

# **‘Brown’ is the new ‘green’: Post-industrial sites as potential in the development of the green infrastructure on the riverfront of Budapest, Hungary**

Anna Adorjan<sup>1</sup>, Anna Pecze<sup>2</sup>, Kinga Szilágyi<sup>3</sup>

*<sup>1</sup>Ybl Miklós Institute of Architecture, Department of Urban Planning and Design,*

*<sup>1,2</sup>Szent István University Doctoral School of Landscape Architecture and Landscape Ecology*

*<sup>3</sup>Szent István University, Faculty of Landscape Architecture and Urbanism, Department of Garden and Open Space Design*

## **Abstract**

In Budapest, Hungary and all-around Europe in the capital cities, the sight of degraded, industrial landscapes in urban areas became usual during the last decades, due to the unexpected growth of cities. In the last 30 years, many sites have gained new functions and have been reused for different purposes, but still, huge areas remained unused and presumably polluted. According to my hypothesis the unutilized areas – especially in the riverside area - could potentially become the part of a new green infrastructure element, which could make the green infrastructure system of Budapest more complete, usable and ecologically valuable.

For this paper we will analyze the existing research data, maps, concepts and plans for the Budapest riverside area from the past years, and among these especially the actual and planning state of the post-industrial brownfield areas. The research goal is to find out if these documents and plans adequately support the indicated goals and professional proposals of the concepts.

Thereafter, the paper presents international examples and best practices, which may shape the green infrastructure development in Budapest in the future. In the second part, we will analyze and compare a post-industrial renewal residential area which is important for green infrastructure development, and the regulatory plan and design competition of an unused brownfield of Budapest, both in the riverside area and with lots of similarities, with the aim of developing a typology of different approaches, goals, and design means that have been applied, and distilling a set of guidelines for the design of future projects. This means not only comparing potentials and limitations of the site and of the future program but also investigating the different long-term strategies, for instance, a choice for a master plan.

One of the conclusions from the analysis of the Hungarian capital and the international examples is that an integrated approach of the development documents and regulatory plans is needed to ensure the long-term development of the green-infrastructure of Budapest. From the second part, the case studies show the realization of the plans, and help to conclude the successful and failed acts on the riverside for the future real estate developments, and exact actions which would be able to promote the development of the riverside in the hope that future real estate development will deliver the new green infrastructure element of Budapest to adapt the city for the 21th century.

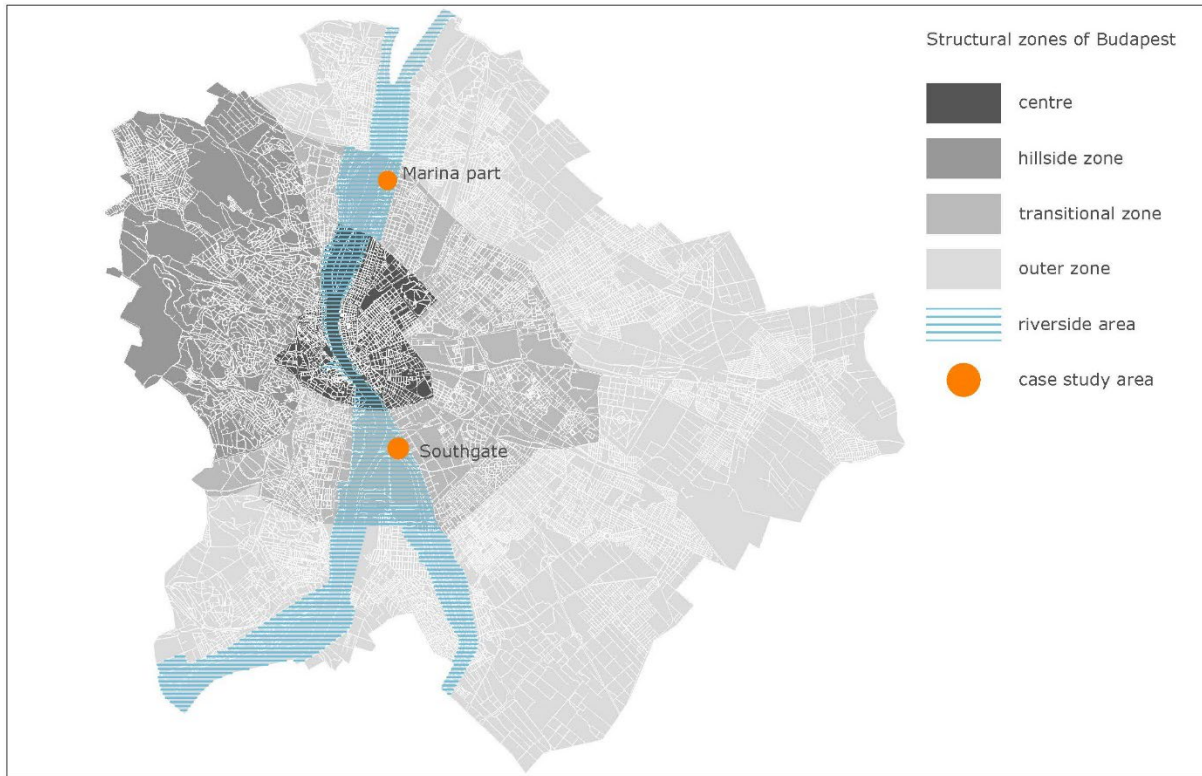
## Introduction

It is said that the value of a concept can be measured by the degree of its materialization. Yet, this is only partly true. Sometimes urban development concepts or their key elements take decades to materialize, yet the existing concept influences our way of viewing the city, quite strongly at times. (Budapest, 2003)

It is important that the realization of the plans must be monitored, reviewed and verified from time to time in order to clarify the correlations of the changes.

The present research paper is a part of a more complex research – a Ph.D. work in progress, whose aim is to represent main problems of the brownfield areas of the Central European cities, through examples taken from Budapest. The hypothesis of the research is that the rehabilitation of the brownfield areas has enough potential to become the base point/main tool for the development of the green area network of the cities. (Budapest 2017a) The topicality of the matter is that in recent years both the brownfield survey (Budapest 2014) and the city on the Danube area (Budapest 2017c) and the Budapest Green Infrastructure Development Concept (Budapest 2017a) have been completed. In the paper, the general research of the entire Danube zone and a detailed research of two sub-areas are concluded.

The research is located in Budapest, the capital of Hungary, the 10th most populated city of the European Union (European Union 2010; KSH 2017); population: 1 752 704, area: 525,14 km<sup>2</sup>. The city was formed on the two banks of the river Danube by the merging of three distinct towns and the Danube islands; the eastern, Pest side was the commercial center and the township, while the western Buda side was the royal court and the administrative center. The city is administratively divided into 23 districts, which enjoy partial autonomy in construction activity. Most of the areas along the Danube have been transformed into transport and industry areas; thereby the major brownfield areas have been formed here. Until recently, the zone along the Danube was not treated as a unit by the city, the various districts could regulate the areas on the basis of their ideas in the Capital City. The DÉSZ –Danube riverside Regulatory Plan – has changed this, which creates detailed rules for the zone. The examined area by DÉSZ is 1.64% of Budapest's administrative area, or 8.65 km<sup>2</sup> (Budapest 2017b).



**Fig. 1. Structural zones of Budapest and the case study areas**

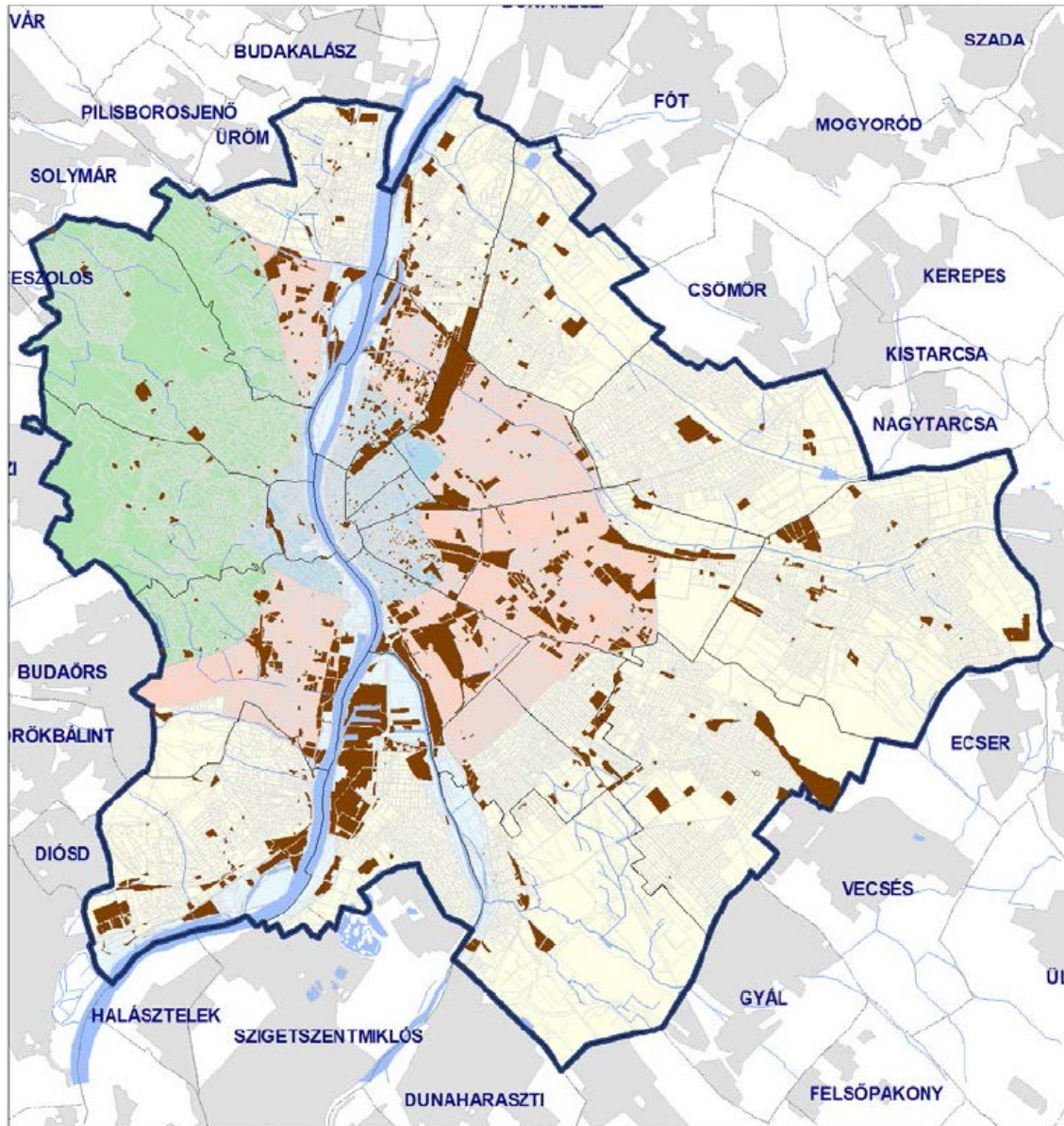
The large-scale analysis shows the zone along the Danube on the level of the settlement structure plan, while in case of the two sub-areas the parameters of the DÉSZ are analyzed. Furthermore, the development of two brownfield residential areas is analyzed on the basis of the role of the green infrastructure network and the regulatory tools.

### **Background and Literature Review**

The term 'brownfield' used in Hungarian is similar to the American scientific literature. According to the definition used by the European Union's CABERNET Programme, brownfields are sites which have been affected by former uses of the site or surrounding land; they are derelict or underused; they are mainly fully or partly developed urban areas; they require intervention to be returned to beneficial use; and may have real or perceived contamination problems." (European Union, 2005).

The problem of environmental pollution is connected to the under-utilization of the area and also to the extremely chaotic property relations. (Barta, 2004). In Budapest, there are large areas of brownfields in the fabric of the city (Budapest 2014), scattered throughout the city's area. Their appearance as a united entity is mainly in the transition zone, along with the areas adjacent to the railway, as well as in Csepel and south Buda. In the historical core of the settlement, brownfields mostly appear as non-used demolished areas or as empty buildings.

Deindustrialization (at the same time as rehabilitation) continues in the capital, especially in areas close to the city center. In 2006, industrial areas accounted for merely 3-4% of the urban area (Kiss, 2008). In the past decade, the cadaster and strategy for the renewal of brownfield areas in Budapest have been born. In addition to the "classic" brownfield areas, the strategy aims to record and utilize empty buildings and plots in the city core (Budapest 2014). It is evident from the depiction of brownfields that significant areas are found along the river.

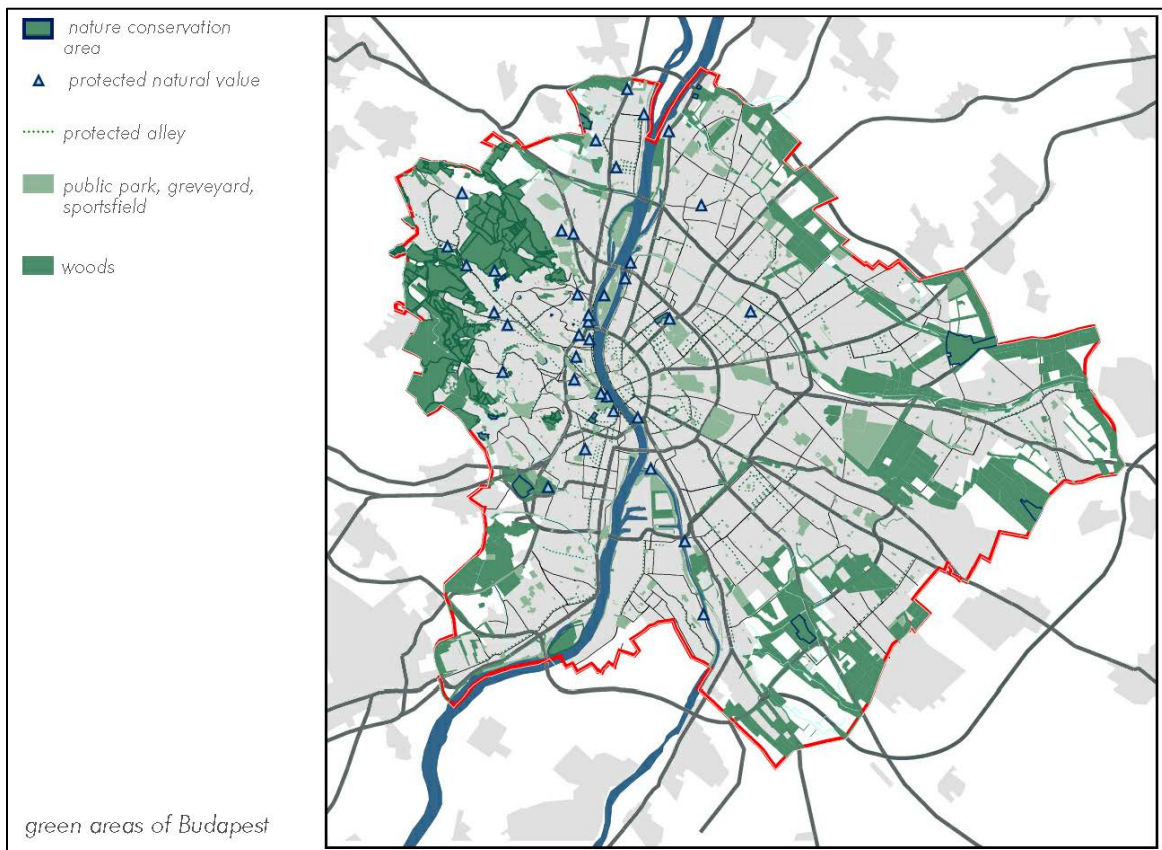


**Fig.2. Brownfield areas of Budapest**

In the case of European cities such as Budapest, the development of the green area network in the city is severely restricted by the densely built historical city center. The green area system can be developed only within the boundaries of the built environment by using the empty plots and unused areas. Due to the presence of water surfaces and their coasts, significant forest areas and green spaces, the 60% green-area

ratio seems to be a realistic and achievable aim in the 60s. For today, this number declined significantly, and the total green area in Budapest is now under the critical 50%. (Hutter 2015).

Only a fragment of the generous green space developments that emerged during the 20th century has been realized, therefore, instead of a well-structured, ring-radial green surface system that would be beneficial from the point of view of urban ecology, landscape and, urban tissue cannot be formed. (M. Szilágyi et al. 2012). For the 21st century, the green space intensity in the central zone of the city is low and the so-called green area intensity also needs significant improvements in the transition zone (Budapest 2013).



**Fig. 3. Green areas of Budapest**

Reviewing the green area network and brownfield areas of Budapest, it is clearly visible to the professionals and the decision makers that brownfield sites have potential and opportunity to develop a green surface system and green infrastructure network. Many of the brownfields are connected to the Danube because of the former industrial and transportation needs, so the ecological value and the development potential appear at the same time.

Research has shown the possibilities of utilizing abandoned railway areas: connecting the fragmented green surface system components and developing the non-motorized transport and green road network (Hutter, 2015). The result of the research has become part of the Green Infrastructure concept (Budapest 2017a). Developing the green areas along the river Danube, another green network element could be created in parallel with the renewal of brownfield sites.

## Goals and Objectives

The research goal is to find out whether the development and regulatory documents and plans of Budapest adequately support the goal of a quality green development of the riverside area and professional proposals of the concepts, to develop the green infrastructure system of Budapest through the renewal of the brownfields. These plans include:

- Budapest 2030, Development Concept of the Capital, (Budapest, 2013)
- Structural Plan of Budapest City (Budapest, 2017d)
- Green Infrastructure Concept of Budapest, (Budapest, 2017a)
- Danube Riverside Regulatory Plan, (Budapest, 2017c)

In the matter of the case study areas, the main goal is to outline the good and missing components of the regulatory plan to maintain or develop the green surface /green space ratio and public functions of the sites, such as common areas at the riverside, the minimum of the green space ratio and the maximum of built-in area.

## Method(s)

Spatial analysis of Budapest was made in order to find common sections between the brownfield areas, green area network and the areas along the riverbank. The next step is to define the areas and analyze the conceptual aims for the selected areas. The comprehensive and concrete acts are summarized in a table. In the comprehensive category, only those acts are listed that have textual descriptions, while in the specific category those elements are listed which are plan-marked, related to their respective exact location.

In order to evaluate the aims of development, they are classified according to a specific criterion, which contains the following 5 categories:

1. Land use
2. Urban structure
3. Infrastructure
4. Green infrastructure
5. Environmental Protection

Creating a new category system is necessary because the aim-system of Budapest 2030 is diversified; therefore, the chosen topic and area is affected in several places.

A case study was done where the green area system, lot coverage, floorspace ratio and regulatory requirements for community functions will be analyzed. The case study is based on two examples. One is realized (Marina beach residential park), where the research covers the current green area, and the other case covers a planned residential development (Southern City Gate - Student City), where textual description, regulatory plan, and design contest materials will be analyzed.

During the analysis, we are looking for evidence for our hypothesis, the conceptual aim for the development of the green surface system on places of the brownfield areas along the Danube. These areas

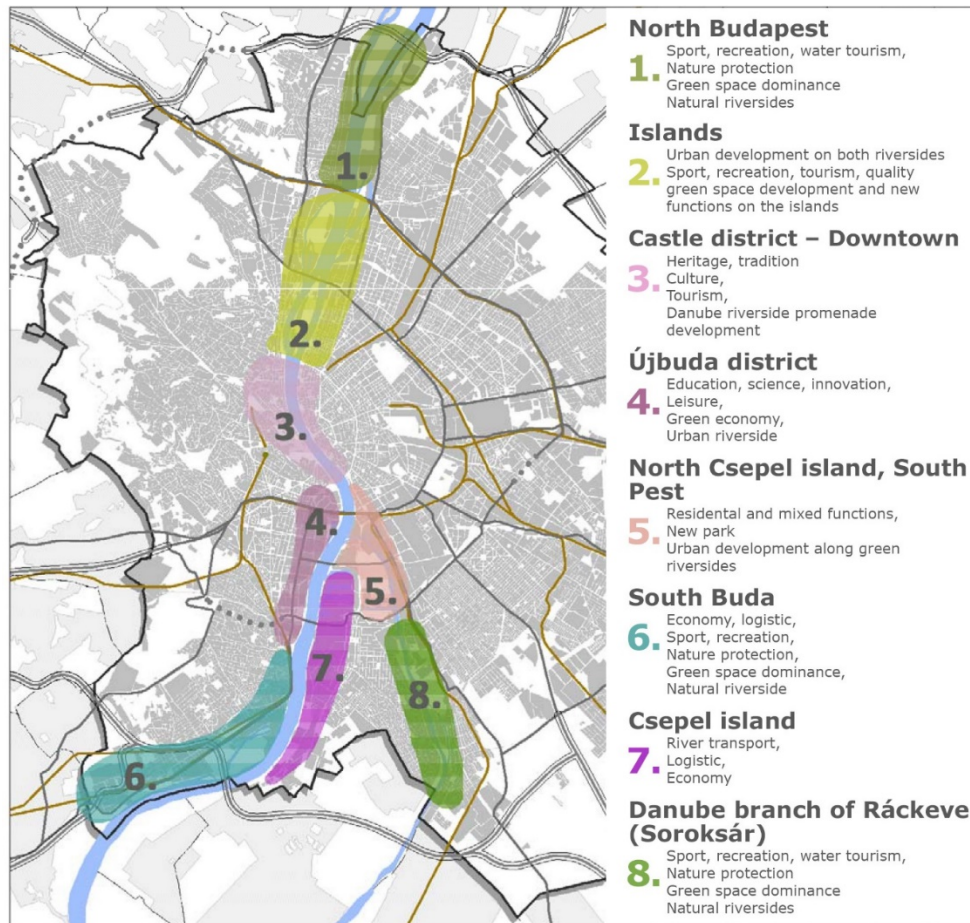
can be partly or fully ensured in settlement planning tools and can be found in the implemented developments even after construction.

Finally, we try to show alternatives through the selected examples of the various functions in the future.

## Results

### Large-scale analysis

The aims and acts of the development and regulatory documents and plans of Budapest should be analyzed reflecting on the brownfield areas along the river Danube. The Budapest 2030 Development Concept of the Capital (2012), based on the environmental, social and economic conditions of Budapest, determines the direction of the changes and the development goals for the long term. The urban development concept defines 4 comprehensive and 17 specific goals (Budapest 2017a). From these, the 8<sup>th</sup> “City living together with the Danube” contains the main conceptual elements of the riverbank area, including the utilization of brownfields (8.1. Functional expansion of the Danube areas by utilizing brownfield sites).



**Fig 4. Development target areas along the Danube (forrás: Budapest 2030 109.o)**

The zone is made of eight differentiated target zones (see Figure 5 Danube Development Target Areas). In the central areas of the riverbanks, the renewal of public areas, radical traffic reorganization, and motor vehicles without traffic restrictions are in progress. Potential brownfield development areas are in the transition zone. These are the Pest and Buda sides of the riverbank between the Aquincum Bridge and the

Árpád Bridge in the north, including the built-in areas of the Hajógyári Island, and due south from Petőfi Bridge and the planned Csepel-Albertfalva Bridge on Buda side, and the area along the part of the tributary of the river Danube called Soroksári-Duna. (Budapest 2013)

title	Budapest 2030, Development Concept of the Capital
<b>Town planning provisions for the development of brownfields into green areas along the river Danube</b>	
<b>comprehensive proposal</b>	Formulating functional preferences in each target area Realizing City Integration, Creating public spaces to strengthen the city-riverbank connection Exploring the hard-to-reach riverbanks, at least 50% new connections Rehabilitation of damaged riverbanks, remediation of soil polluted areas in brownfield areas "Good mix" between public and other functions in high prestige areas Transforming riverbanks for public use; Ensuring the interoperability of the riverbank zone by reviewing settlement planning documents Arranging ownership and status of the riverbank areas Defining new tourist attractions, routes Development of water sports infrastructure Increasing the pedestrian and cycling traffic and reduction of vehicle traffic to reduce the rail and HÉV (Budapest Railway of Local Interest) separation effect passenger shipping, development of cargo shipping, infrastructure development, development Regulation of docking for the ship hotels Temporary utilization of brownfield areas as green areas Development of public transport Encouraging green space growth; developing a green area network in brownfield areas to better accommodate residential areas in the transition zone
<b>territorial proposals</b>	Ensuring high green area ratio in the area to be built (development of green network along the river) Green area, city park design (Népsziget, North Csepel) Defining a green promenade on the north, linear green area Népsziget, mixed traffic along the riverbank of Újpest Defining an urban promenade at the south with bridges, nature-close promenade and mixed traffic development, existing promenade on the eastern side of Csepel Island Reducing the separation effect of road, rail and HÉV lines (Budapest Railway of Local Interest) Shipping Service between the Northern and Southern agglomeration

**Table 1. Budapest 2030, Development Concept of the Capital town planning provisions for the development of brownfields into green areas along the river Danube**

According to the Development Concept, besides the qualitative and quantitative development of the green and public areas along the river Danube, the development of the connecting elements is important too, in order to create a green network with a greater attraction and a higher recreational potential. The general goal is to transform the riverbank into a pedestrian and cycling area, which does not affect nature conservation areas (Háros island) and some functional units (ports and related logistics areas, urban areas).



Overall, the length of the difficult-to-reach riverbanks should be reduced to at least half during the time frame of this concept. Since a significant part of the Danube is unusable for the public, a connection between the city and the river must be ensured by establishing public spaces and pedestrian connection solutions. In addition, the connection between the riverbanks and islands should be strengthened by creating pedestrian and cycling lanes.

Based on the Development Concept, the settlement structure plan for the capital city is made (2017), which serves the preservation of the built and natural values of the city, the coordination of the interests of the district governments, the unified but territorially differentiated development of the city.

title	Structural plan of Budapest
<b>Town planning provisions for the development of brownfields into green areas along the river Danube</b>	
<b>comprehensive proposal</b>	Proper restructuring of impassable areas Preventing the unprovoked expansion of the city, utilizing brownfield sites Providing a liveable and sustainable, differentiated living areas by developing brownfield areas in the transition zone Facilitating change of function of brownfield areas, environment-friendly production, habitational dwelling function by determining optimal installation density Providing opportunity to temporary land use Providing opportunity to the development of the riverbank - Functional expansion by utilizing brownfield areas Providing availability and public use of the riverbanks by defining green area connection Reducing the dividing effect of traffic along the riverbank Creating pedestrian and cycling connections with the islands of the Danube Presentation of potentially soil-polluted areas Revitalization of the river branch of Soroksár
<b>territorial proposals</b>	Defining the connection of structural significance of large green and forest areas along the river Designation of brownfield areas with no specific development goal in order to be transformed into a recreational area To improve the connection between the islands with planned ridges on the river Minimal green area intervention in riverbank areas for economic and logistical aims based on Budapest 2030 New city park at North-Csepel Planned cycling line of structural significance Planned international passenger ship station Planned railway (tram) line Define the exact place of tall buildings, where the highest point is 45m, 65m Watercourse that needs revitalization Potentially soil polluted area National Water Quality Protection Zone - Protected natural waters

**Table 2. Structural plan of Budapest town planning provisions for the development of brownfields into green areas along the river Danube**

The Development Concept of the green area network of Budapest (Green Infrastructure Concept of Budapest - ZIFFA) is an independent development concept in which urban landscape architecture represents the guiding principle, the system of goals and tools for solving the social, economic, technical

and ecological problems of urban development. The plan is based on the Budapest 2030 long-term urban development concept, and is connected to it. It demarcates three goals related to goals and tasks of the Budapest 2030. The future role of greenfield infrastructure in brownfield areas, as well as its potential, will play an important role in the concept. It integrates the results of recent research, synthesized in the parts of the proposal.

<b>title</b>	<b>Green Infrastructure concept of Budapest</b>
<b>Town planning provisions for the development of brownfields into green areas along the river Danube</b>	
<b>comprehensive proposal</b>	<ul style="list-style-type: none"> <li>The protection of natural and artificial waters, connection with the coastal areas</li> <li>Designation of new protected waterfront areas</li> <li>Coordinated ecological and recreational development along the watercourses and the islands of the river Danube</li> <li>Encouraging the temporary utilization under local regulation</li> <li>Preventing the destruction of the natural green belt / green corridor</li> <li>Preventing further expansion of the built area</li> <li>Increasing the minimum green-area ratio at the regulatory plan level</li> <li>Green surface (temporary) utilization and development of brownfield areas</li> <li>Afforestation of brownfield areas that are temporary, used as areas for recreation</li> <li>Brownfield areas should be used to supplement the green surface system</li> <li>The appearance of the green area network and the green corridor in the settlement planning tools</li> <li>Establishing city parks and green allées on the brownfield areas</li> </ul>
<b>territorial proposals</b>	<ul style="list-style-type: none"> <li>Realizing protection of the recommended areas for protection (Háros Island, north-east of Újpest)</li> <li>Conservation of consecutive green areas along the river Danube</li> <li>Establishing city park in north Csepel</li> <li>Establishing a green promenade along the river Danube</li> <li>Transforming a park axis in the city</li> </ul>

**Table 3. Green Infrastructure concept of Budapest town planning provisions for the development of brownfields into green area along the river Danube**

In the case of other European cities, brownfield areas are the link between green areas, enabling the development of a green surface system and green infrastructure. Valencia (Spain) is a good example, where the developmental hiatus caused by the financial crisis provided an opportunity for decision-makers to rethink the strategies and regulations. From the aspect of actions the latest green-surface developments are based on plans from the late 20th century, however, some formerly planned elements have never been made into reality.



**Fig 5. The development opportunities of the green network and green infrastructures in Valencia (Spain)**

In the case of Valencia, developing the green network system and the green infrastructure can be executed on brownfields, underutilized areas and lands in functional transitions. This is partly possible via the previously planned elongation of the existing city park (Turia park), partly through the retaining of the southern agricultural areas (Huertas) - already closed because of constructions, the utilizing of these areas in the sense of green surfaces, and establishing the connection with the Albufera National park in the south of the city. (Adorján, 2016) The brownfields in Budapest have the same potential to become links and to fill the gaps in the green infrastructure of the city.

### Case studies

The next step in the research is to see how much and which project goals have been achieved during the realization. Therefore, a realized residential area development plan and a competition for residential development will be analyzed on industrial areas on the two sides of the river.

#### Marina-part residential development

The development of the Marina-part area, which defines the silhouette of the north-western side of the Danube, was realized on the shore of the former Foka Bay in place of former Kavicskotró Company. Currently, the V-VI stage of the project is being built (out of the planned 17). Its size – especially the 21-meter-high building height – far exceeds what is considered to be optimal (Schneller, 2012), and the city's

Danube-style silhouette has changed dramatically. The previously characteristic height and intensity decreasing from the center was distorted. The smallest green area coverage is 40%, of which some are green roofs or roof gardens. The current zone classification of the area allows large-scale, high-density construction. Although the classification of public areas on the riverbank is limited, due to the private nature of this kind of residential area, the riverbank is closed to the public and the connection to the surrounding areas is also incomplete. Green area intensity studies showed a significant reduction in green intensity between 1992 and 2015. (Budapest 2017a). In the planned situation, with the developments to the southern areas, the pedestrian connections improve, and the green area on the riverbank can be more appreciated.



**Fig 6. Marina-part development and regulatory plans, actual state**



**Fig 7. Marina riverside I-III. stage (Triholding 2018)**

Southgate Budapest, masterplan design competition

The aim of the Southern City Gate project is to develop a city district renewing the previously neglected north Csepel and south Pest zones. Along the southern part of the riverbank, north Csepel and south Pest, there is a livable, health-conscious urban development in which the green solutions, park development and the riverbank are renewed and transformed into livable areas, as well as historic and locally protected buildings. (Budapest, 2018) (Budapest, 2017c)



**Fig. 8. Budapest Southgate development and regulatory plans, and the competition-winning masterplan**

In the winning project, a dense residential building, similar to the mentioned Marina Park, is built with lower-level buildings. It does not follow the idea of a continuous pedestrian promenade along the riverbank, the coastal areas are built-in, paved surfaces, and the northern connecting road is built inside. Thus, the public transport and public purpose of the Danube shore are transformed, the area becomes a part of high prestige residential properties instead of public area. The green areas are in the city park, close to the residential area. The proportion of the planned green and built areas are similar as of the Marina Part project. (KKBK Budapest 2018, 2019)

## Discussion and Conclusions

The town development goals are evaluated in 5 categories:

1. Land use
2. Urban structure

3. Infrastructure
4. Green infrastructure
5. Environmental protection

According to the system above and the concept's theoretical and territorial appearance of the aims, the following picture can be drawn:

	Bp 2030	ZIFFA	Bp TSZT
<b>comprehensive proposal</b>			
Land use	4	4	4
Urban structure	6	3	6
Infrastructure	4	1	4
Green infrastructure	2	6	3
Environmental	1	1	2
<b>territorial proposals</b>			
Land use	2	2	2
Urban structure	1	0	2
Infrastructure	4	1	4
Green infrastructure	3	6	2
Environmental	0	1	3

**Table 4. The comprehensive and territorial proposals of Budapest 2030 at the ZIFFA and Budapest TSZT**

The conceptual goals in the settlement structure plan are largely reflected in all topics, and at the level of concrete recommendation, further elements are added. The appearance of the infrastructure, green area network and environmental protection is dominant, while some of the structural changes are only comprehensive and the number of concrete recommendations is decreasing.

The ZIFFA divides the elements of the green area containing them as comprehensive and as concrete elements. The significant added value is the recommendation for the functional transformation of brownfields (temporary use, temporary afforestation, green area system complement), and highlighting the role of green areas along the river Danube.

Significant change – not visible from the quantified graphics – is that the city park recommended in the northern part of the city is no longer included in the plans for Budapest 2030, the area demarcated in the concept has been transformed into an area with a significant proportion of green space.

The conceptual aim that is to achieve the “appropriate mixed area” along the high prestige area of the riverbank is missing from the plans. To ensure this, settlement planning tools are only partially

appropriate; the solution depends on urban policy and economic decisions. Altogether, the concept, green area network development strategy and the structural plan contain elements for the transformation of the brownfields into the green area. The research has shown that in the case of Budapest, the settlement planning tools accomplish some of the goals included in the settlement development concept and ensure the development of the brownfields along the river Danube into the green infrastructure.

However, it can also be seen that the general aims cannot always be accomplished through the construction law because of the lack of general formulas, the settlement planning, and regulatory tools or because of the aim is not formulated in the appropriate way (e.g. community function). It can be observed that the major green area developments are omitted of plans by the time, and a strategically important Northern public park has been removed from the targets, presumably for economic reasons.

It can be said that there are positive and negative shifts in the development and implementation processes; the density of the built area creates a larger green area per person, presumably with a more pleasant residential environment. Nevertheless, it handles conceptual goals flexibly, and does not help to develop the urban green area network and green infrastructure properly, while the concept and the planned elements are realized, keeping in mind the goals that highly valuable green surfaces and residential areas could be formed.

In the case of case studies, in the realized private residential estate development, the goals and principles that are not defined in the construction law cannot be realized and therefore the established. Also, and expected building density is higher, while the green surface ratio is lower than the aim was. In the planned Southern City Gate area, the winning project handles the Danube promenade as a non-structural element. The green area network of the riverbank is realized, but it is far behind its potential, because some of the connections are not built.

The international outlook on Valencia's example illustrates that under-utilized brownfield areas as a potential for the development of a green infrastructure network can be realized, even though it took decades between planning and completion. Based on the research it can be said that the development of green infrastructure in Budapest has advanced very well in recent years, but the keeping of long-term goals is still important. The Green Infrastructure Development Plan and its philosophy can be helpful as it interprets the green network as a service for the city dwellers and management of the environment, so the economy of the developments can also be demonstrated (e.g. with decreasing health expenditure).

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