Eleonas: Urban Voids as Opportunity for a Water Sensitive Approach to the Design of Cities

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Abstract

Cities embody both networks and physical entities and live on production, consumption and waste rejection. A vital part of their metabolism is how water is managed, to the point that the water cycle develops characteristics that are exclusive to the urban context—what is known as the “urban water cycle”. Yet current planning strategies rarely acknowledge water management as essential, and are instead dominated by land-use considerations.

This paper will attempt to shed light on some of the particularities of Athens’s urban water cycle by focusing on Eleonas’s ‘urban void’. Specifically, this paper will scrutinise the relations of causality between urban form and the recurrence of flooding events and the deterioration of surface water quality. By deconstructing Eleonas—a paragon of a previously industrious region—into smaller in scale entities that constitute the zone, this paper will attempt to discern to which extent they affect the urban water cycle locally and to expose the potential that small scale interventions can have in transforming the city as a whole.

A strong correlation has thus been found between the worsening conditions of the urban void and the quality of its water management. After a series of survey visits, we found that water-related issues not only affect the urban setting but are also induced and exacerbated by its form and quality of infrastructure. Therefore, if urban voids are developed appropriately, they can play a meaningful role in the urban setting and enhance its global condition. Such conclusions imply that if planning is fostered by a water-sensitive mindset, the environmental quality of the metropolis should increase in the long-term. Consequently, a change of paradigm towards a more integrated and flexible water management is suggested in order to attain more adaptable cities.

Keywords: Integrated water management, metabolism, urban void

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Introduction

Urban settings and water are closely related entities and as many have argued throughout the last decades, their independence is but an illusion (Karvonen, 2011). Within cities, human activity creates new conditions for water due to the necessity of humans to actively use and eliminate water. This creates a separate water cycle that differs from the natural one, known as the “urban water cycle”. In an urban setting, the journey of water—from the point of collection in catchments to its return to nature as purified wastewater—creates the necessity for effective management as cities need to catch, retain, canalise and discharge water through their supply, sewage and drainage systems respectively.

Due to climate change, elements of the urban water cycle are affected and the intensity of water related events is rising (OECD, 2013). Intense rainfalls occur more frequently, periods of scarcity are stretching and the lack of proper management leads to severe floods, water scarcity and the pollution of the urban ecosystem. One could argue therefore, that a continuous interaction exists between water flows and the urban area. As SybrandTjallingii indeed states, “urban activities may suffer from water scarcity and pollution, but they also create scarcity and pollution. The city may suffer from floods, but the abundant paved surfaces also create peak-flow and flood problems” (Tjallingii, 2012).

Water-related issues are therefore linked to the condition of the urban form. As such, they usually have a greater impact on disadvantaged regions. In dense cities, underdeveloped areas can be defined based on socio-economic factors but also on the condition of their tissue, a growing condition of which, are urban voids. More than “terrains vagues”, urban voids are understood as large areas that possess a distinct texture to the average urban setting. They suggest a certain vacancy and are usually characterised by a high degree of dereliction fostered by economic downfall, migration of activity or political disregard. Their size varies from lots to entire districts and radically contrasts with their surroundings. Urban voids in fact, form enclaves of city-scale importance that create important social and urban discontinuities.

In this context, this research tries at first to address their implication in the recurrence of flooding events by investigating the causality between their morphology and urban water. In dealing with the relationship between water management and urban form, two questions arise:

- What is the causality between the urban tissue’s morphology and natural events made of?
- To what extend urban voids can contribute to the prevention of extreme events?
This paper will focus on the capital city of Athens, Greece which is currently undergoing a severe urban crisis apparent on social, demographic, economic and environmental levels (Komninos, 2013). In the recent years, the shift from an industrial to post-industrial and informational era has deepened the urban disparities (Kotsikou, 2009) and fostered the creation of urban voids within the Attica Basin. In particular, this paper focuses specifically on the urban void of Eleonas, the city’s most extensive industrial and retail area. Today, due to de-industrialisation and shutdown, it is neglected and faces an important decline in activity. Its impressive size in the core of the city and its strategic location above flood-prone areas render it ideal for a case study. At first, we will underscore its relation with the city of Athens and the Attica Basin, then gradually divide the area into its constituting entities—buildings, roads and voids—in order to examine them in depth. By dissecting the research area in such a way, this method attempts to create a better understanding of small scale interactions and eventually reach conclusions inherent to the water condition of the area.

Context

As a historical context, Athens expanded at an extremely fast pace growing from 34,000 inhabitants in 1834 to more than 4 millions in 2004 (Stergiouli and Hadjibiros, 2011). This exponential growth boosted the construction-related and industrial sector, over-exploiting the natural resources of the region. In addition, the new settlements heavily altered the rural landscape since urban expansion was not thoroughly planned (Lasda et al., 2010). The unprecedented increase of impervious surfaces forced stormwater through the road network aggravating thus, runoff and flooding incidents in the sprawl areas (see Figure 1). In Attica, the highest concentration of flood events is perceived along the basins of the rivers Kifissos and Ilissos with a clear increasing trend along the former (Diakakis, 2014). In fact, as Diakakis shows, the oldest western and northwestern areas and the newly urbanised southern suburbs are the most affected zones (see Figure 2).
Figure 1. (a) Spatial Evolution of the City’s Built Environment and (b) of the Flood-Related Incidents in Five Study Periods. The Dark and Light Grey Areas Represent the Limits of the City at the Beginning and at the End of Each Period, Respectively. (Source: Diakakis et al., 2014)

Figure 2. Change in Flood-Related Incident Numbers between the Periods 1880–1960 and 1960–2010 in the Athens Metropolitan Area (Source: Diakakis et al., 2014)

The urban void of Eleonas is located in exactly the same western parts of Athens that Diakakis has mentioned, along the river Kifisos. This discovery allows us to consider that factors in addition to those of a purely geographical nature might indeed influence the manifestation of water-related incidents.

Eleonas is an industrial zone of almost 9km², situated 2km away from Athens’ historical centre (see Figure 3). Until the early 19th century, taking
advantage of the river’s seasonal floods, it was composed of an extensive olive orchard, eradicated in the 20th century to house the industrial heart of the capital (Biris, 1966). This shift occurred through the unauthorised and unplanned construction of the area as it remained out of the city’s plan until 1995 (Sapuntzaki and Wassenhoven, 2004). As an excluded area it was rarely accounted for by politicians and the subsequent development was not followed by an appropriate draining infrastructure. Eleonas thus became the most deprived zone of Athens in terms of water management lacking sufficient drains and drinking water supply (Kasselouri, 2012). Today, it leaves a void of unprecedented proportions dominated mostly by paved surfaces, abandoned industrial buildings, vacant lots and informal settlements.

Figure 3. Eleonas (Circled in White) in the Attica’s Basin, in Relation with the Capital’s Centre (Pointed in White) (Source: NASA, 2005)

The dominant industrial land-use and clear morphological distinction between Eleonas and the rest of Attica leaves a mark in the centre of the capital’s homogenous residential fabric both in terms of texture and infrastructure (see Figure 4). As the two patterns meet, the small scale networks come together in a completely arbitrary way—rendering the transition crooked and unnatural, and thus segregating parts of the city. The fabric of Eleonas is composed of a relative balance between open and built spaces, and could be characterised by the term “porosity” in the particular sense developed by Secchi and Viganò. “A fraction of space where movement can take place. [Porosity] is the ratio between built and unbuilt space [...] Evidently, a high porosity implies that the given space for movement is high. But it does not imply that movement is effectively favored.” (Secchi and Viganò, 2011). Furthermore, in their definition of connectivity they state that “a high porosity does not always coincide with an optimal mobility.” (Secchi and Viganò, 2011) and Eleonas is indeed a very precise example of the aforementioned definition. Although the ratio of built and unbuilt surfaces
would reveal certain porosity. Eleonas is characterised by a high number of physical barriers such as separating walls, fences, and small private streets that form enclaves. These internal boundaries not only constrain the passage of people and goods but they also trap stormwater within confined areas. It could be argued therefore that while spatially it presents enough open spaces to be characterised as porous, because of the multiple internal boundaries, it results in a very low connectivity.

**Figure 4.** (1) Illustration of Contrast between Eleonas’ Urban Tissue and the Strict Residential Grid of Athens (Source: Bing). (2) Map Showing Eleonas’ Notable Lack of Drainage Infrastructure (Source: YPEXODE, Ministry for the Environment, Physical Planning and Public Works)

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**Case Study: The Urban Void of Eleonas**

**Strategy**

The analysis of the study area through its division into specific entities is an attempt to understand the territory by a direct confrontation with its reality. This contextual approach has the merit of providing the opportunity to examine otherwise unnoticeable relationships between land-use, built form and water management. When viewed in a holistic scope, these seemingly isolated conditions seem deeply and thoroughly interconnected. This research aims to separately analyse the road network, the built form and the open space.

**Roads**

The transportation network of Eleonas is striking in terms of size, length, materiality and state of deterioration. Without extensive generalisation, three types of roads are encountered: a capillary system of off-grid, disconnected alleys, three major east-west arteries and finally a massive infrastructure of

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1 Notions such as porosity, enclaves and connectivity were inspired by Secchi, B. and Vigano, P. (2011). The Porous City: A Project for the “Grand Paris” and the post-Kyoto Metropolis. (La Ville Poreuse. Un projet pour le Grand Paris et la Métropole d’après Kyoto.in French)
Kifissos Avenue. It is indeed a peculiar network as nowhere else in Athens is such diversity encountered (see Figure 5).

Figure 5. Photographs of the Capillary Network (1,2,3), East-West Motorways (4,5,6) and Kifisos Avenue (7,8,9)

In the core of Eleonas, the multiple changes of land-use lead to the creation of an anarchic network of streets (Llop Torné et al., 2012) unsuitable for the heavy industrial and retail use of the area. Their “disconnected” state, and the lack of competent water infrastructure, creates major flooding issues within the tissue of Eleonas as they turn into torrents and pools. Moreover, the morphology of the fabric is characterised by a multitude of boundaries and does not allow water to be eliminated efficiently. Instead, dead ends, walls, soil depressions and uneven surfaces keep stormwater within Eleonas in a fashion similar to a sponge or buffer. A second network is composed of the major regional avenues connecting the city centre with its eastern suburbs, the only arteries within the study area to be connected to the drainage network of Athens. As a result, they collect—in addition to their own—the runoff that has not been halted from the surrounding tissue. More often than not, because the critical capacity of the combined sewage is reached, both rain and wastewater come together on the streets, causing flood and sanitation problems. The third component, Kifisos Avenue, was constructed in 2002 as part of the necessary evacuation infrastructure for the 2004 Olympic Games at the exact location where the Kifisos River flows. Its massive 8 lanes substantially altered the landscape as the river is now either surrounded by the motorway or enclosed within its culvert. Adequate water management equipment did not follow the construction works and as a result, excess, untreated water is today discharged into the river’s stream. This runoff, heavy in pollutants, contaminates the water body lowering its regeneration capacity considerably.
Buildings

Buildings play perhaps the most determinant role in Eleonas. Their relative position and orientation shape the urban landscape and structure the space created in-between. As the industrial sector was weakened in the 1970s and 80s, a number of these constructions were partially or totally abandoned (see Figure 6).

Few houses exist in Eleonas and their small scale—two or three stories—entertains a sometimes awkward relationship with the predominant industrial landscape. As is the case throughout Athens, all buildings in Eleonas use drinking water for all daily purposes, a great range of which could have been achieved alternatively by rainwater harvesting. Instead, rainwater is discharged onto the public space inducing additional stress on the area’s flood issues. In comparison, the industrial architecture is dominated by massive concrete constructions or fragile metallic structures packed in groups. Their size varies between two to six stories and is often surrounded by vast empty lots. Industries widely use drinking water to satisfy their needs, and it is yet unclear if and which of those still use wells to pump directly from the underground. However, it is most certain that the extensive industrial land-use heavily pollutes the groundwater due to untreated waste eliminated into cesspit pools (LlopTorné et al., 2012). Likewise, surface water is also affected. The natural stream of Profitis Daniil, flowing through the area, regularly receives raw litter resulting in an excessive pollution of the natural element and the difficulty for riparian vegetation or life to develop. Finally, the recent tertiary sector is housed in massive—six or seven stories—office-like buildings bordering the motorised transportation axes. Given their location, they become the façade of Eleonas and create an impenetrable built layer along the main roads. They were constructed during the last decades and despite being connected to the central sewage system, still discharge rainwater onto the public space. Their large size, if seen as a potential, could induce a positive impact symbolically and factually if they integrate a sustainable water management.

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2 The extensive pumping of Attica’s phreatic naps has induced an important settlement of the underground water levels. In addition, the human interventions throughout Attica’s basin, have severely affected the quality of the groundwater. (Bathrellos, Skilodimou, Kelepertsis et al., 2008.)
**Figure 6.** Photographs of Residential (1,2,3), Industrial (4), Retail (5,6) and Tertiary (7,8,9) Units of Eleonas

*Voids and Open Spaces*

Beyond the built reality of Eleonas, voids are what distinguish it most notably from the city it belongs to. Properly designed public space is scarce, as open areas are usually the remnant of an obsolete condition, land-use or activity. There, an informal activity develops as workers and ethnic minorities occupy the territory in an ephemeral and temporary way. These places, used or abandoned, enclosed or open, are the fruit of multiple land divisions (Llop Torné et al., 2012) creating a patchwork that conveys a sense of decay, abandonment and recklessness (see Figure 7).
Figure 7. Photographs of the Diverse Open Areas of Eleonas. These Include, Productive Lands (1,2,3), Parks (4,5) and Vacant Industrial Lots (6,7,8,9)

The first types are industrial voids, the paragon of a former intensive industrial activity. Now, completely deserted, they have become squats and temporary homes for different ethnic minorities. Similar voids appear after the interruption of construction sites, the most notable of which is the site of Panathinaikos Athlitikos Omilos’ (PAO) stadium. Today, it constitutes one of the larger vacant zones of Eleonas and houses one of the biggest flea markets of Athens attracting populations from multiple parts of the city. The unregulated use that followed the industrial practice generated significant conflicts between urban form and activity. The high degree of impermeabilisation and the inexistent retention infrastructure leads to the discharge of water, clean or polluted. Another type of open space is the lots dedicated to production—the sole reminder of a previously productive Athenian landscape. Today, a few disparate kitchen gardens are found but only two or three consequent fields, which use the city’s drinking water supply and potentially groundwater from wells for irrigation, remain. Finally, public parks are limited in number but heavily used by the residents when conditions allow it. They are usually connected to a public facility of certain substantial importance, for instance an archaeological site or a church. Hydrologically, these last two categories are the closest to the natural water cycle as rainwater naturally evaporates, is cleaned and infiltrates the groundwater.

3 The data related to the precise use and pumping of the underground water in Athens is extremely limited. Wells and boreholes though have been a common supply method as the city expanded and was in need to supply an ever growing demand of water. (Bathrellos, Skilodimou, Kelepertsis et al., 2008)
Results

To simplify the reading of this analysis, the above research elements were put together in a table and compared on the basis of water sources, usage, treatment and evacuation. This allowed for a synthesis of the key problems and their causes, making the possible solutions more evident (see Table 1).

Table 1. Table Reproducing Schematically the Different Urban Entities of Eleonas and their Relationship with the Water Element

Two major water-related issues rise within Eleonas: the pollution of the natural element and occasional floods. The industrial use of the area induces a significant contamination of the streams, natural green areas and groundwater, as untreated litter is constantly discharged into the natural environment. The peculiar morphology of Eleonas responds in its own way to floods usually generating big pools of water or turning the streets into torrents, constraining the activity of the area. These closely related problems are caused mainly by a dysfunction of water management including wastewater and rainwater. In Eleonas, what we see as a redundant condition is the notable absence of a “post-use” water treatment and management that would take into consideration the totality of the urban water cycle. This deficiency, coupled with an obsolete infrastructure, is the root of the majority of issues Eleonas faces regarding water.

The study of the road network revealed a high potential of regeneration because of the retention capacity of the anarchic tissue. The diversity of situations it presents, offers multiple possibilities to design an on-site runoff infrastructure. The development of receptive devices could possibly allow water to flow through rightly designed flood-plains instead of streets and lots. Subsequently, the analysis of the built form reveals the importance of

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4 “Post-use” in this context refers to the manifestation of the related event. For example, runoff, polluted rainwater or wastewater are all considered here to be “post-use” waters.
orientation and size regarding water-related issues. Lastly, redevelopment initiatives could gain weight and relevance if the consideration of the void changed from its status as a residue to being a productive entity.

Discussion

Urban water systems are arguably the most vital of urban systems as they provide cities with the most essential services for their existence. Yet, they tend to be unsustainable and unbalanced as water management often fails to respond to the challenges of the urban setting. Such challenges can be as diverse as the anticipation of seasonal events (i.e. droughts and floods), the management of excess water or the balance between demand and distribution. When similar issues exist, they are likely to be aggravated by important shifts such as climate change or population growth, thus constraining even further the urban ecosystem and especially its least developed parts. As this research has shown, areas may diverge in terms of their status, activity or texture, but merge as they take shape through buildings and voids, paths and infrastructures. As this morphological layer of the city comes to life—through the underlying networks of transportation, food, waste, water and energy—all of the aforementioned components become intimately intertwined and induce specific stresses on one another. A holistic and integrated approach should encompass the totality of these components in order to facilitate the proposal of contextualised interventions.

In recent decades, new approaches have appeared that move from a focus on flood mitigation towards a more balanced relation between the hydrological cycle and the urban landscape in which a wide range of environmental, sanitary, social and economic considerations are taken into account (Fletcher et al., 2014). Such developments carry multiple names—Low Impact Development (LID) in the USA and Canada, Low Impact Urban Design and Development (LIUDD) in New Zealand, Sustainable Urban Drainage Systems (SUDS) in the UK, Water Sensitive Urban Design (WSUD) in Australia or Integrated Urban Water Management (IUWM)—and aim at a “rethinking” of urban drainage by integrating “source control” (Fletcher et al., 2014). This approach focuses on the benefits of containing water upstream rather than with end-of-pipe solutions after the events manifest. Source control modifies the basic strategy of conventional water management by shifting the focus from the symptoms to the causes of related occurrences (Karvonen, 2011). To that extent, large storm-water tanks are replaced by decentralised strategies such as pervious surfaces, rainwater harvesting, constructed wetlands or infiltration ponds (see Figure 9) that treat smaller quantities of water, doing so in a more efficient and sustainable way. They mimic the natural water cycle and are ultimately capable of adapting to changes and diverse situations as they are flexible enough to be annexed to infrastructures, industries or residential areas and buildings.
Cities could benefit greatly if decision-makers and actors integrated adaptability into their agenda of concerns and aimed to educate their citizens on the importance of individual water management. Technological advancements become outdated fast due either to technology itself or from the increasing intensity of naturally occurring events. In this perspective, source control could be seen as an ideal alternative to current water management strategies.

Conclusions

As we had the opportunity to explore in this paper, urban voids can become the ideal location to start implementing some form of source control in urban water management, mainly due to the possibilities their vacancy offers. That being said, no single strategy can be applied universally, as the particular nature of the “void” varies greatly between those enclosed or open, linked or disconnected, used or abandoned, etc. Voids can be as vast as they can be tiny. As we have argued, such diversity should be embraced. Urban voids not only allow for, but demand solutions that can adapt—rather than fundamentally alter—their diverse surroundings. In addition, through the analysis of Eleonas, we could see to which point the interdependency between flows and buildings can be complex. The option of evacuating one part while addressing the issue of source control can be appealing. However, as we have attempted to demonstrate, the capacity of a landscape to adapt to changing conditions depends rather on this complexity—on this hybrid and layered condition. Eleonas, for instance has dramatically changed through the centuries: from a leisure area to an agricultural landscape, becoming later a heavy industrial zone and, finally, turning into a brownfield. Additionally, it changes greatly with the seasons, alternating from floods in the winter to being ravaged by an aridness and drought landscape typical of a Mediterranean summer. Any sustainable
and adaptive management should therefore consider the different events occurring within the city and anticipate their fluctuations.

In terms of water management, a contextual approach seems to yield greater benefits than a one-size-fits-all approach (Bahri, 2012; Brown, 2007; Lloyd et al., 2002; Mitchell, 2006). On the other hand, changes in urban morphology do not seem to suffice in order to shift the approach to water management when confronted with new developments. It is only by increasing the citizens’ and policy makers’ awareness that a true shift in how water is regarded—more as a resource than a liability—will occur. Unfortunately, however, this awareness-raising process is far from evident within the current context of conditions. More often than not, water is invisible, hidden underground in pipes and quickly discarded, thus failing to become an essential part of our daily lives and of the collective consciousness.

**Further Research**

This research was restricted to only one urban flow: water. Further research, however, should integrate the remaining flows of food, transportation, energy and waste in order to develop a holistic understanding of how urban voids function. Additionally, because this research was conducted at the Université Libre in Brussels, the opportunities for fieldwork were limited. A more extensive on-site investigation would add a fair amount of contextual inputs to the analysis.

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