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PRINCIPLES OF ARCHITECTURAL AND LANDSCAPE DESIGN
OF WATER AREAS

ZASADY PROJEKTU ARCHITEKTURY I KRAJOBRAZU
OBSZARÓW WODNYCH

Abstract

Nowadays, the paradigm of coexistence with the planet's aquatic environment is changing due to the impact of many factors, among which climate change plays a principal role. The importance and necessity of finding new rules for the coexistence of water and humans on the planet is a reality of our time. The Paper justifies the necessity of considering Water areas as an object of urban planning and landscape design. There are three main ideas that uncover the meaning of the subject according to the principles of designing Water areas: considering them as habitat environments, investigation of changes in the lives of the current generation in accordance with the necessity to adapt to climate change, studying a nation's memory in a historical retrospective and in the process of searching for historical national identity. The study considers water depending on its physical state.

Keywords: architectural and landscape design, water areas, habitat, environment, adaptation to climate change, historical memory of nation, physical state of water: solid, liquid, gas

Streszczenie

W dzisiejszych czasach paradygmat współistnienia planety ze środowiskiem wodnym zmienia się z powodu wpływu wielu czynników, wśród których główną rolę odgrywa zmiana klimatu. Znaczenie i konieczność znalezienia nowych zasad współistnienia wody i ludzi na planecie jest rzeczywistością naszych czasów. Artykuł uzasadnia konieczność uznania obszarów wodnych za obiekt planowania miejskiego i projektowania krajobrazu. Istnieją trzy główne idee, które odkrywają znaczenie tematu zgodnie z zasadami projektowania obszarów wodnych: uznanie ich za środowiska siedliskowe, badanie zmian w życiu obecnego pokolenia zgodnie z koniecznością dostosowania się do zmian klimatu, badanie pamięci narodu w retrospektywie historycznej oraz w procesie poszukiwania historycznej tożsamości narodowej. Badanie uwzględnia wodę w zależności od jej stanu fizycznego.

Słowa kluczowe: projektowanie architektoniczne i krajobrazowe, obszary wodne, siedlisko, środowisko, adaptacja

1. Introduction

Earth is a blue planet, the surface of which is distributed between water and land. 71% of the planet is covered with water. In the past most attention in landscape and architectural practice was paid to coastal and riparian areas, while water was usually used for economic or decorative reasons. Nowadays the paradigm of coexistence with water has changed due to many factors, among which climate change plays a principal role. While the industrial revolution has determined our civilization's development in recent centuries, the only way to evolve successfully now is to embrace the ongoing green revolution. It is quite difficult to disagree with the general statement of Dr. Hart Porsch of Balam Investments, LLC, that "the future state of Green is Blue" [1].

2. The aim of the research

The aim of this research is to reveal the main trends and principles of the design of water areas in an architecture and landscape context and to determine social aspects of their influence on further development.

3. Description of water areas and their design in an architectural and landscape context

3.1. 'Water areas' – a new term and the main principles of architectural and landscape design

The importance and necessity of finding new rules for the coexistence of water and humans on the planet due to the climate change is a current reality.

So, it is necessary to consider 'Water Areas' as an object of urban planning and landscape design [2]. Let us evaluate all the pros and cons from a professional point of view and try to clarify why water areas have potential in architectural and landscape usage, how long they have been used by humans, and their prospects for the wellbeing of people on the planet. 'Water areas'¹ is a new term introduced by the Author in the theory of urban development and landscape architecture.

In fact, humans have long used water areas extensively for their own needs. Let us analyze how.

The term 'Water areas' implies areas under natural bodies of water such as oceans, seas, lakes or rivers. Water areas include the water surface, the water column and the underwater shore. They are potential areas for future human settlement. This leads to the introduction of a new urban construction concept for the development of aquatic spaces of the planet and the

¹ The term 'Water Areas' was approbated in the works of the scientific and technical conferences «Energy-Integration-2017», «Underwater Technologies-2017» at KNUBA, UA; International Multidisciplinary Scientific Conferences on Social Science and Arts SGEM 2016, Bulgaria.

territorial waters of countries. Thus, the geographic system of land and water in its projection on spatial planning is the zone of their mutual inter-influence, which must be designed at a qualitatively new level [2]. The peculiarities of their design take into account the natural processes of water ecosystems, etc. [3].

Like all urban planning and landscape design objects, water areas also need principles of architectural and landscape design. We may consider some of the following main principles: the principle of complementarity of water and land coastal territories; the principle of transference; the principle of balanced cooperation; the principle of a technologically diverse architectural-design approach to the utilization of water in landscape architecture, etc. For example, the principle of transference assumes the transfer of elements of water areas to coastal areas and vice versa to achieve and enrich a variety of architectural and landscape solutions.

3.2. The architecture and landscape context of water areas

What are the principles of the spatial composition of water areas? From a landscape and architectural point of view, what does it mean to live in direct contact with water, near water, on water or under water? We discuss three main ideas that uncover the meaning of the subject.

Irreversible climate change and innovations in social development at the beginning of 21st century are related to changes in the paradigm of coexistence with the planet's aquatic environment. In the Author's opinion, the importance of water areas is primarily related to considering water territories as habitat environments. Secondly, the urban planning politics of land and water areas should be changed in accordance with the necessity of adapting to climate change. Lastly, changes in the paradigm of coexistence with the planet's aquatic environment

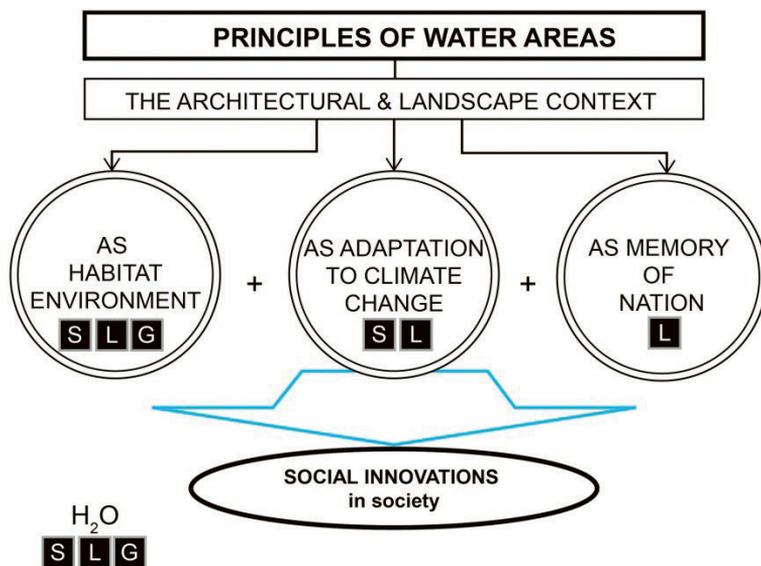


Fig. 1. Diagram of Designing Water Areas (by Liudmyla Ruban). Physical state of water: S – solid, L – liquid, G – gas

influence attitudes towards natural water bodies from a historical perspective and raise the issue of uncovering its meaning in historical and national development. Therefore, historical national memory is tied to determination of the role of water bodies in the development of civilizations: they can be either big rivers or seas. This influences contemporary approaches to the planning of memorial places [4]. All these aspects lead to social innovations in society and enhanced living conditions. The diagram below shows the main trends and design principles of water areas, Fig. 1.

Water is the only substance on our planet which can naturally be present in all three possible physical states. The general concepts of architectural-landscape usage of water components depend on the physical state of water and are outlined by the Author in articles [5–8]. Additionally, the Author has previously investigated the application of water components in solid and liquid states at various scales [9–11]. So, the existence of water as a liquid, solid and gas can help us to investigate the architecture and landscape principles of composing water areas in a more embracing way.

3.3. Architecture and landscape design of water areas as habitat environments

Liquid State: on water

In this part, we examine water as a habitat in its three possible physical states: liquid, solid and gas. The main focus is on marine ecosystems and their possible future development in the 21st century as these currently seem the most popular. The possible planning of underwater and above-water settlements and analysis of international projects over the past five years can provide us with a general idea of the direction in which the architectural-landscape practice of water areas is developing [10]. The conducted analysis of international experience in the design and planning of new cities in aquatic environments highlights new approaches in modern engineering and technology solutions, revealing the potential of marine ecosystems for future development and housing.

Futuristic living suddenly seems to be approaching quite rapidly. For five years, California-based company The Seasteading Institute has been conducting research into the potential for permanent innovative communities that float on the sea. DeltaSync and their associates completed their concept in December 2013. The company signed a deal with the French Polynesian government to begin construction in the Pacific in 2018. The first floating city with significant political autonomy may be established by 2020 [12]. However, people living on the surface of water is not something extraordinary to our planet. For example, the Uros people created an artificial floating island in the Lake Titicaca, in Peru, South America. This is a traditional form of living on the water of a lake. The Uros build their homes and boats from reeds called totora. Each artificial island can support about 10 houses.

Liquid State: under water

Other contemporary evidence of the active usage of water areas can be found in numerous examples of existing underwater dwellings or tenements for people. The diversity of public underwater buildings at the beginning of the 21st century can be separated into the following

categories: hotels with underwater accommodation; hotels with underwater restaurants; individual floating rooms or small houses. Hotels with underwater accommodation have been built all over the world in the USA, Maldives, Emirates, Singapore, etc. The first underwater hotel, Jules' Undersea Lodge, appeared in 1986 in Key Largo, Florida. The newest is Resorts World Sentosa, Singapore. Underwater restaurants in hotels can be found in the Maldives, Emirates etc. Floating rooms or small independent houses have existed in Sweden since 2000 (in a lake near Stockholm; in Lake Mälaren in Västerås), and in Tanzania since 2006 (Manta Resort on Pemba Island in Zanzibar). In fact, underwater usage is the newest trend in Green Blue underwater infrastructure. There are several fantastic examples, e.g. Green Ocean Farming (Cangas, Galicia, Spain), which uses the entire water column and ropes on which thousands of mussels grow to commercial size. This is green ocean farming. No pesticides, feed or antibiotics are needed, and these mussels are recognized as among the best in the world. Small-scale ocean farms which practice multi-trophic aquaculture like this one can provide sustainable food and biofuel, clean up the environment, and facilitate the reversal of climate change.

Solid state

Our research also considers accommodation in permafrost where water is in its solid form as ice and snow. The Arctic is a dynamic, heterogeneous and contested territory today. Catalyzed by climate change and increasing pressure from globalization and natural resource demands, the region is entering a new and unprecedented era in which greater environmental, political, economic and social fluxes are both challenging and redefining its future. Areas of permafrost, for example Nunavut, a rapidly transforming region and one of the newest independent territories in Canada since 1990, has a strong demand for urban planning projects. Among the most interesting projects for snow and ice environments, it is worth also mentioning some others: the new Halley Research Station, Brunt Ice Shelf, Antarctica, 2005–2012; the Transformable Antarctic Research Facility Project, 2014; the concept Alpine Capsule by Ross Lovegrove, 2010; and the Large-Scale Hydroponic-Farming «Arctic Harvester» near Greenland, 2013.

The beginning of the 21st century saw steady development of the ice architecture sector, as evidenced by the appearance of new buildings and facilities. Strong competition in tourism leads to new exotic ice objects, not only ice hotels, but elements of spa centers, churches, chapels, museums of ice sculptures, etc. The range of ice architecture is constantly expanding and seems limitless. Usually, ice hotels are temporary buildings made of snow, sculpted blocks of ice, and in some cases steel framing. Most ice hotels are reconstructed every winter and depend on constant sub-zero temperatures during construction and operation. In addition, ice interiors in hotel suites have become quite popular.

Gaseous State

Gas, the third and the most intriguing state of water, is now in the focus of research. The last 10 years of the creative mind of one dreamer show that Cloud Cities can exist not only in the imagination: “The Cloud Cities series by Tomás Saraceno shows a world without scale



or definable reference points. A seemingly endless landscape covered with a very thin layer of water erases the ground plane, placing the subject matter in the middle of an ostensibly null space” [13]. Man can successfully use water vapor, as shown by the example of the Blue Lagoon Spa Center in Iceland. The Center is located in a lava field in Grindavík on the Reykjanes Peninsula in southwestern Iceland and is used by visitors for total healthy relaxation. The Blur Building, a media pavilion for Swiss EXPO on Lake Neuchatel in Yverdon-les-Bains, Switzerland, is an artificial cloud on the surface of a lake, designed in 2002 by Diller, Scofidio and Renfro [14, p.80].

3.4. Architecture and landscape design of water areas as a contribution to adaptation to climate change

The role of water landscapes in adaptation to climate change is highly significant. The paradigm of modern coexistence with natural water bodies, according to the author, is characterized by not only seeing natural water bodies as a source of threat which demands permanent protection, but also from the standpoint of understanding the natural processes of aquatic ecosystems and the need for adaptation to climate change. Attitudes need to change in this regard. To open the design of water areas in this direction, environmental art-installations can help a lot in understanding the urgency of the climate adaptation process.

Liquid State

One symbolic work from the turn of the 21st century was a climatic installation project called ‘Green River’ created by Olafur Eliasson in various countries around the world [15]. This way of using water areas in art installations attracted global attention to the contemporary problem of environmental pollution and how to fix it.

Solid state

Environmental issues affect every human being on our planet. Contemporary environmental art installation works have targeted environmental protection, attracting attention to water pollution, protection of glaciers, and other problems related to climate change. This can be illustrated by numerous art works which utilized water in its solid state as ice. A good example is the Iceberg Murals by Sean Yoro (aka “Hula”) which were painted in Iceland in 2015. This new series of artworks is entitled ‘A’o’Ana or a Warning about climate change’. “On the shoreline, Hula has painted the image of an arm reaching onto an icy mass. Within a few weeks, the murals will be forever gone” [16]. Other examples are ice installations in European cities: ‘Ice Watch’ by Olafur Eliasson, which allows people to listen to and feel the ice [17]. Artists also want to attract mass attention with the assistance of sculpture. The sculptures by sculptor Nele Azevedo showed the natural process of climate change in a very lucid and clear manner. In 2008 in Italy and in 2012 in Chile Azevedo put more than 1,200 little ice figures to sit and relax on the steps of famous buildings. These human silhouettes, called Monumento Minimo, only stayed a few hours before “melting into the crowd” [18].

3.5. Architecture and landscape design of water areas as historical national memory.

Liquid State

The architectural and landscape design of water areas is also concerned with creating a social urban environment in which inter-generational cultural and historical memories are included. Regarding the author's paradigm of coexistence with aquatic surroundings, the attitude to landscape water bodies has changed in recent years: from taking them into account as just an object of nature, to regarding them as an integral part of the spiritual heritage of a nation. There are many historical science works dedicated to the study of the meaning of different water bodies such as a seas or great rivers in the historical process of humanity [19]. The focus of composing water areas as human memory is related, in our opinion, to the architectural-landscape setting of memorial places [4]. Along with the general idea and design, the natural condition of a site and particular elements of landscaping play an important role in planning the composition of memorials

One of the most expressive landscapes is a sea shore with its natural rocks, waves and tides. A meaningful and unusual example of a combination of a sculpture alongside the natural features of a sea shore is demonstrated by the Monument to the Partisan Woman at the Biennale Gardens in Venice. This monument is devoted to the memory of the partisan movement, and the women who contributed to the fall of fascism in Italy. The monument makes a very strong impression when the limp figure of a woman lying on the ground is covered by the waves. "Great art as a reminder of the horror of humanity. The monument was designed by Carlo Scarpa, and it's a great design. Never meant to float – and the female form is submerged at high tide. Maybe that submergence and disappearance says something about the fate of women in war" [20].

The riparian areas along rivers can also be used in relation to the memory of a nation, but in a different way. The main principles (the complementarity of water and coastal areas; transference; balanced cooperation) can be illustrated by examples of 20th century Ukrainian architectural and landscape practice. It worth mentioning that not only great rivers but also small streams can play a significant role in architectural and landscape design of historical sites. The Dnipro River and its tributaries in Kiev play a significant role in the general planning of the city; its role can be revealed by the architectural and landscape features of the planning solutions. A unique landscape characteristic of Kiev is the contrast of the high right bank and the low left bank along with the breadth of Dnipro river bed and its natural islands. The architectural-landscape design of the slopes of the high right bank of Dnipro River in Kiev consists of a number of historical parks, objects of sacral architecture and historical monuments. Among them are the famous Kievo-Pecherskaya Lavra and the Memorial Complex of World War II with the Monument of the Motherland. One notable planning solution of the Memorial complex is the imitation of Dnipro River with the assistance of an artificial reflecting pond and a group of monumental sculptures, all of which combine with Dnipro River in the background of the panoramic view. In such a way, the principle of transference is used in the general planning of coastal areas.



A similar landscape situation – a river bed with the contrast of its banks – can be found in another place in Kiev, but due to various urban reasons and conditions it is rarely seen at all. This is Lybid River, which was once a high water but is now a degraded watercourse completely swallowed up by the city. The Baikovo Memorial Cemetery was built on the slopes of the eponymous mountain on the riparian areas of Lybid River in 1834. Next to it the architectural Park of Memory (1967–1982) complex was built in the mid-20th century [21, 22]. This complex provides a unique planning example of a place of historical memory in the city (Fig. 2 a and b). “The plastic forms of Memorial Park are filled with ideas. The dominant idea is motion – the eternal, unstoppable motion of Life. It is also an invitation to everyone to think about themselves, about an implication, about a time. The materialized metaphors are water, mirror, reflection, transition, and entrance portal (it cannot be used as an exit)” [21, p. 355], Fig. 2. Being based on the principle of transference, the theme of water was developed by the author-sculptors in several ways: in the fluidity and smoothness of the created terraces as well as in a pool that reflects the monumental relief of the Memorial Wall, with a total length of 213 m, Fig. 3a. The artistic relief up to 14 meters in height became an integral part of the powerful system of the retaining wall of the slope. The third method of using the plastic features of water was to create an artificial reservoir with a system of vertical jets that create a vertical water wall delineating the various functional zones of the complex. The project was implemented in 10 years and was opened to the public in 1978. To great public regret, a decision was made to cover the unique relief with a concrete sarcophagus in 1982 and a unique artistic object was therefore lost. Now, instead of water in the reservoirs, bushes and young trees grow, and there is only a concrete retaining wall, Figs. 2c, 3b, c and the historical Lybid River again “disappeared”.

4. Results

The qualitative change of the paradigm of modern coexistence with natural water bodies nowadays leads to changes in the architecture and landscape design of water areas. The principles of composing water areas are also manifested in the complex interactions of historical processes, national characteristics, global problems and the readiness of mankind for these challenges. The disclosure of the architectural and landscape meaning of water areas once again allows us to realize the role of architecture in changing national mentality and the necessity of such changes in historical, national, and environmental terms. The question of prosperity in the future – the happy future of mankind – is directly connected to the present.

The future existence of mankind on the planet, its direct dependence on the quality of drinking water, as well as the critical state of the planet’s aquatic ecosystems and irreversible climate change determine changes in attitudes towards water areas and raise questions about the complimentary coexistence of human beings and the aquatic environment.

In the paper, the author illustrates the great importance of understanding contemporary problems such as the fragility of aquatic ecosystems. It is necessary to change the mentality of humankind in order to support and implement corresponding decisions. According to the author, revealing principle issues in this way should influence the development of new

innovative approaches to architecture and landscape design of land and water areas on the principles of complementarity and balanced cooperation, which will qualitatively improve the environment in the future.

5. Summary

The main conclusions are:

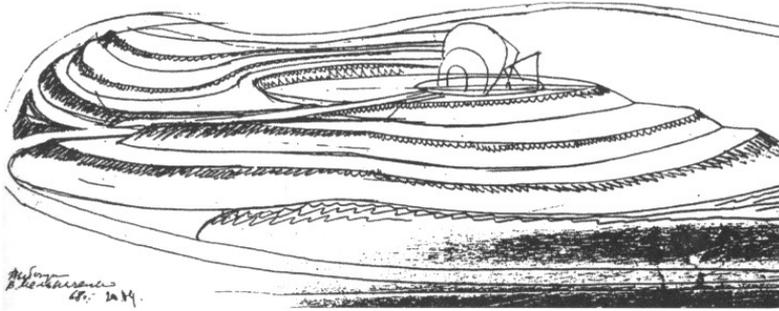
- 1) Water areas are a new object of architectural and landscape design;
- 2) The research examines the principles of architectural and landscape design of water areas: the principle of complementarity of water and land coastal territories; the principle of transference; the principle of balanced cooperation; the principle of a technologically diverse architectural-design approach to the utilization of water in landscape architecture, etc.
- 3) The main trends of the design of water areas are revealed from three positions: as habitat environments, as the need to adapt to climate change, and as the memory of a nation.
- 4) The different states of water (solid, liquid and gas) are considered in the research.
- 5) The architectural and landscape context in composing water areas once again allows us to realize the principal role of architecture in changing the mentality of humankind and the opportunities it provides in creating qualitatively new habitats by the development of a specific design approach

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a)



b)



c)



Fig. 2. Memory Park Crematorium on Baikova mountain on the riparian areas of Lybid River, Kiev, Ukraine, 1967–1982, by artist–monumentalists Ada Rybachuk, Vladimir Melnichenko:

- a) authors' sketch, 1968, [21];
- b) general aerial view of the complex, 1978, [21];
- c) general aerial view of the complex, 2017.



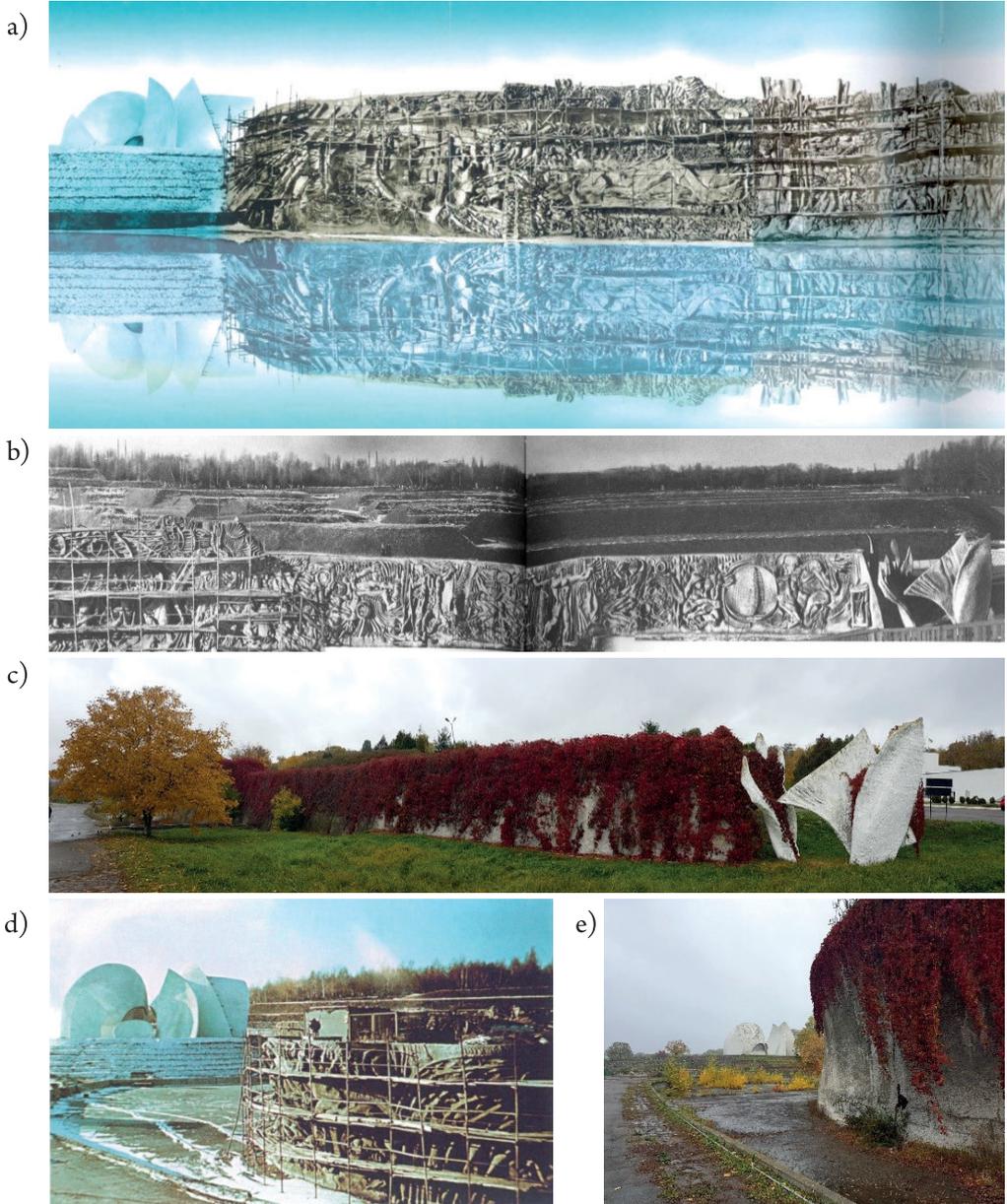


Fig. 3. A comparison of the Memorial Wall: construction in 1978 (a, b, d) and its state in 2017 (c, e). The 1978 photos (a, b, d) are from [21] and the photos of its current state (c, e) are by Ruban L.