage value (despite the adoption of the relevant state standard), with appropriate communication of findings shared with international protection bodies, are carried out only sporadically.

The existing law on protection zones in relation to the international status of St. Petersburg does not work satisfactorily: suffice it to say that the World Heritage property is not mentioned at all. Buffer zones are completely absent, which is mandatory for such sites and ensures the preservation of distant views and panoramas (UNESCO World Heritage Centre and ICOMOS 2019). The Neva Bay – a potential buffer zone for coastal and island heritage elements – lacks protection status. It could be protected by World Heritage – listed historic fairways and underwater groyne barriers – but that's only in theory.

Until recently, alluvium of new territories for residential construction was widely practiced in St. Petersburg, primarily in Neva Bay, along the western coast of Vasilievsky Island (in 2018, in Beijing, at the first official working meeting of the Asia-Pacific Subcommittee of CIVVIH [Comité International des Villes et Villages Historiques, International Committee on Historic Towns and Villages], I presented a report on this topic). Only in 2021 was soil reclamation excluded from the city's general plan: the arguments of experts who proved that the reduction of the water surface could lead to a catastrophic overflow of the bay during a secondary flood were finally taken into account. However, this does not guarantee reliable protection for the Neva Bay water area. For example, the water body of Neva Bay, including along the western coast of Vasilievsky Island, has federal status, and authorities in Moscow may decide that reclamation may continue for development.

Like all components of the UNESCO property, Neva Bay lacks a buffer zone. In 2018, on behalf of the National Committee of ICOMOS (Russia), the author of these lines prepared and sent a report to the ICOMOS headquarters in Paris, listing cases of damage and warning of threats to the World Heritage property. The list included many cases related to water areas that are part of its components. Although these cases were selected based on the criteria of damage to the landscape, which was not directly related to the threat of climate change, the most egregious are worth noting. One is Gazprom's Lakhta-1 skyscraper, which has invaded the Neva and the Neva Bay panoramas. Today, despite the losses of recent years, Gazprom intends to build two more skyscrapers next to the first one – Lakhta 2 and 3. Another scandalous initiative of Gazprom is the construction of a business center on the bank of the Neva, at the mouth of the Okhta River, destroying the cultural landscape and the most valuable potential archaeological sites of the ancient settlements and Swedish fortresses located on this cape.

Conclusion

The risk of flooding coastal cities with historic centers inscribed on the World Heritage List is greater today than ever before. In St. Petersburg's Regional Climate Change Adaptation Plan, significantly more attention should be devoted to the protection of cultural heritage sites, in line with scientific forecasts. Corresponding amendments should be made to the Law of St. Petersburg on Protection Zones. Buffer zones for the World Heritage property must be developed and officially approved, and a comprehensive management plan should finally be established – one that accounts for projected sea level rise.

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Sergey Gorbatenko is the vice president of the Scientific Committee for Cultural Landscapes of the ICOMOS National Committee in Russia. He is an art historian with particular expertise in heritage protection, including World Heritage properties. He studied at St. Petersburg's Institute of Painting, Sculpture, and Architecture (Academia of Arts, Russia). He worked in a restoration workshop in St. Petersburg and then in the Committee for the State Inspection and Protection of Historic Monuments of St. Petersburg (KGIOP). He is the founder of the St. Petersburg regional branch of ICOMOS (ICOMOS St. Petersburg) and served as its chair from 2010 to 2019. Since 2013, he has been a member of CIVVIH. The author of over 180 publications, including 10 books and numerous works on history and the protection of cultural heritage, he is a website administrator of the "Heritage Expert" (http://heritage-expert.ru/) and "World Heritage of St. Petersburg" (http://whl.spb.ru/) portals.

Contact: icomos.spb@gmail.com