Repurposing Kom El-Dikka’s water reservoirs
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The Egyptian port city of Alexandria encompasses a range of sites, structures, and landscapes that witness industrial patterns. Supply of water had always been a fundamental concern during the subsequent development of the city. It developed over a significant infrastructure of underground aqueducts, cisterns, and water reservoirs that contributed to the existence of Alexandria from the town’s birth until the early XX\textsuperscript{th} century. However, standing water storages are exposed to the processes of decay over time. They are generally at risk for adverse perceptions, and lack of maintenance and recognition.

Nevertheless, expanding the life-cycle of industrial living heritage can play major roles in urban regeneration, strengthening urban character, and supporting long-term future. Adaptive reuse has the potential to add value by being part of an effective redevelopment plan for a wider context. It generates opportunities to preserve historic characteristics and sustain economic and social needs for upcoming generations. Accordingly, heritage assets ought to be considered in managing the sustainable use of Alexandria’s industrial heritage settings.

Hence, this paper illustrates that the distinctive historic water tanks of Kom El-Dikka will be requalified by respecting the recommendations of “The Dublin principles”. The research follows the Charter’s standards in adapting the industrial site. The water reservoirs are located on a manmade mound at the heart of the historic city centre of Alexandria. The first tank was built in 1860 and operated from the second half of the XIX\textsuperscript{th} century until the middle of the XX\textsuperscript{th} century, and it was left empty without use until today. Whereas the second tank was constructed in the 1950s and is still functional, its heritage significance is not renowned. Therefore, this study proposes a cohesive strategy through the functional and symbolic requalification of the unique structures in a manner that guarantees compatibility with their surroundings, safeguarding of heritage values, and contribution to social and economic development.

Introduction

Water supply has made a major contribution to human development since towns birth. Similarly, the port city of Alexandria developed over substantial waterworks systems, which are the core of urban infrastructure. The ancient system was composed of water channels that supply a series of underground cisterns from the Canal of Alexandria when the Nile flood\textsuperscript{1} (figure 1). The canal initially started on the Canopic branch of the Nile, nearly thirty kilometres east of Alexandria. According to an estimate by astronomer Mahmoud Bey el-Falaki, there existed 700 cisterns in the city’s foundation\textsuperscript{2}, although the exact number remains a matter of debate. Whereas most underground reservoirs were reconstructed in the Byzantine and Islamic eras, some dates back to the Ptolemaic and Roman eras. Water distribution networks were documented by el-Falaki under part of the ancient city’s main streets and side streets. They seemingly compose part of the earliest city design\textsuperscript{1}.

![Figure 1: Plan of Alexandria’s ancient water channels and cisterns, cross section through underground channels. Source: Mckenzie, 2007.](image-url)
Nevertheless, this significant ancient system has disappeared due to frequent pandemics; the water obtained from the cistern was unhealthy. Until 1849, 450 cisterns were still used by Alexandrians; subsequently, the Municipality of Alexandria officially banned the extraction of water from cisterns at the end of the XIXth century. The majority of the cisterns were destroyed or left empty and used during the Second World War as an anti-aircraft shelter. As part of Muhammad Ali’s reform for Egypt, he rebuilt the canal of Alexandria, which fed the cisterns, as the Mahmoudiyah canal. It mostly followed the ancient path but was redirected around the western Arab city walls. Pursuing the developmental process of Alexandria, it was essential to sanitize the water in the canal, which led to establishing a modern water supply system. Therefore, in 1860, a French Egyptian company with multinational owners was founded in Alexandria. The new company constructed a pumping station, named Bab-Sharq station, a water reservoir Southeast Kom El-Dikka area, and extended water pipes to the city’s main quarters. This modern water industry was adopted by many cities by the late XIXth century.

Pioneering industries encompass a range of structures and landscapes which contributed to social and economic change and the establishment of modern world. Thus, water-related facilities compose a type of industrial heritage sites. As mentioned in Nizhny Tagil Charter, water industry is “the infrastructure built for the management of drinking water during the industrial period”. Water supply properties are distinguished by outstanding universal human value for reconciling the urban sanitary crisis that followed industrialization, along with paving the way towards better living conditions. The remarkable remains of urban water networks and waste systems reflect the scientific, economic and technical effort during the 19th and early 20th centuries. Moreover, the authenticity of waterworks is expressed through physical attributes in terms of form, design, and materials. However, such sites are often endangered, remained long-term vacant and unused. Industrial structures undertake continual adaptation to pursue their original purpose; accordingly, adaptive reuse is crucial for safeguarding industrial settings. It is a way to recognize the values that distinguish these significant properties, in order to inform better decisions about its future.

This represents the case of the historic industrial site of Kom El-Dikka, which includes two water tanks subjected to lack of maintenance and acknowledgement. Generally, international charters adopt worldwide principles for every challenge facing heritage conservation. Consequently, each country develops its own plan to suit the goals of international committees. This research follows the recommendations of the Dublin principles, the latest updated guidance for industrial heritage, in requalifying the use and symbolic representation of Kom El-Dikka industrial site. The charter’s framework is divided into: documenting and classifying industrial site’s values, ensuring effective measures, managing the sustainable use, and raising appreciation and awareness. The value assessment is derived from urban analysis undertaken between March and September 2018 and further observations in 2021. Because of security reasons, only one short visit to the historic tank was permitted in 2018; hence, all the information is not fully gathered. Only the older tank’s outline was traced from a 1952 cadastral map, and it is assumed that its ground floor level is the same as its plot level.

Kom El-Dikka water reservoirs: site location and significance

Overview on kom El-Dikka area
The industrial site of water reservoirs lies in the middle of the historic city centre of Alexandria. It shapes the southeast side of a residential quarter, named Kom El-Dikka. It is considered one of Alexandria’s most remarkable heritage areas as it is the highest area within the surrounding context. In addition, it is bordered by Fouad street, the oldest planned street and the major destination for many commercial and entertainment uses, from the northern side and by Alexandria Stadium from the southern side. It has a prime location close to Greco-Roman archaeological site and the main train station (figure 2). Also, the area is distinguished by the heterogenic urban fabric, which defines the lower-socioeconomic community of Kom El-Dikka. This survival urban pattern comprises a rich architectural setting that ranges from the
Ottoman to European style. It combines diverse open spaces that serve as transition nodes with scales of activities and users.

The social cohesion between its inhabitants presents the social character of Kom El-Dikka. The most common jobs practiced by the residents are craft-based. Besides, the cultural value is perceived by Sayed Darwich, the noteworthy early XXth century musician who was born in Kom El-Dikka, and the area has become famous thanks to its connection to him. The quarter includes a noticeable percentage of an ethnic group, Nubians, and holds cultural events managed by small NGOs and attract several social groups (figure 3&4). One of the most remarkable events in the area is an annual music festival called “Zorni kol sana mara” or “visit me once a year”, on the commemoration of Sayed Darwich every March. It takes place either on the streets or the spaces, especially in front of the historic tank. Recently, the festival has not taken place annually due to limited resources.

Figure 2: Google earth image showing the location of Kom El-Dikka’s water reservoirs, the current entrances of site, and its surrounding context. Source: Author, 2021.

Figure 3: Map shows the ground floor activities in Kom El-Dikka area. Source: Author, 2018

Figure 4: Map shows the urban character of Kom El-Dikka area. Source: Author, 2018
Industrial site: heritage assets and challenges

The neighbourhood’s built fabric bears witness to the development of water supply systems. It encompasses two registered historic cisterns dating back to the Islamic era, in addition to the industrial plot that demonstrates the late XIXth and early XXth century water industry6 (figure 4). Two structures with the same function are dominating the southeast edge of Kom El-Dikka. These reservoirs store potable water, as preferably located on a high ground artificial mound to maintain the necessary water pressure and storage supply. Generally, the waterworks system starts by drawing water from rivers, whether the Mahmoudiyah or Nubaria canal, with pumping engines, filters the water, then pumps it up to reservoirs to convey it to the city via cast-iron pipes3.

The first water storage tank was built in 1860 during the establishment of the city’s modern infrastructure6. It was an associated component of the new pressurized urban water distribution which predominated in towns since the middle of the XIXth century. The water tank was operated until the middle of the XXth century; afterwards, it became functionally obsolete due to a complicated maintenance process. In addition to its historical and industrial significance, the authenticity of the water tank is showed in its urban, architectural and structural values. Starting with the urban value, the reservoir borders historical trees and overlooks huge levelled green space, but is not accessible by the public. The cylindrical container is built of limestone and XIXth century yellow bricks. Its architectural value is also defined by the semicircular arched entrances filled with wooden doors, the small longitudinal openings, and an extruded brick cornice surrounding the reservoir. Authentic interior features are demonstrated such as the water level indicator. Additionally, it was constructed with a durable structure system designed to support hundreds of tons of water. It embraces a thin steel diaphragm that assists both as liquid isolation and vertical support.

By the 1950s, a cylinder-shaped second tank was reloaded on the same site but on a ground lower than the old tank’s ground. The technical development of established systems and the introduced electric pumps had an influential impact on the shrinkage of waterworks architectural expression. The additional reservoir exposes an example of modernist heritage; it is elevated and constructed of reinforced concrete. A rhythm of a concrete member is repeated along the cylinder perimeter; each double members enclose narrow vertical openings. Besides, a top roof dome on top of the structure enables the presence of a ventilation shaft. Lately, supplemental paint was applied presumably as recoating processes for the second reservoir maintenance. Though the concrete container is still functioning and distinguished by historical, technological and architectural aspects, its heritage assets are not recognized. Thus, the water structures embody a symbolic meaning as the utility to produce clean water; the older reservoir is projected as a historic building but falling into disuse while the second one is still a living production in service but unappreciated.
**Functional and symbolic requalification**

Every single building goes through phases divided into design, construction and usage. The use stage comprises the actual use, the reuse, or the end-of-life phase. Therefore, buildings’ renewal is essential to maintain their performance capacity and prolong their life service. Though the permitted uses in Kom El-Dikka area are residential, commercial, crafts, and cultural, repurposing the historic water tank for viable new use ought to address community needs. Unstructured interviews were conducted with local inhabitants of different ages. They require wide-ranging facilities such as providing cultural and entertainment services, parking areas, green spaces, as well as protecting the social fabric. Besides, outsiders visit Kom El-Dikka regularly for craftsmen or celebrations that are held during the month of Sayed Darwich remembrance.

A complementary strategic plan for safeguarding the residential district aims to connect Kom El-Dikka with its borders. Kom El-Dikka will be connected with its Southern border by reviving the water tanks that will serve as the main node for the area development. The adaptation of historic site in a manner that ensures compatibility with its surroundings and accommodates the contemporary needs. According to the Dublin principles, appropriate measures need to be adopted to protect and ensure the conservation of industrial settings. General considerations are proposed for the requalification of the unique structures by maintaining strict controls to: preserve all exterior features, limit the visual impact of physical intervention, provide an economic incentive to rehabilitate historic structures, propose alternative use that will preserve and promote the cultural heritage in the area, and respect community demands.

In line with the first action, the historic tank can be conserved and adapted into a cultural hub that can host amenities for community use. The possibility to reuse the site as the venue for an edutainment environment would provide the chance to create a vital public space and support a long-running future. This significant hidden structure can be opened up to the public by introducing a range of activities for various groups. Respecting the existing topography of the land, the elevated green space is upgraded into a series of urban spaces that lead to the historic tank (figure 9&11). The design proposal features a ground floor plan hosting spaces for exhibition, art and music classes. The first and second floors occupy approximately a semi-circular plan, overlooking an atrium which reinforces the tank’s form. The first level offers a space for learning crafts, whereas the second level comprises a public library. Moreover, a public roof onto the top of the reservoir is accessed directly by a ramp from the backside (figure 10). The back entrance is followed by a ramp that overpass water pipes, one of the industry’s main components. A skylight that forms a part of the roof space is provided for better lighting and ventilation purpose. Light additions are deferential and compatible with the original building. Design intervention is distinct and respects the original heights rhythm without interrupting the built fabric (figure 11&12).

Sustainable use ought to be managed by following heritage values while addressing social, economic, cultural and environmental development. The social aspect tends to be achieved by integrating the significant site with its surrounding while strengthening cultural diversity, preserving the social cohesion, and accommodate the current needs. Secondly, economic growth is emphasized through introducing a range of cultural facilities and exhibition which promote the community products. Therefore, it will allow for marketing of the local resources and represent an important source of revenue based on a creative economy plan positively impacting the local trade and the living conditions. Furthermore, the cultural identity of community is enhanced through supporting cultural activities and events that present local cultural heritage. Additionally, the urban space will include weekly or annual festivals, leading to off-wall show highlighting the value of the architectural features. Lastly, the ability to enhance the environment by providing green accessibility, protecting the standing urban pattern, and using light construction system that complement the valuable structure. Meanwhile, the plot area of the active concrete reservoir is to be protected with secured entrances, the presentation of its operation through informational panels and organized visits should be sustained to raise awareness for the water industry for the general public.
Conclusion

Alexandria comprises a range of valuable industrial sites that are exposed to deterioration and abandonment. This paper follows the parameters of the Dublin principles in repurposing Kom El-Dikka’s water reservoirs. The research categorizes the site heritage values, proposes general measures and cohesive plan for the reuse and appreciation of water structures. The functional and symbolic requalification can ensure the sustainability and recognition of irreplaceable sites for upcoming generations. Furthermore, it ought to be considered that the new use contributes to economic and social development, reinforce local values, and preserve heritage significance.


