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The potential of water in urbanism

Redesigning the shore zone of Graz

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Abstract

In contemporary urbanism river and riverbanks often did not get the thoughtful appreciation which they deserve. In urban structures running water are valuable potentials which can be integrated in the existing infrastructure to create more space and greenery and therefore increasing the quality of life.

The core statement of this work refers to a careful handling with rivers in an urban context on the basis of a specific river situation in the centre of Graz.

The thesis firstly is concerned with general planning foundations in urban river structures and covers the most commonly riverbanks situations in an urban structure. After the theoretical part, the work deals with an analysis of the city structure of Graz which hereinafter leads to a practical based design concept.

The analysis and the design process leads to the conclusion that the urban structure of Graz creates different kind of height differences near the river space. Which both can be connected and transferred in a more perceptible urban landscape. The concept implies the connection between both levels in a high compacted urban structure and unites those levels to a spatial structure. The objective is to raise the populations awareness, to acknowledge the surrounding landscape and to encourage a conscious approach in urbanism and daily life. As far as the future is concerned, rivers can be a significant and integral element of contemporary urbanism to ensure new qualities in city structures.

Introduction

Panta rhei

Water is the source of live, 70 percent of the earth´s surface is covered by water. Water is the element which brings every landscape to life. Water requires to know the substance and to understand it.

In ancient times, there are already testimonials of the close connection of urbanism and water. This functional relation was visible from antiquity to middle age to modern era and was apparent in the city structures.
Water ways were responsible for transport and traffic, drinking water was purchased by waters and wells and the reliable dewatering was guaranteed through valleys and rivers.

All these components decide whether or not a city was established and furthermore characterised the cities structure, public spaces and streets.
Thereby water is much more then supply and disposal, it defines the atmosphere of a city and builds connections between the city and surrounding areas. [1] [2]
Water is the most important substance for the human population, and that´s why water plays an influential role in settlement development.
Rivers were and are still today a focal point in the supply of drinking water, waste disposal and the natural fertilisation of agriculture. In the past, the population was facing the natural fluctuations of water levels, flooding areas were not cultivated and the population respected the force of nature. [3]

1 Cf. Henze u.a.,2015.6.

2 Cf. Dreiseitl, 2011, 10 f. 42.

3 Cf. Henze u.a.,2015.6.

However, water is material basis and a symbol between the relationship of humans and the environment. Technic and aesthetic are mostly separated because of their insurmountable differences.
Water is part of the ecosystem and it offers qualities which can influence the urban climate and increase the well-being in urban space. The sound of water can drastically lessen street noises and therefore it even helps to reduce the stress of the city.

Although water is partially not renewable, human beings make so highly demands on water like to no other natural resource.
In-between the city structure water is part of cultural, social and architectonic functions. The handling of water requires creativity, the art to design, social understanding, management of water and technical innovation. [4]

4 Cf. Dreiseitl, 2001, 10 f. 42.

Annual rainfalls and the never-ending source of water give the population the impression of limitless disposal to water. Therefore, water developed to be a daily commodity. [5]

5 Cf. Dreiseitl, 2001, 78.

The quality of water often suffers from neglected river courses in cities. The self-cleaning ability of rivers is often insufficient. In the last decades' humans get used to rivers with no drinking water quality or swimming possibilities. [6]

6 Cf. Dreiseitl, 2001, 130.

Through the increasing of technical development, people started to believe that waters can be controlled. In early middle age and especially during the industrialisation rivers suffered because of massive changes in their natural water processes. Furthermore, rivers got polluted and the population started to turn their backs on waters.

Only since 1990 the opinion changed and water returned in the thoughts of the population. Living on the waterfront and nearby rivers got enjoyed by great popularity.[7] Through progressive development planners started to deal with possible problems, caused by floods, in creative ways. This kind of near natural infrastructure reduces the possibility of damage and allows the development of attractive public spaces nearby water. [8]

This work deals with the subject of urban river structures and in order needed planning requirements in specific situations. The main focus of the questionnaire is how to connect rivers and their immediate surroundings within an already existing high compacted urban structure.

The practise related example includes an analysis of the rivers position and the surrounding area from a large scale to a detailed research on the riverbank itself in the centre of the city.

Further on, the design concept refers to those generated results and includes selective alteration suggestions to connect the river and riverbank with the urban city structure.

7 Cf. Henze u.a., 2015, 6.

8 Cf. Henze u.a., 2015, 7.

Planning requirements in urban river areas

Traditional urbanism basically deals with two forms of water management: The supply of fresh water and the discharge of waste water.
From that point of view engineers often struggle with supply and discharge.
In sustainable settlement areas, the water circulation is optimized to treat each type of water, regardless of origins, as material.
By that the fresh water system is structured in a sensible way.
Waste water gets divided in grey water and black water. Grey water can be reused, after a simple water conditioning, for sanitary and watering.
Black water has to go through an entire water conditioning, before it can be reused. [9]

9 Cf. Ruano, 1999, 15.

However, another part of water management is inter alia biological water management. It deals with the biology of waters and their shore zones, agricultural and forestry crops, fishing, nature protection and landscape conservation.
Further water quality management and water amount management are important parts of water management. The interaction between those three parts are necessary for the success of economic measures and useful regional planning.
To guarantee this balance of water demands, the water resources have to be divided in surface water and ground water. [10]

10 Cf. Korda, 1999, 367.

On that basis, cities should be seen as ecosystem, which contains a living community and their environment, a balanced ecological unity.
Designing and structuring the human habitat does often require merging different demands, regarding to specific interests, claims and conditions in an area.
These steps of development are difficult to translate in a precise design without causing a possible inner disharmony or missing identification with the urban setting.
Possible consequences can be an unbalanced ecosystem in urban living spaces.

The responsibilities of water economy are structured in 4 sections.
The settlement water management cares about the supply for the populations and the industry with drinking water and water as process material. Further on it also comprised the discharge of waste water, rainfall and prevention of pollution of waters as well as the control of ground water.
The agricultural water ecology serves the local culture. Based in time on consumption this is the section with the highest water usage.
The water management through storage serves the balance between needs and supply. Hydropower management deals with energy production. Traffic water management deals with water measurement, which helps to develop traffic on water. [11]

11 Cf. Korda, 1999, 367.

Waters in near-natural conditions should be preserved. Those waters, which are artificial and therefore not near-natural should be if possible rebuild to near-natural conditions.

Natural flood retention areas can preserve the natural runoff behaviour of waters and can help the settling of animals and plants.

Those areas are zones which are flooded during high water, they provide a certain amount of relief. [12]

12 Cf. Korda, 1999, 368.

All life maintains through fundamental circulations in nature, between air, water and earth. In urbanism, it is necessary to show the circulation of water, like collecting, cleaning and using water, in an educational way. [13]

13 Cf. Ruano, 1999, 48.

Watercourses and water areas are often preferred elements for design and recreation areas. They improve the recreational value and the quality of life.

The shore zones of waters often have a high significance for designed landscape areas.

Furthermore, waters improve the microclimate due to increasing the air humidity. Planning tools are the development plan and the waterway construction plan.

Important and ecological parts are the enrichment of the groundwater and discharge delay of rainwater. Unnecessary sealing in the city structure, like asphalt areas can be avoided due to constructions like cobblestones and gravelled walkways.

Watercourses are natural borders and connecting lines, which structure landscapes and areas. Regulation and reconstruction can have unwanted and unfavourable effects on flora and fauna, as well on the self-cleaning ability of those waters. [14]

[14] Cf. Korda, 1999, 368.

Further on rain water is collected and used, floodwater can be dammed in cases of flooding. Those actions can help to refill the groundwater and support the water system in a healthy way. [15]

[15] Cf. Ruano, 1999, 15.

Worldwide cities grow and displaces natural environment like forests, meadows and wetlands. The spreading of cities slowly and quietly destroys habitats of wildlife and plants. [16]

[16] Cf. Dreiseitl, 2001, 10.11.42.

Running waters are the lifelines of landscapes. Lively running waters are not only a basis of life for animals and plants, they have also an important symbolic and psychological value for people. [17]

[17] Cf. Kumpfmüller, Kals, 2009, 79 f.

For the purpose of designing urban river areas, it is necessary to consider at least 3 fundamental aspects.
Firstly, urban river areas need different demands on their environment, which is described as multifunctionality. Secondly, an interdisciplinarity between the different methods of water management, ecology, urban planning and landscape design is necessary. Thirdly, the river and water processes should be considered. [18]

[18] Cf. Prominski u.a., 2012,15.

Multifunctionality

Especially in cities and urban situation rivers show their complex character. Mostly they get forced in a specific form and have spatial boundaries, but are also artfully controlled infrastructures. They are artificial and natural and the same time.

However, the most important question in redesigning urban river sections is:

How is it possible to connect the functional requirements of waters with the design of urban rivers?

Furthermore, it is also important to combine those requirements with the natural dynamic of waters.

Because of the perspective that urban river areas are only optimal usable if they are protected from flooding and are free from their natural dynamic processes, the water influenced space get forced in narrow boundaries. Furthermore, the mostly bad water quality causes to erase waters from the urban populations memory, and moreover from city planning.

Through those developments, a lot of water typical plants and animals disappeared from technical formed urban river areas.

Aim of the urban flood control was yet to allow a fast and efficient draining of masses of water. Still the narrow water profiles do not offer enough space to conduct deluges of water, because of extreme heavy rain and increasingly impervious surfaces.

In the last couple of years, the tendency to retain accruing waters in hinterlands, through retaining, storage and seepage, established. [19]

19 Cf. Prominski u.a., 2012,16.

Interdisciplinarity

The designing of new water areas does not only include one discipline. It is import to consider the mutual areal situation and connect economy, ecology, urbanism and landscaping disciplines. [20]

20 Cf. Prominski u.a., 2012,16.

In regional water locations, often only small interventions, like opening and offer access to the water through developing the shore zone, make a significant redefinition of a specific place.

The interface of water and land offer special features, in which different interests hit each other's, like the purposes of urban development and water- management circumstances. [21]

21 Cf. Machleidt u.a., 2011, 14.

Strategy differentiation

Rivers and river areas are amenable to specific processes. Natural processes, structural engineering and also landscape designing are constantly changing systems and adaptive developments.

Process- orientated designing and working includes thinking and planning in options and react to spontaneous developments. [22]

In each river, there are the same processes happening, nonetheless no one equals the other. Every location is different and every location creates different conditions, therefore each river is basically different.

As a result, the arrangements of the design process have to be coordinated in various ways on each river.

The water system covers the earth´s surface as a dense network, depending on the landform configurations the water collects in areas and gets together in watercourses. Each river forms and transforms the area it is surrounding and in correlation nature and the environment form the river and waters.

Rivers and in general waters are changing under a specific period of time, it is expanding or contracting in different spatio-temporal processes. This moulding processes are based on the transport medium of water. [23]

22 Cf. Prominski u.a., 2012, 17.

23 Cf. Prominski u.a., 2012, 25.

River areas and their limits

From the perspective of economy, terms of traffic and strategical aspects the focus of settlement was offered to be nearby rivers. [24]

The spatio- temporal processes which are proceeding in natural rivers are a challenge for using river areas as a human habitat. The uncontrolable changes and the extensive conduct of waters are endangering for populated and cultivated landscapes. For this reason, humans are limiting the internal dynamic of waters to control the unpredictable strength of rivers.

The type of process limits changed through history. In pre- industrial times the setting of process limits were characterised of small specific differences, which conformed with the natural and internal dynamics of the river.

In early middle age, small apportionment and impoundments were realised, to enable the use of mills and build defence facilities.

Through the industrialisation rivers gained importance as transport routes and river valleys got more and more populated.

24 Cf. Spandau u.a., 2015, 11.

Because of increasing technical possibilities, the population started to control and to shore river valleys on a big scale. This contained basically interventions like straightening river sections to influence the shipping industry in a positive way. [25]

25 Cf. Prominski u.a., 2012, 29.

Those extreme technical measures in changing river section did not happen selectively, rivers got restructured in their total length. Basically, trough strengthening the banks of the river and secure the water by ground ramps and weirs.
By means of those massive changing the setting of process limits reached a new level, particularly according to that massive scale and the durability. [26]

26 Cf. Prominski u.a., 2012, 30.

The relevance of waters in contemporary urbanism

Human living in cities and villages correlates with open spaces. They influence them and they get influenced in his well-being, his health and his actions. [27]

For many people water has a special attraction. Therefore, the demand for housing, recreation and workspaces near water is accordingly high. The condition to recognise special features, qualities and sensitivities of waterfronts is an important element of successful and cautious urban development. [28]

A city needs well developed open spaces, in which the population can casually interact with other people. These places have a huge impact on the social functioning structure of a city. Therefore near-natural designed public spaces play a major role in a functional city, also concerning ages, social groups, density, size and design.[29]

In the last decades, the awareness of waterfront sites, especially in cities and urban situations, drastically increased. Because of this increased awareness waterfront sites take a central stage in today's urbanism as example as recreation areas and public spaces. [30]

Further on the increasing site density in cities requires those public spaces, especially for humans living in flats without direct access to their own gardens. These spaces should be accessible within a short distance.

27 Cf. Kumpfmüller, Kals, 2009, 6 f.

28 Cf. Machleidt u.a., 2011, 10.

29 Cf. Kumpfmüller, Kals, 2009, 6 f.

30 Cf. Machleidt u.a., 2011, 10- 12.

Public spaces, play grounds, streets, walkways and sport facilities can fulfill the requirements of open spaces. In total, this structure develops a system, which is a significant part of the quality of a city. The principle of near- natural designed open spaces, is to be in accordance with nature. [31]

Despite the increased awareness of those qualities, the view of planning often considers only single aspects of waterfront locations for urban development, such as transportation, technical infrastructure or specific architecture on waterfront sites. [32]

Relating to those facts contemporary and efficient urbanism considers each aspect and creates an interdisciplinary view of waterfront developments.

Therefore, integral part of designing and planning open spaces is to familiarise with the special characteristics of a location and carefully observe the development during years to respond to possible chances. Furthermore, it not only requires careful planning but also public relations work. [33]

Due to regulation, building development or emission of pollutants a lot of indigenously waters have impaired ecological functions.

Near- natural designed waters are an experience of nature which have great qualities and can connect the concerns of nature protection with the concerns of the population. [34]

31 Cf. Kumpfmüller, Kals, 2009, 6 f.

32 Cf. Machleidt u.a., 2011, 10 ff.

33 Cf. Kumpfmüller, Kals, 2009, 8 f.

34 Cf. Kumpfmüller, Kals, 2009, 77 f.

Further linear bodies of waters form important fresh air corridors and serve to ventilate overheated urban areas. Due to the water and the accompanying vegetation a cooling effect gets created. For the purpose of utilize this advantage, the climatic functions must be considered in the conceptual phase.

The aim of water- related urban planning is the creation of high quality design of public spaces as well as creating attractive shorelines and waterfront sites. This requires direct physical contact and a visual relation to the water.

This involves an interdisciplinary cooperation between city and landscape planning, water management and nature protection. [35]

Those potentials are also useful for traffic. Route relations along a river course and near water lines to raise the quality of traffic structures and increase the usability of those routes.

Further on recreation zones in cities and especially green zones along rivers drastically increase the quality of a city.

The most important aim is the connection of all those different potentials of an urban structure, like traffic routes, green areas and river courses, with people living within the city.

Developing an overall network of all individual parts to create a functioning system which combines each and every single part of this structure.

35 Cf. Machleidt u.a., 2011, 10 ff.

To develop a sustainable and successful integrated urban development by water, there are recommended actions which give an overview about laying the best foundations. Those conditions show, how urban development in connection with water can integrate with the overarching development strategy for the city and how it can create an added-value for the public.

The first recommendation is to gain attractive locations in the city by connecting them with the water and connect attractive places at the water with the city.
Further on the multidimensional use of water and also guarantee the public interests are ideal conditions for a successful urban development.

Flood protection, construction and design, considering potential flooding are one of the most important concerns while working with water. Relating to those issues maintenance and care costs are essential components in a preliminary stage of planning. [36]

36 Cf. Machleidt u.a., 2011, 14 f.

The attractiveness of inner cities accompanies with the qualitative development of housing, working places and resting areas.
Next to good infrastructural developed places, locations with particular quality of open spaces and atmospheres are in demand. If water locations are well developed, they offer those attractive characteristics.
To recognise these special qualities and sensibilities and gentle use them as potential for urban development, is an important condition for successful and sustainable progression in cities. [37]

37 Cf. Machleidt u.a., 2011, 16.

Fig. 01

Overview
Madrid Rio

Fig. 02

Section
Madrid Rio

The project Madrid Rio in Madrid, concerning the river Manzanares, was one of the most laboriously and expensive urban redesigning project.
The project aims to achieve a new integrated urban axis in the city (fig. 01).
Once the area was a highly traffic frequented space in the urban structure.
The traffic routes through the city were relocated and disappeared underground (fig.02).
Now the former traffic route is a new green corridor which spreads across 8 km and contains urban parks, gardens and recreation areas.

The redesigned area develops through the city from south and west and integrates the river in the structure. A wooded walkway connects six already existing green areas. The area contains a large amount of facilities, like sport fields, children areas and cultural facilities.
The running water through the city was integrated in the city infrastructure to create qualitative open spaces with attractive characteristics to increase the quality of life in the city.[38]

38 Cf. Franchini, Arana, 2011, 1f.

Fig. 03

River Manzanares
Madrid

The redesigning of the urban river area enables a spatial appropriation for pedestrians which was not available cause of the highly frequented traffic roads.
Before the realisation of the project the river Manzanares was a non-existent urban reference in the cities structure.[39]

39 Cf. Franchini, Arana, 2011, 3.

Now the river is an essential part of the urban structure, which forms and strengthens the visual appearance of Madrid. The water offers the possibility to interact and experience a daily infrastructure and supports the advantages running waters can offer.

Particular these potentials are desirable to support and develop. Connecting each element to a working structure and offering people to experience and enjoy the positive aspects of a city.

Designing river environment

Aspects of public space in urbanism

Because of specific prevalent spatial and natural conditions and as well flood protection, water locations are often more isolated from their environment then other locations and only offer selective access points with their surroundings.
Moreover, river courses are frequently accompanied by streets, therefore they represent a much higher barrier, which only can be overcome with a high effort. In order to develop water locations with a specific reinstatement value for the public, those barriers have to be overcome and integrated with the urban structure.
In addition to the urban planning integration the functional and social connection with the environment must be considered.
The seamless integration of new areas requires the connection of those places in the already existing public transport and path system. These measurements include the construction of new streets, walkways or bridges. Predominantly the creation of public space, the linking of shore zones and their connection within the existing walkway and transport system result in attractive and overall functional urban development. [40]

40 Cf. Machleidt u.a., 2011, 18 f.

Near waters and in fringe- zones a couple of different interests collide.

Those interests, like flood protection, recreation areas and cultural facilities, often cannot corollate with each other. For that reason, water- related developments have to overcome those conflict potentials and develop synergies to create new urban qualities.

Corresponding to this the attractiveness of water spaces also request visual relations and physical contact with water. [41]

41 Cf. Machleidt u.a., 2011, 20.

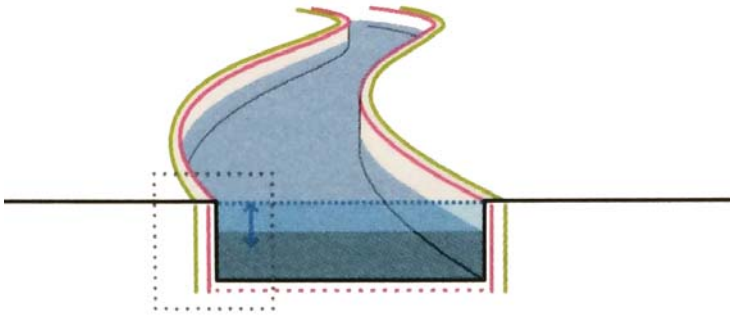


Fig. 04

A Sea walls and promenades

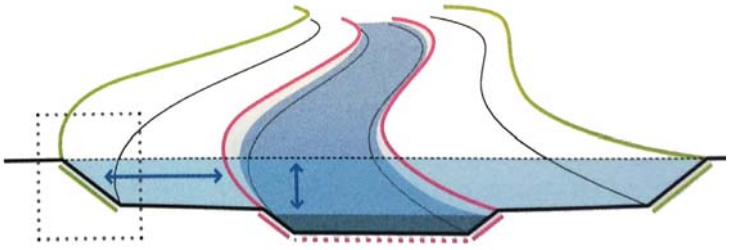


Fig. 05

B Dikes and floodwalls

Types of process areas

In urbanism and urban river areas there are a quantity of different situations and no one equals the other. Therefore, it is necessary to summarise major spatial types to achieve a manageable number of categorization and transfer those designing tools on specific situations. Those specific situations in urban river areas, in which spatial conditions and water processes emerge, are in relation to a clearly defined process, called process area.[42]

42 Cf. Prominski u.a., 2012, 39.

There are basically at least five different types distinguishable:

Situation A deals with sea walls and promenades (fig.04).

In those situations, the shore is especially steep and there are no flooding areas available. Therefore, the water fluctuation exclusively happens vertical.

Process area B deals with dikes and floodwalls (fig. 05). Hereby the dikes and floodwall limits, are in a specific distance to the shore zone. According to those zones there are vertical elements as flooding areas available. The water fluctuation happens vertical and horizontal.

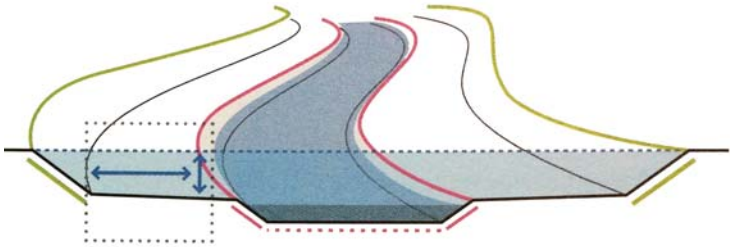


Fig. 06

C Flooding areas

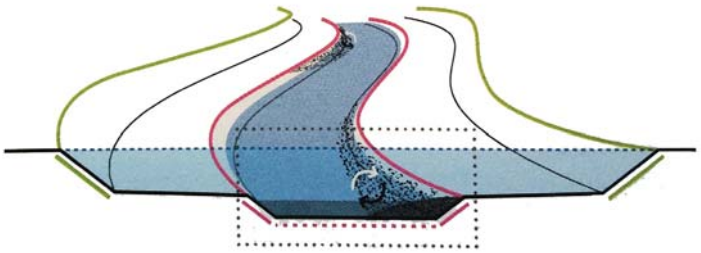


Fig. 07

D Riverbeds

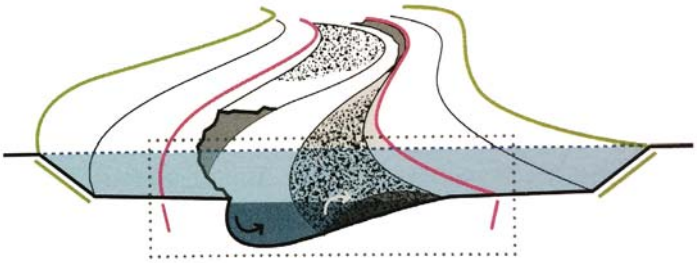


Fig. 08

E Dynamic river landscapes

Process area C concerns flooding areas (fig.06).
These flooding areas involve specified zones, which are available as regularly horizontal and vertical water fluctuation zones and are mostly existing in rural areas ahead of and after a city.

In the process areas A to C there are no changing modifications in the river basin intended. Instead just the different kind of water amounts convert the visual appearance of the river. [43]

43 Cf. Prominski u.a., 2012, 39.

The process areas D and E are in contrast to the others dealing with the shifting of sediments, such as mud, sand and gravel. Therefore, the changing river basin not only appears in different ways because of the amount of water, it also changes as well as the river basin itself, such as significant river relocation.

Process area D deals with riverbeds and flow spaces (fig.07). Reversible changes in riverbeds can be caused by erosions processes, which are effecting the appearance of the river bed and shore.
Dynamic river landscapes are the subject of process area E (fig.08).

It deals with a more natural process of water courses. Due to including the flooding areas in erosions processes the whole river appearance, like the water course, can be changed in total.
This work is going to cover mostly process area A and B, due to their appearance in urban situations.
The legend below explains the different borders, process areas and limits of figure 04 to figure 19.

<u>Borders:</u>

Process area

Flooding borders

Border of dynamic channel development

Mounting of sole

Borders of vertical water variation

<u>Processes:</u>

Vertical water fluctuation

Horizontal water fluctuation

Transfer processes

Sedimentation

Erosion

Sediments

Design strategies

Running waters are the lifelines of landscapes. Lively running waters are not only a basis of life for animals and plants, they have also an important symbolic and psychological value for people. Waters should always be considered in their whole appearance, including embankment, edge strips and wetlands. Those areas should not be affected in a negative way as a result of planning measures. [44]

44 Cf. Kumpfmüller, Kals, 2009, 79 f.

The different types of process areas and the therefore related designing strategies clarify in which way a specific river area should and could be designed. The designing strategy shows several and different kind of designing inventions to influence urban river areas in a positive and reasonable way.
The designing tools can be either small interventions, like individual seating facilities near the shore or more sophisticated interventions, like flooding areas. [45]

45 Cf. Prominski u.a., 2012, 41.

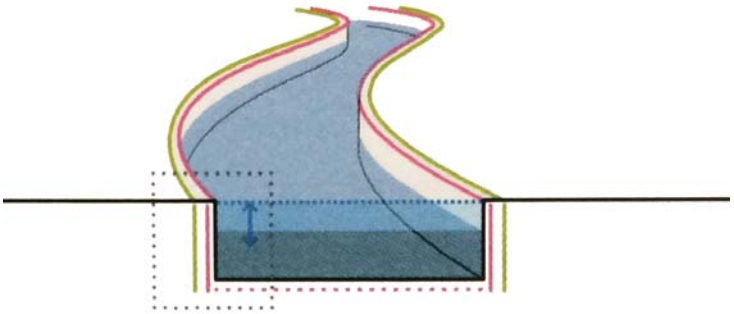


Fig. 09

A Sea walls and promenades

A Sea walls and promenades

Sea walls and promenades are characterised by their steep and artificial created water banks (fig.09), the focus in this area is on flood protection and bank stabilisation.

The redesign allows to transform the steep water bank into a differentiated shore area. Through this transformation, the borders lose their separating character and creates a usable area between water and land.[46]

Further the design strategy can also be based on elements which are either able to be flooded or able to be floated, due to rising water.[47]

That kind of constructions are mostly located in city centres, they got build many centuries ago and are typical for the development cores of a city, in which the first settlements happened.[48]

And even today the design and organisation of contemporary living space casts some doubts on the form of today's environment. Current and past urbanism often aimed to high density living spaces, traffic structures and other varying elements, those changes often caused, among considerable results, bad side effects.

46 Cf. Prominski u.a., 2012, 47 f.

47 Cf. Prominski u.a., 2012, 41.

48 Cf. Prominski u.a., 2012,48.

It is necessary to develop the public space, from our immediate environment to broader regions, to a healthy and reasonable composition, which maintains the population from damage. [49]

Usually the average water amount, by sea walls and promenades is at a mean or low level. However, especially this river conditions could be decisive for a qualitative city transformation, in particular to create new public spaces in a densely built urban areas. [50]
In those situations, looking for the respectively and appropriate use of space is desirable. To aim at stabile and alleged ideal usages is absurd, because of always changing and flexible conditions and usages. There is no such thing as a universal defined settlement structure and space usage. Designs which aim to be variable, flexible and multifunctional and respect the natural and ecological boundaries are much more reasonable. [51]

These situations only offer limited space for the water and the upper shore edge has to be largely maintained. The design possibilities can intensify the visual perception of the water to appreciate the water fluctuation or create differentiated usable public areas.
Those interventions can affect the whole shoreline or just affect selective elements and areas.

49 Cf. Moewes, 1980, 1.

50 Cf. Prominski u.a., 2012,48.

51 Cf. Moewes, 1980, 383 ff.

Due to creating high differences and therefore temporary useable spaces, because of increasing and decreasing water levels, traffic noises can be minimized and quiet spaces can be created.

From an ecological point of view the heavily fortified shore zones do not offer any vegetation. The riverbed does not offer enough flow for the settlement of animal species.

Nevertheless, only small interventions, like creating selective amphibious zones to facilitate the fishes and amphibians' migration are helpful. [52]

52 Cf. Prominski u.a., 2012, 50.

Fig. 10

Linear extension

Linear extension

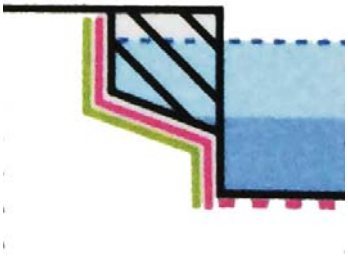
The linear area extension describes a couple of different extension possibilities for thigh river areas (fig.10).

A horizontal water spread is generated due to a stronger structured shore area. This means that, instead of a steep water bank, the shore get structured in terraced stairs. Hereby this configuration allows a direct access to the water and there even is still enough space available as flooding areas. Further on through the structured perceptible levels the water gets part with the city structure.
In this case, there are a couple different design possibilities possible, as example stone elements or even planted areas. Taking under consideration that these materials have to be resistant against erosion.
However, there are three different kind of structures possible. Firstly, it is possible to structure the shore in an extensive and wider way through intermediate levels. Secondly, a terraced structure across a wider area is useful if the shore zone offers enough space. In this case a fluent transition between urban area and river area is desirable. Thirdly, public shore zones can be created by stairs, hereby visual contact can create a strong connection to urban areas. [53]

53 Cf. Prominski u.a., 2012, 52 f.

Fig. 11

Selective extension



Selective extension

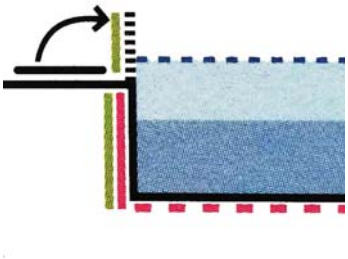
The selective extension is useful to create a narrow access to the water, through ramps or terraces (fig.11).

The flat access allows a direct water contact and offers new possibilities, like bathing areas, water playground or canoe entry.
In this case the water flooding area extends in horizontal ways, and can also cause sediment deposit.
Those selective extensions can, despite of their artificial creation, develop a biotope diversity, birds, amphibians and mammals can use the access as water- land transition. It is possible to create the water access parallel or vertical to the shore. [54]
Biotopes can also be useful for improve water quality and assemble ecological stability. Further they add aesthetic diversity. [55]

54 Cf. Prominski u.a., 2012, 54 f.

55 Cf. Hoyer, Dickhaut, 2011, 23.

Fig. 12
Temporary facilities



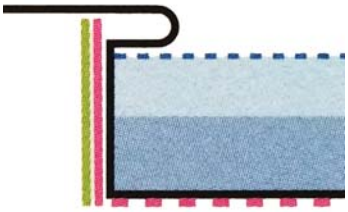
Temporary facilities

Temporary elements only get used in the case of flooding. They offer the possibility to complement already existing flood protection walls (fig.12), and maintain visual links and walk ways if they are not used.
Further temporary facilities sensitize the public to the danger of possible flooding.

The use of temporary elements, however requires the provision of storage areas in case of no use. Permanent installed lockable gates and gaps do not need the accessibility to storage areas. The great advantages of temporary facilities are the preservation of water access, walkways and visual links, therefore a close connection from shore zone and water can be remained. [56]

56 Cf. Prominski u.a., 2012, 56 f.

Fig.13
Raised elements



Raised elements

Rivers in a dense urban area and a high intensity of use do not often offer the space for complex modification in their shore zones. Therefore, projecting platforms or balconies are creating additional open spaces (fig.13), as well they are not influenced by flooding water.

The platforms project in the rivers space and allows views which are not possible from the shore side. Furthermore, they stage the river area in a new point of view and raise it in the awareness of the city. According to their position they can either be highly frequented or isolated recreation area. [57]

57 Cf. Prominski u.a., 2012, 58 f.

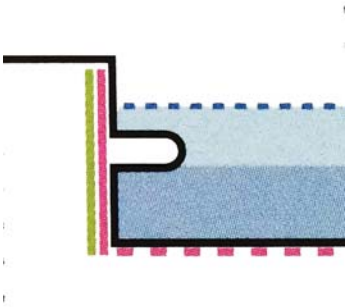


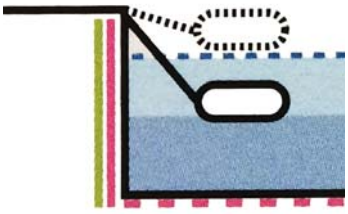
Fig.14
Tolerated areas

Tolerated areas

The most interesting areas near rivers are in direct contact with the river itself. In relation to this high water is the most important challenge.
During flooding those areas are not useable and are below the water surface (fig.14).
The facilities have to maintain their position and permanent damage, despite temporary flooding. Therefore materials, furniture and plantings have to be well anchored.
Different designing tools like semi- submerged treads on the water´s edge and stepping stones in the water can convey between water and land. Artificial islands and small shore zones can be available as amphibious zones. The designing of attractive arranged stairs, ramps and landing stages also allow a temporary use as public space. [58]

58 Cf. Prominski u.a., 2012, 60 ff.

Fig.15
Adaptable elements



Adaptable elements

Adaptable elements are classified as swimming modules on the water's surface (fig.15).
They react to changes of the water level and can be used permanent or only temporary. The connection between the shore line and the swimming platform has to be a flexible construction, due to changes in the water level.

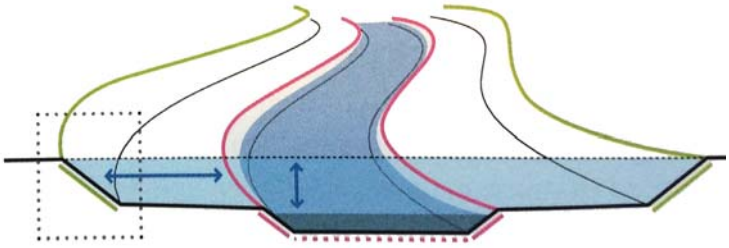
Furthermore, swimming islands, swimming landing stages and specially made ships on exposed location can influence the cityscape significantly.[59]
Those elements should not be seen as selective decorations, it is important to imply them with their environment and with the population. In order that they can be used and enlivened. [60]

59 Cf. Prominski u.a., 2012, 64 f.

60 Cf. Dreiseitl, 2001, 9.

Fig.16

B Dikes and floodwalls



B Dikes and floodwalls

Dikes and floodwalls are periodically used spaces and elements, which are exposed by flooding water in recurring cyclical intervals (fig.16).

The construction of flood protection lines protects the residential areas beyond that, it constitutes an artificial boundary and therefore a reduction of the natural retention area of the waters. Through dikes and floodwalls, the awareness of the danger of flooding in natural flooding areas highly decreased.

Dikes and floodwalls are seen as the oldest and simplest structural construction of flood protection. In urban context floodwalls are mostly designed as vertical flood protection walls, due to limited available public space, therefore they often cause strong spatial boundaries in between settlement areas and river basins.

Aim of designing process areas like dikes and floodwalls are multifunctional boundaries and the development of enriching and communicating elements for specific situations of flood protection. [61]

61 Cf. Prominski u.a., 2012, 67 ff.

Each designing strategy in process area B deals with the issue of water resistance.

The flood protection elements have to resist the horizontal spreading of water and therefore have to show a specific height. Because of their appearance, they usually have a significant linear separating effect.

To use those linear structures, it is possible to develop viewpoints and useful walkway systems for an optimal integration of the flood protection with the environment.[62]

62 Cf. Prominski u.a., 2012, 70.

Fig.17

Resistance differentiation

Resistance differentiation

If the available space so permits, dikes can be used as a flood protection strategy (fig.17). Dikes are artificial constructed earth walls, which have a core made of sand, another layer made of cohesive clay soil and a final grass vegetation layer.
They can form dominant structures in the landscape and show a high designing potential. Often dikes are used like monofunctional trapezoidal areas, but due to targeted designs they can form new spatial situations in the landscape.
A flat and fluent design of the dikes allow a fluent transition between the waters and their surroundings, considering that the area has to offer enough space for creating those kinds of landscapes. [63]

63 Cf. Prominski u.a., 2012, 72.7.

Dikes can be designed as urban landscapes as well. As example, they can combine the elements of the promenade, the shore staircase and can also contain underground car parking. This kind of construction are often called “super dikes”, because of their immense profiles. Furthermore, it is simple to integrate these kind of dikes in an already consisting urban context because of their multifunctional and flexible qualities. [64]

64 Cf. Prominski u.a., 2012, 74.

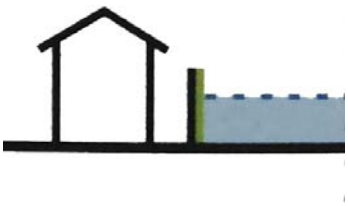


Fig.18
Vertical resistance

Vertical resistance

Vertical resistances are often used, as designing strategies, in densely populated urban space (fig.18).
The vertical wall constructions have to be well grounded, very stable and waterproof, due to the vertical rising water amounts and the associated water pressure. In-between a city structure the available space is often too minimal for the construction of generous dike configurations, therefore flood walls offer a space-saving alternative. In many cases, it is easier to integrate flood walls in existing urban situations then dikes. Due to their multifunctional usage, they can serve as structural elements like boundary lines and seating elements. Furthermore, the design, the choice of materials and the quality of these elements can influence the appearance of open spaces in a positive way.
Otherwise high walls constitute a barrier, which separates visual contacts and walkway systems, in those cases it is desirable to design temporary flood protection elements. [65]

65 Cf. Prominski u.a., 2012, 76 f.

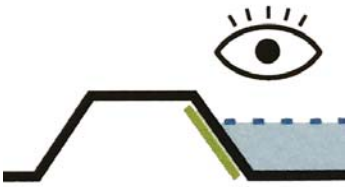


Fig.19

Perceptible water dynamics

Perceptible water dynamics

An important component of flood protection is the indication and perception of water dynamics (fig.19).
Because of the well-developed flood protection system in EU countries the danger of flooding is hardly in the mind of the population, only a few elements are enough to raise the awareness of the population.
Such a measure can be the specific use and visualisation of protective lines. Flood protection walls as example are remembering people about flooding on a daily basis. The height and structure of those walls can be an indicator to past water levels.
A very simple way to show former water levels is the installation of marks, objects or art installations in and by the water. [66]

66 Cf. Prominski u.a., 2012, 84 f.

Rainwater managment

In the development of cities, urban planners, architects and engineers often prefer sealing materials for public places and walkways, due to their low-maintenance.

The design and organisation of contemporary living space casts some doubts on the form of today's environment. Current and past urbanism often aimed to high density living spaces, traffic structures and other varying elements, those changes often caused, among considerable results, bad side effects. [67]

The increased area sealing is sometimes cause of flooding, because of the inability of rainfall to seek away. Further the rainfalls directly flow into rivers and as a result the quantity of groundwater sinks. That's why retention areas, like depressions and ponds, are very important.

Through a careful realisation of those changes, the measurements can be gently included in the existing landscape and combined with practical functions of open spaces. [68]

Due to mixed sewer systems, rivers often get overloaded during heavy rainfalls. Through the creation of depressions and ponds for rainwater retention, rivers could be significant relieved.

Those measures should be created in places, in which the water cannot seep away, due to highly area sealing.[69]

67 Cf. Moewes, 1980, 1.

68 Cf. Kumpfmüller, Kals, 2009, 85 f.

69 Cf. Kumpfmüller, Kals, 2009, 79 f.

In settlement areas road users, like cyclists and pedestrian, do have a much higher status on traffic routes then in open landscapes.
Therefore, the variety of materials are much more for fortified areas. For that reason, fortified areas should always be as strong fortified as required but also as water-permeable as possible. As an exception, extremely used areas should be applied. [70]
Unsealed areas in streetscapes are often seen as unnecessary. Because of this development, vegetation elements have been displaced in urban situations.
According to specific utilisations, frequency and type of use the designing possibilities offer different and near natural alternatives. [71]

The functionality of water management can therefore be included in urban design which leads to water sensitive urban design.
It implies all strategies of water management principles, such as ecological, economical, social and cultural sustainability. [72]

70 Cf. Kumpfmüller, Kals, 2009, 89.

71 Cf. Kumpfmüller, Kals, 2009, 90 ff.

72 Cf. Hoyer, Dickhaut, 2011, 18.

It is necessary to develop the public space, from our immediate environment to broader regions, to a healthy and reasonable composition, which maintains the population from damage.
Therefore, primary objective is a well- coordinated and functional region and much less brilliant individual measures. [73]

73 Cf. Moewes, 1980, 1.

Surfaces in urban situations should be as permeable and vegetation capable as possible, so that sewer systems can be relieved.
Materials like natural stones, granite, lime and conglomerates are, as example, possible alternatives.
Footpaths and cycle tracks are valuable commodity, they raise the quality of life and allow short distances without motorized vehicles.
Therefore, foot and cycle tracks can be permeable and cultivable, because of their frequently usage they have to be constructed regarding usability, safety and visual appearance.
Through the use of natural materials, those areas can further be habitats for animals and plants. [74]

74 Cf. Kumpfmüller, Kals, 2009, 90 ff.

Those measures help to preserve the natural water balance. Essentially, preserving the quality and quantity of the ground water is important. [75]

75 Cf. Gemeinde Tattendorf, 2008, 24.

It is a matter to create spatial living conditions, which connect the humans and the environment, rather than compulsively trying to fit humans somehow in their environment. In a clear and structured relation between environment and humans, it is possible to strive supporting developments.
In social areas and in nature everything is based on interactions, and nothing on absolute principles. Therefore, humans and space do not interact in established effects, but rather they develop a versatile interaction. [76]

There is a need to establish an essential relation between humans and their surrounding nature and strive to a secure balance between humans and environment. Therefore, it is necessary to test new models for the use of space under changing conditions.
In all situations looking for the respectively and appropriate use of space is desirable. To aim at stabile and alleged ideal usages is absurd, because of always changing and flexible conditions and usages.
There is no such thing as a universal defined settlement structure and space usage. Designs which aim to be variable, flexible and multifunctional and respect the natural and ecological boundaries are much more reasonable.
In designing our habitats, it is to consider that almost each element in our constructed environment subjects' changes, therefore eternal valid structures do not exist.[77]

76 Cf. Moewes, 1980, 17.

77 Cf. Moewes, 1980, 383 ff.

Fig.20
Waterplein Rotterdam

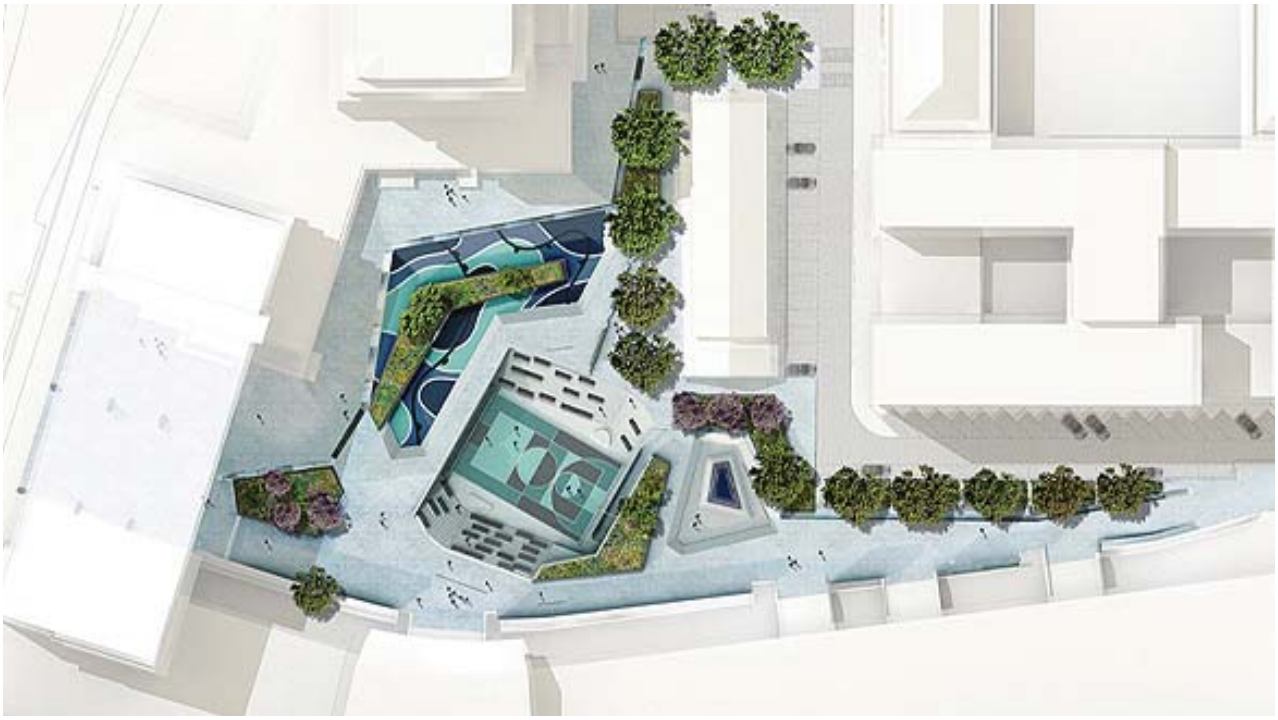


Fig.21
Waterplein Rotterdam

De urbanists, a planning bureau in Rotterdam, developed a multifunctional design concepts called waterplein Rotterdam (fig. 20)

During heavy rainfalls, the city is confronted with quantities of water.

The concept is based on the idea of a multifunctional space which handles different kind of situations, regarding which circumstances and conditions are predominant.

In general, the place is a square which function as meeting place, the place contains three concrete basins of different depth.

Each individual basin offers different kind of opportunities in dry weather.

During heavy rainfalls, the basins serve as temporary water storages, which relieve the cities sewage system. Water of surrounding rooftops and surfaces are collected and storage in these water basins (fig. 21).

Two water basins function as collection area for immediate rainwater.

The third one is deeper and collects water while constant heavy rainfalls.

Further on the water of both undeep basins flows from an underground infiltration device and further back into the ground water, which helps to keep the balance of the ground water level. [78]

78 http://www.urbanisten.nl/wp/?portfolio=waterplein-benthemplein, 17.09.2017

Conclusion

In contemporary urbanism process areas, A and B appear most often, therefore each designing action has to be adjusted to a specific situation in urban contexts.
Those two process areas often differentiate because of each individual situation and in which urban context the river course appears.
The urban context also includes the urban structure considering traffic routes, green areas, hotspots and the behaviour of the population.
In order to develop a functioning urban structure all these components have to be united to a network.
This cooperation can further on be experienced in the infrastructure and also experienced in specific designed places in the city and along a river.
Left over spaces, as example along a river, can therefore be integrated in the daily infrastructure and can be integrated in the urban network as well.
Through those spatial integrations the city and the relating infrastructure can be more and more developed by reacting to small changes in the system and by adapting these modifications in the network.
The water management in a city can be a helpful instrument to help people understand and appreciate water and rivers as part of the infrastructure.
Essential water features like water drainage systems, drinking water provisions and sewage disposal are hardly visible without any aesthetics and only accessible for engineers.

Therefore, it is desirable to link water art with complex issues. Creating new and visible ways for rainwater and flood protection, and design new forms of near- natural wastewater treatment. This results in focused and qualitative changes in urban areas, and leads to new perceptible fields of experiences, water playgrounds and art installations. [79]

79 Cf. Dreiseitl, 2001, 9.

Further on those rivers, which disappeared from cities and from the awareness of the public, because of pipe systems should be recovered. It is possible to reintroduce those waters to their natural function and create entirely new situations.
That´s why it is useful to design new line managements, which are compatible with the spatial concept of a specific location.[80]

80 Cf. Kumpfmüller, Kals, 2009, 85 f.

The case of the Mur in Graz

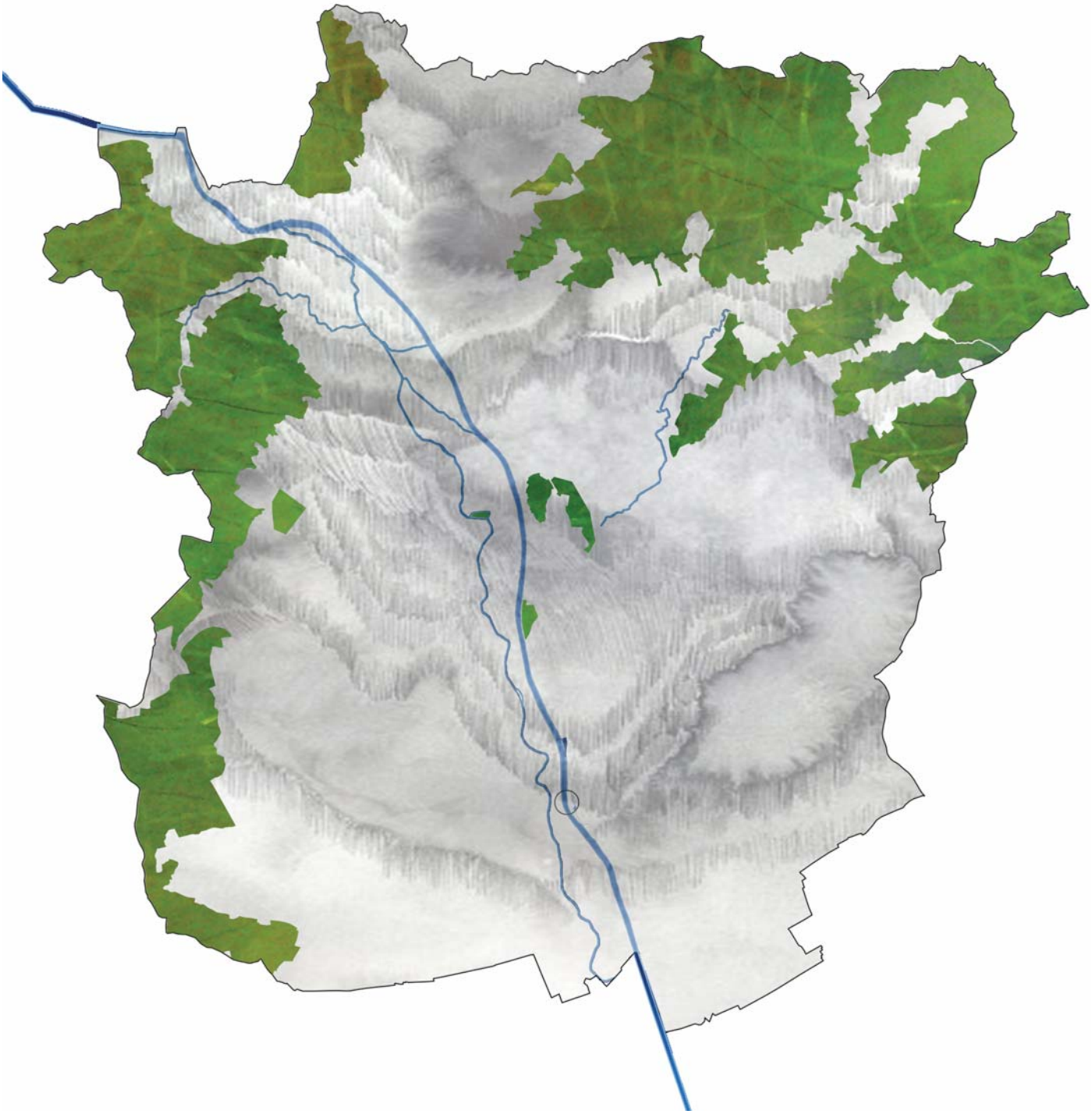


Fig.22
Catchment area

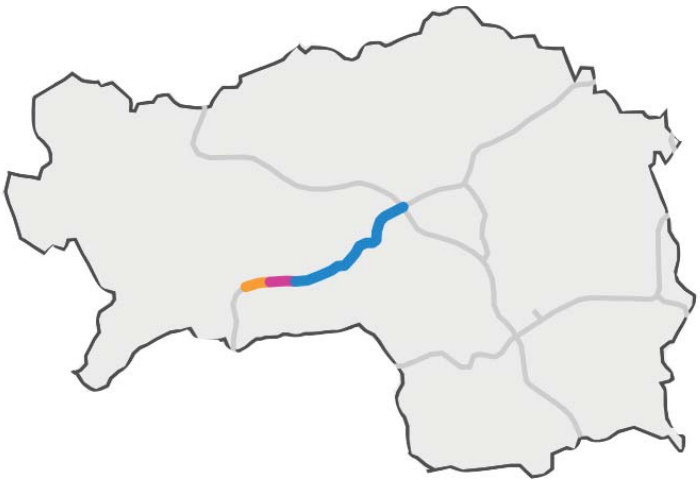


Fig.23
Murtal highway

The river Mur flows through four states, Austria, Slovenia, Croatia and Hungary. The source of the river is located in Salzburg in Austria and reaches Graz in lower Styria. It passes the city linear from the north- west to the south (fig. 22).

The Mur´s source is located in Sazburg in Lunggau, and flows south east in direction to the so called Murtörls which approximately is located about 2260 meters above sea-level.
The Mur is 444 kilometres long until it leads in the Drau in Croatia. About 348 kilometres are located in Austria.

In upper Styria, the Mur has been used as sewer for several industrial waste water removals. Therefore, the river had a very bad water quality until the late 90s.
At the beginning of the next century the Mur has been more and more cleared and todays quality is much better than in the 90s.

The river passes the Murtal in upper Styria and is accompanied by the Murtal highway (fig. 23), which is one of the most important traffic routes in upper Styria.
Until the Mur reaches Bruck an der Mur the river flows north east, in Bruck the direction changes southwards. At this point the Mürz, which is a river flowing from north east to south west, leads in the Mur.

Fig.24
Phyrnautobahn

Fig.25
Barrages along the Mur

After the Mur passes Bruck an der Mur it is accompanied by the Phyrnautobahn
(fig. 24) and flows further on southwards until it leads near Radkersburg in Slovenia.

The catchment area of the river is dominated by forests and grassland. About 61 % of Styria is afforested. Another 25 % is grassland and meadows. [81]

Currently the Mur shows 30 barrages in Styria, not all of them are built on the main course of the river (fig. 25). Some of them are constructed on tributaries. [82]

Momentary a new power station is planend in Graz Puntigam.

81 Cf. www.agrar.steiermark.at/cms/betrag/10026294/14502599, 02.09.2017.

82 Cf. Düsing, 2009, 9.

Fig.26

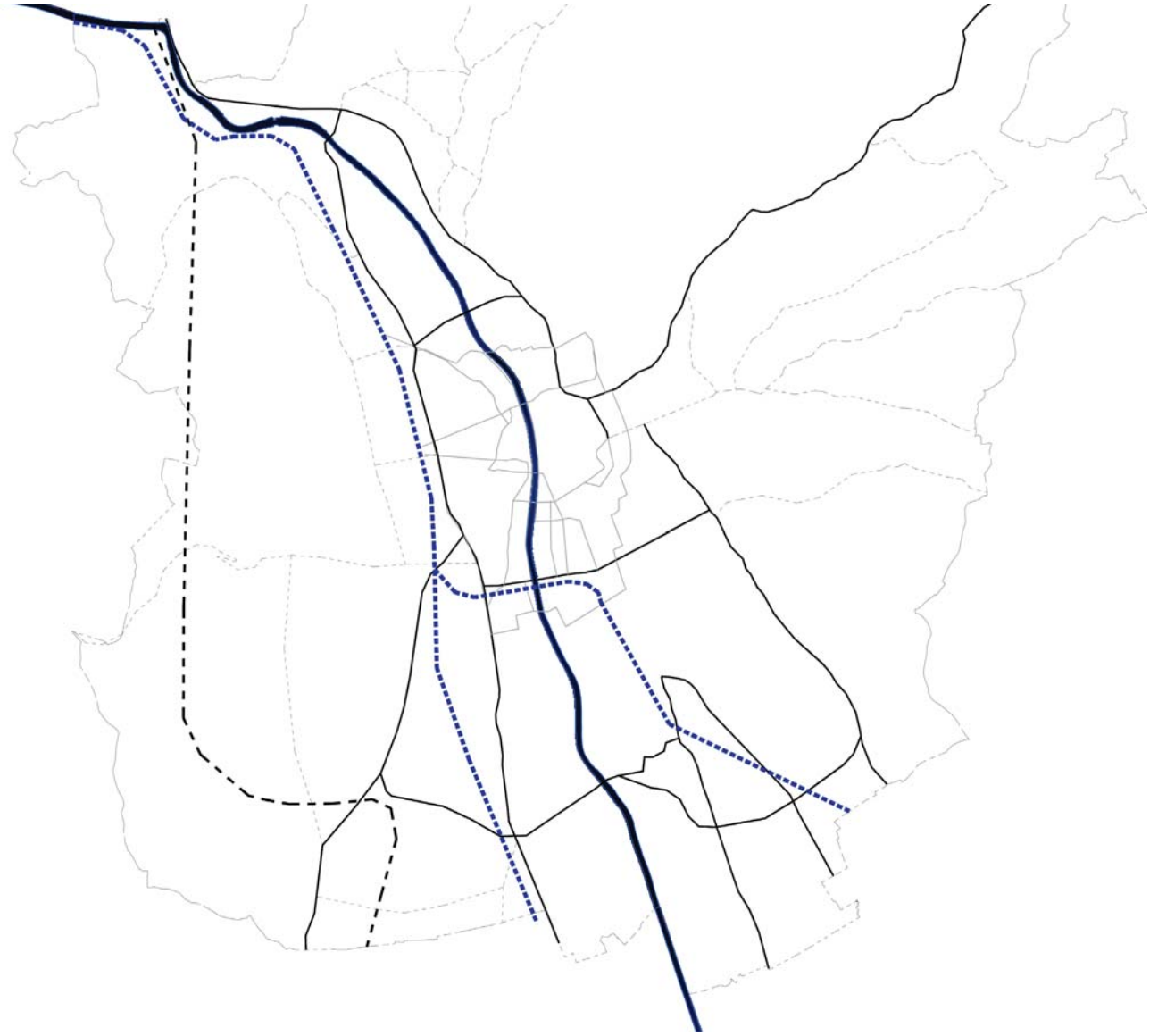
Graz


Stattegg
Niederschöckl
Faßlberg
Weinitzen
Gemeinde Gratwein
Fölling
Judendorf-Straßengel
ANDRITZ
Schaftal
GÖSTING
MARIATROST
Plankenwarth
LEND
GEIDORF
Schloßberg
Thal
Graz-Ragnitz
Graz
ECGENBERG
Hart bei Graz
GRIES
ST. PETER
WETZELSDORF
STRASSGANG
Mantscha
PUNTIGAM
LIEBENAU
Raaba
Mayersdorf
Grambach
Attendorfberg
Seiersberg
Feldkirchen bei Graz

After the Mur passes Gratwein, the river reaches Graz.
The river separates the city in two parts, the east ant the west part.
In the past, the right waterside belonged to workers and factories, while the left waterside belonged to wealthier citizens.
Today the barriers are no longer visible in the infrastructure of the city but the social barriers are still in people's minds.

Fig.27

Car traffic routes



Infrastructure

Car traffic

The transport structure of Graz is formed through three different street categories (fig 27).

The high way forms the external structures, it passes Graz in the west and is an important north south connection from upper Styria to different destinations in lower Styria, Carinthia and Slovenia.

The regional roads form the second layer of the transport system. They connect surrounding regions with Graz.

The main roads result the inner-city transport structure. Those streets form the transport network through the city itself.

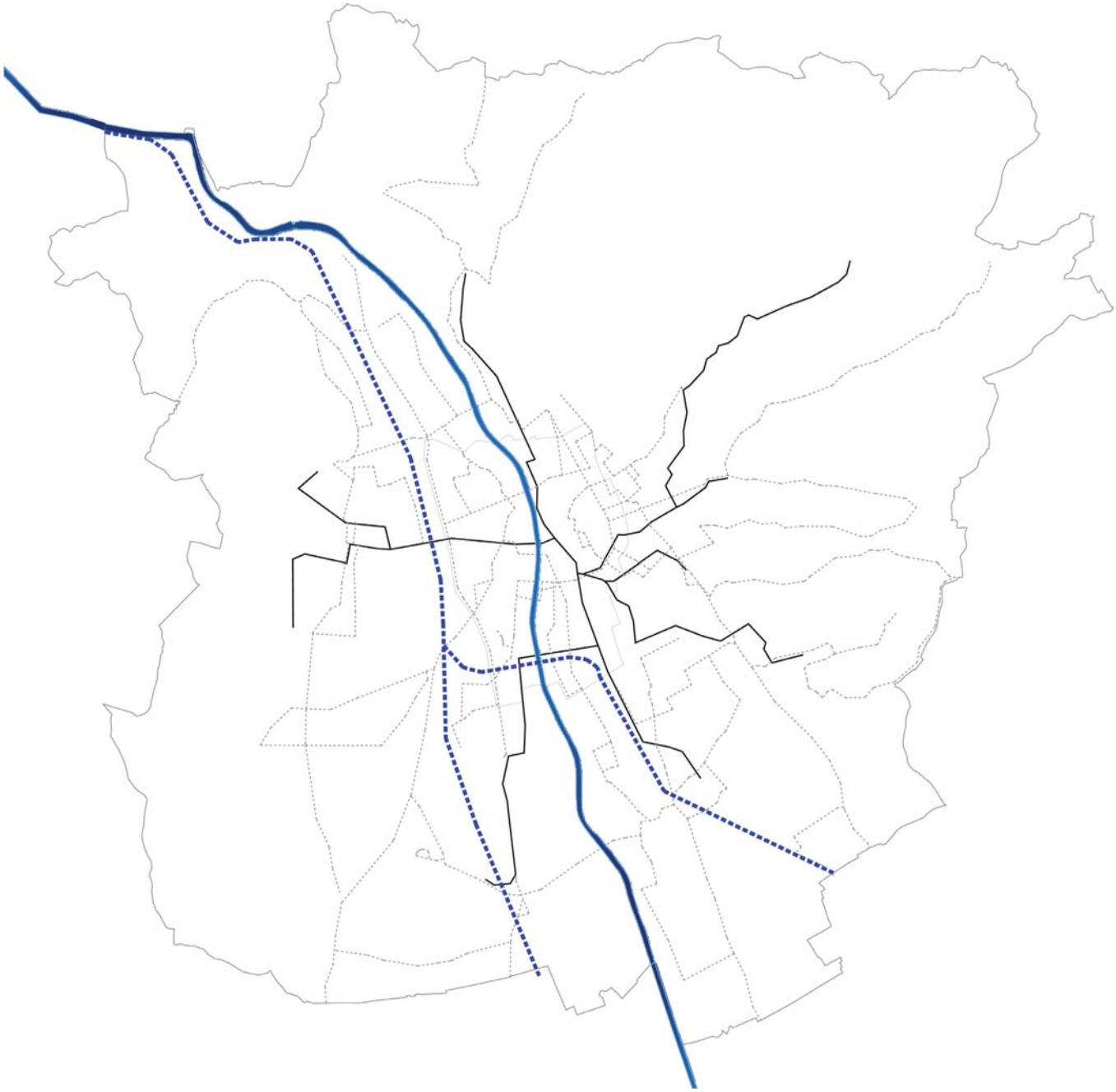
The transport structure of Graz offers 16 crossing possibilities across the river, 9 of those are located in the inner-city structure.

While the historical city centre of Graz does not allow car traffic, specific outer traffic routes show high traffic load.

- Highway
- Regional road
- Main road
- Railway

Fig.28

Public transport system



Trail traffic

The main railway station in Graz is located in Lend and is part of the southern runway system. The station is starting point from the eastern railway and it connects cities all over Austria, like Vienna, Innsbruck and Salzburg, with Graz.
Four out of six tram lines pass through this point and the railway station is of course a turnover point for many bus lines.

Public transport system

The city of Graz offers 6 different tramways, which connect the cities districts with the city centre. Additionally, to the tramway system, bus service supports the public transport system (fig.28).
The intersection of all trams is the Jakominiplatz, which is the most frequented public space in the city. The place serves as bus station, tram station and is a highly-frequented transition point, without any car traffic.
In the north of Jakominiplatz beyond the Hauptplatz is the Erzherzog- Johann Brücke located.
It is known as the main bridge of the city and connects the east and west watersides of the Mur. The bridge was built in 1890 and functions as essential connection for pedestrians, public transports and cyclists across the river.

Fig.29

Foot and cycle path system

The foot and cycle path system

The old city centre is characterised by extensive pedestrian zones. Further on the city is relatively bike friendly and offers a good cycling track system (fig. 29).
In 2002 parts of the east waterside of the Mur was redesigned and received a linear foot and cycle path along the river.

Besides the main bridge, three other connections across the river are available only useable for non- motorised traffic.
The Erich- Edegger bridge is not far from the main bridge up the river. It creates a connection between the two river sides, near the Mariahilferplatz to the Schlossbergplatz.

Another possibility to cross the river is the Mur-Insel, it is located north from the main bridge. The island offers different cultural function and works as well as pedestrian bridge.

Placed at the height of the Augarten there is another footbridge located. Seen from the main bridge the connection is downstream in the south.

Fig.30
Bridges

Fig.31
Kunsthaus

Fig.32
Erich Edegger Steg

Bridges

The inner-city structure of Graz offers 9 connections across the Mur (fig. 30).
The most frequented one is the main bridge, it is used by trams, cars and pedestrians.
Furthermore, it is the connection from the Hauptplatz to the Kunsthaus (fig. 31).

In the north of the main bridge, there are another two possibilities to cross the river.

The Erich Edegger Steg (fig. 32.) is a steel bridge across the Mur placed at the high of the Schlossbergplatz. It was built in 1992, it is only useable for pedestrians and cyclists.

The second possibility is the Mur-Insel. It is one of Graz best known cultural facilities and also functions as pedestrian bridge.

In the south of the main bridge, located at the Andreas Hofer Platz the Tegetthof bridge is a highly frequented connection across the river, primary used by cars.
The next connection, also strongly frequented by cars, is the Radetzky bridge.

Fig.33
Augartenpark

Fig.34
Augartensteg

In the north of the Augarten (fig. 33) park the Augarten bridge is located.

The next pedestrian bridge is the Augartensteg (fig. 34). The bridge offers a connection directly from the park to the other side of the Mur, only usable for pedestrians and cyclists.

At the end of the Augarten the highly frequented Karlauergürtel is located.
The Bertha von Sutter Friedensbrücke is connecting both river sides.

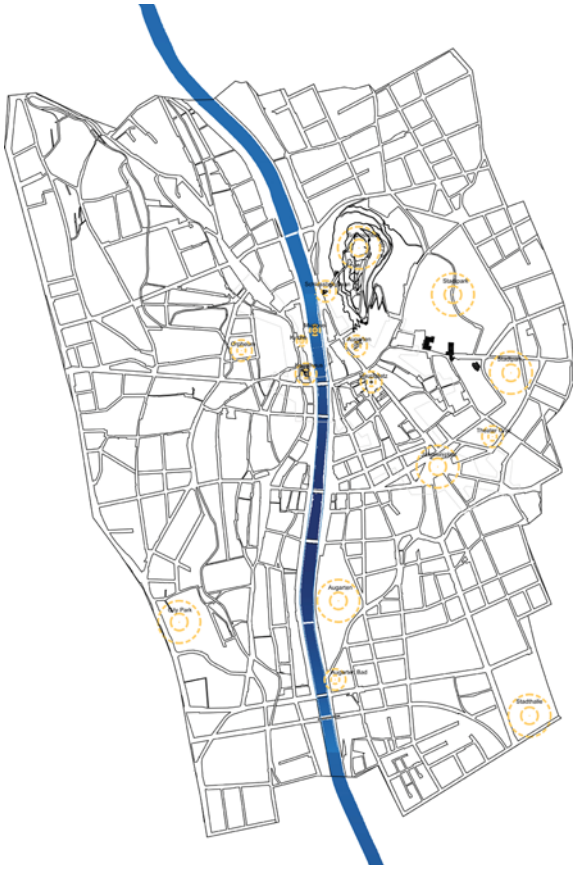


Fig.35
Attractive destinations inner city

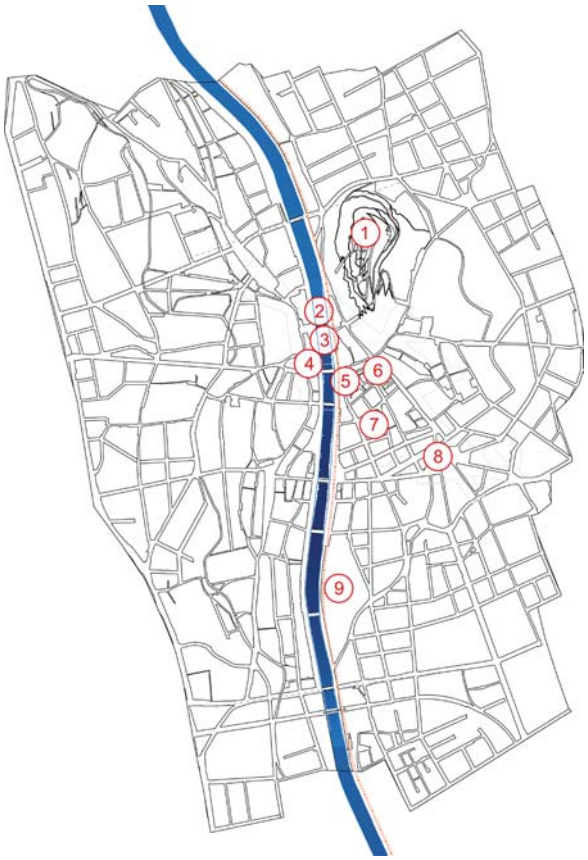


Fig.36
Attractive destinations along the river

Public places, recreation areas and cultural facilities

In Styria Graz is known as cultural centre.

Specific places in the city offer different kind of experiences. (fig. 35).

In the centre of Graz, the Schlossberg raises up (fig. 35| 1), the hill is located in the east side of river and can be reached across the river through the Edegger bridge (fig. 36 | 3).

On the top of the hill different facilities are located. The clock tower is the landmark of the city, next to the tower the rose garden is a popular attraction during summer. The casemates are also known as popular event location. A restaurant, quiet walkways and a spectacular view over the city complete the Schlossbergs appearance.

The plateau can be reached through different starting points around the hill, near the river there are three possible options, an elevator, a footpath and the Schlossbergbahn.

Fig.37
Mur Insel

Fig.38
Kunsthaus

Fig.39
Hauptplatz

Another special attention is the Mur-Insel (fig. 36 | 2), completed in 2002 it is considered more precisely a ship. Two entrance bridges offer access to a coffee-house, a promenade, a viewing platform and a children playground. The island presents itself as connection between the two river sides and as popular residence. It is also located north from the main bridge up the river (fig.37).

On the westside the most popular cultural institution is the Kunsthaus (fig. 36 | 4), built in 2003 it sustains a significant influence on the rivers shore zone.
The western frontage on the rivers side presents itself as media installation (fig. 38).

Along the river course there are a couple of important places as well.

The most frequented public place in the city centres structure is the Jakominiplatz, as mentioned the place is the transition point in the public transport system (fig. 36 | 8).
About 5 to 10 walking minutes away is the Hauptplatz (fig. 36 | 6).
The place is known for the various possibilities of restaurants, cafes and snack stands, it is a very lively square near the river (fig. 39).

Fig.40
Extension area Franzis-
kanerplatz

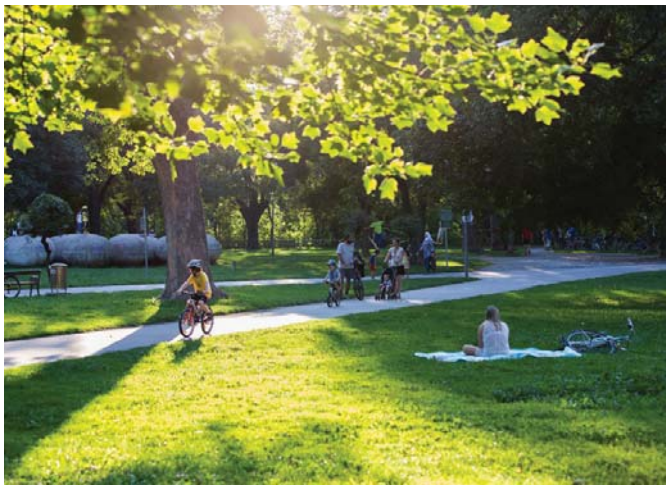


Fig.41
Augarten

Following the street toward the river the Franziskanerplatz (fig. 36 | 5) is a small but charming place, which as well offers culinary establishment (fig. 40).
Crossing the river to the west side the Südtirolerplatz with the Kunsthaus offers another possibility for resting, refreshing and consuming.

Another cultural facility near the river is the Universalmuseum Joanneum, in addition to the extensive exhibition the museum is also known for the contemporary architecture (fig. 36 | 7).
Slightly aside from the river in the south, the Grazer exhibition centre is located. It offers different kind of exhibitions and events all over the year.

In the south of the city centre the Augarten (fig. 41) represents the largest recreation area near the river (fig. 36 | 9).
The park offers different kind of facilities, such as playgrounds, green areas, well-groomed walkways and even a public swimming pool called Augartenbad.

The promenade

Graz is very proud of the green belt which represents the various plantings and the habitat of different kind of animals along the east and west river side of the Mur.

Already in 1990, an urban development concept was formulated to protect and maintain the rivers habitat.

- The whole natural landscape zone has to be preserved in all his elements. Living species and plants have to be preserved and protected to regenerat them, to protect their ecological inter action.

- The river course of the Mur including the shore zones should be regained as near natural urban living space.

- Recovery of near natural watercourse.

- Protection of bank vegetation through keeping clear from construction projects. [83]

83 Cf. Gepp, 2016. 43 ff.

Fig.42
Mur promenade 2002

Fig.43
Mur promenade 2017

Fig.44
Promenade access

In 2002, the east shore zone got redesign, today the waterside promenade appears as a linear guided walkway along the water. The consistent green link, which offers various water- related plants and animals, still exists.

Since then the rivers promenade is implemented and available for the public. The promenade near the city centre allows the public, through a linear walkway along the river, to experience the shore zone. However, in 2002 when the promenade was finalised (fig. 42) the vegetation was not as overgrown as today (fig.43), as a result of the vegetation visual connection from walkers to the water itself is hardly possible.

Further on the urban public space above the promenade is hardly connected with the promenade itself (fig.44).
Although there has been realised a staircase which allows fast access to the promenade, the visual and experienced water connection is still missing.
By that the promenade and the river, itself does not allow visual and noticeable connections between the urban city space and the Mur.

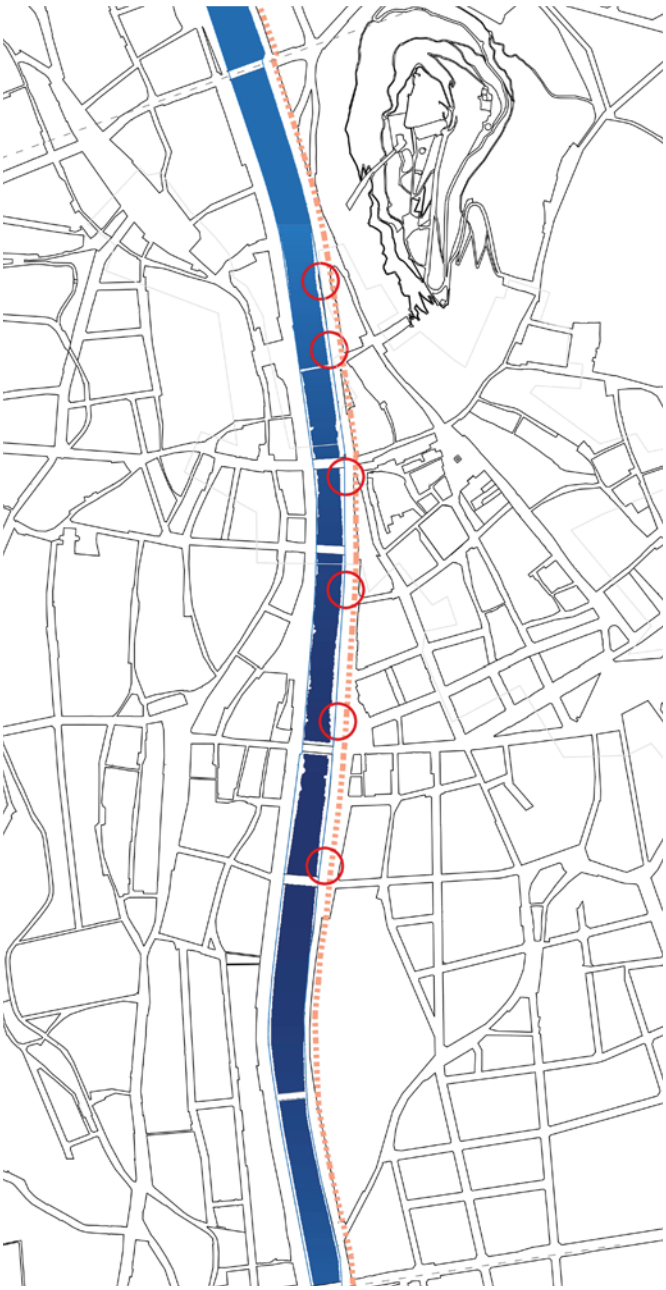


Fig.45
Promenade accesses | inner city

Fig.46
First access (from north to south)

Upper and lower connection

The upper city area offers various types of accesses to the promenade. In sum, there are six possibilities in the inner-city structure to reach the promenade (fig. 45).

Viewed from north to south the first access are two stone staircases (fig. 46).

The upper traffic route is called the Kaiser- Franz Josef Kai and is highly frequented by cars, pedestrians and cyclists.

The stairs connect an altitude difference from about 7 meters. Because of the stone material the staircases appear in a very massive way.
At the foot of the stairs the promenades walkway begins. A small place offers the possibility to stay.

Fig.47
Mur- Insel access | View to staircases and elevator

Fig.48
Promenade | elevator exit

Fig.49
Staircases | overhang

The second access offers the Mur- Insel. In the course of the islands construction an elevator and stairs have been built (fig. 47).

This access connects the “Mur-Insel” as well as the promenade with the upper street level.
The elevator offers barrier- free access to the promenade and the Mur- Insel (fig. 48).

The construction of the upper walkway forms an overhang above the promenade (fig. 49).

The predominant materials are steel, stone and concrete.

Fig.50
Main access | View from the main bridge

Fig.51
Main access to the promenade

Fig.52
Transition upper and lower level

The main access from the upper to lower level is next to the main bridge (fig. 50).
The staircase appears in a massive and heavy look.
At the foot of the stairs the promenade forms a place, which offers opportunities to stay.
In summer, the place is used as an urban city beach, which attracts a lot of people.
The predominant material is again concrete, the staircase appears in cyan.
The overhang of the upper walkway forms again a small roofing above the place, which can certainly be used as a quality characteristic (fig. 51).
The balustrade at the river side appears only in this specific area and functions as safety boundary to the river.

The next access is located near the Tegetthof bridge. It is a fluid transition from the upper to the lower level.
This situation also represents the transition from the urban promenade appearance to the more natural one.
The soil covering changes from concrete stone to simple and natural soil (fig. 52).

Fig.53
Transition upper and lower level

Fig.54
Shore Zone

A few meters bevor the Radetzky bridge there is the fifth access (fig. 53). It also connects upper and lower level in a very fluent way.
Following the walkway, the last access leads directly to the Augarten.
Below the official walkway there is a small zone at the shore, where people often sit by the water (fig. 54).
However, after completion of the power station the water will rise about two to three meters and will make it impossible to sit by the water anymore.

Fig.55
Ivy Mur promenade

Flora and fauna

Waterfront trees assume multifunctional tasks in a city structure. Due to the amount of accessible water, it is possible for trees to achieve a much higher evaporation performance.

Therefore, highly overgrown shore zones have a much higher cooling effect, which support the climate of an urban space in a positive way.

Another aspect of overgrown shore zones is the shadowing of footpaths. [84]

Beside the biodiversity of trees, bushes also form an essential element of the green belt.

Blooming plants offer nectar and pollen for various types of insects during the warm months of the year. The lightning system of the promenade aims to a gentle and careful lighting system, due to nocturnal insects and animals.[85]

Other well-established plants are climbing plants. A lot of them are ever green climbers, such as ivy (fig. 55) and virginia creeper. [86]

84 Cf. Gepp, 2016, 48.

85 Cf. Gepp, 2016, 52.

86 Cf. Gepp, 2016, 56.

The shore zone of the river offers habitat for various kinds of animals as well.
Among them, are a lot of different types of ducks. Running water and understorey vegetation serve them as living space.
Different kind of birds also colonise the rivers environment. Some of them only came during winter, from higher areas and spend the colder months at the Mur. [87]

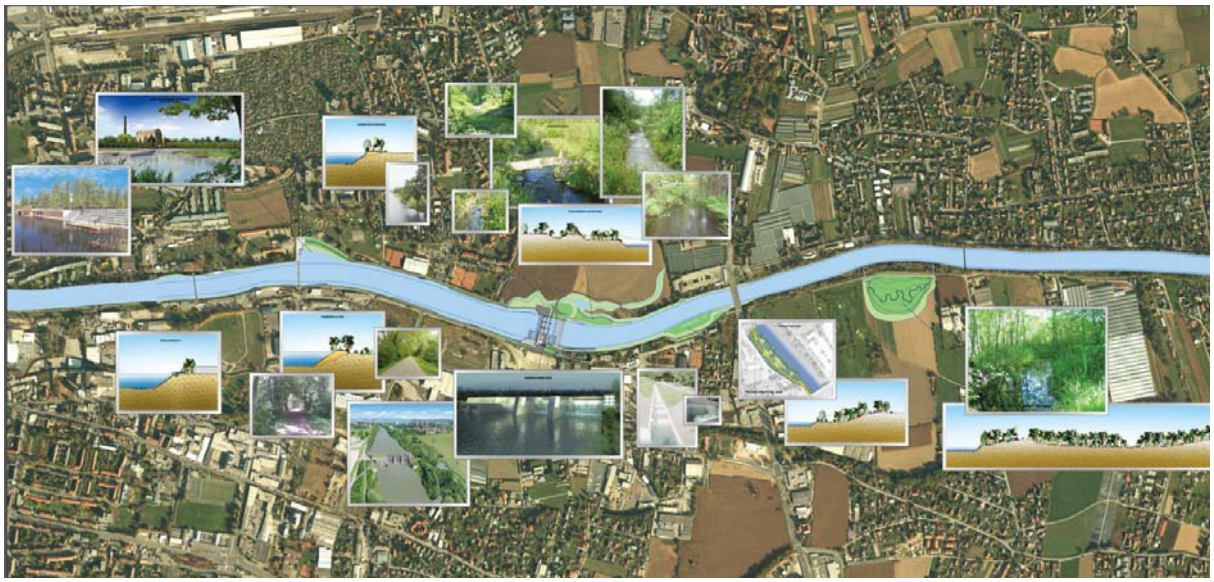
87 Cf. Gepp, 2016, 62 f.

In general, and in the Mur the fish fauna is largely unknown, therefore the habitat of water should much more be appreciated and seen as significant element of nature. [88]
In the Mur, common fish species are the nase, grayling and huchen, they need flowing, oxygen enriched water to survive.

88 Cf. Gepp, 2016, 64.

Power station Puntigam

Fig.56
Overview power station concept



Compared to other forms of power generations a water power station produces much more electricity, in relation to construction and activity. By that water based power generation shows the highest amount of payback including renewable energies. [89]

In Styria, the Mur´s river course contains 30 weirs. [90] The position of the power station in Graz is approximately 600 meters in the north of the Puntigamer bridge, nearby the Olympia Wiese.
The effects of the power station are going to spread out about 6 km along the river. The reservoir starts at the height of the Mur- Insel and will extend to the south edge of Graz (fig. 56).

89 Cf. www.e-steiermark.com/erzeugung/Wasserkraft/Murkraftwerk.Graz, 6.07.2017.

90 Cf. Düsing, 2010, 9.

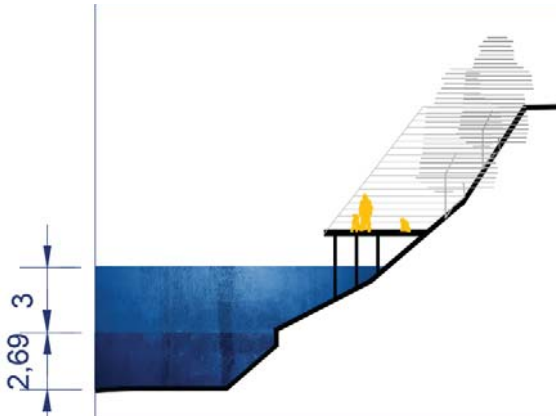


Fig.57
Augarten
Water difference

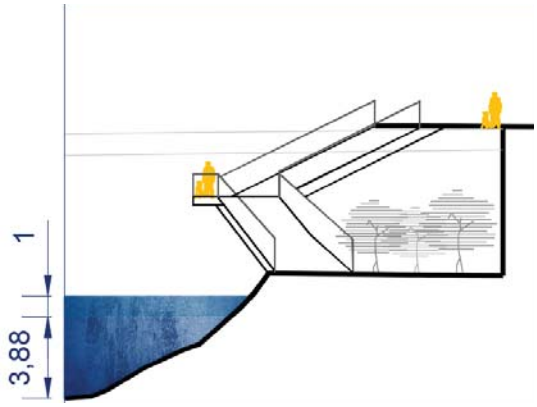


Fig.58
Main bridge
Water difference

Fig.59
Shallow water zone /
recreation area

Fig.60
Design power station

Due to the water retention, the water level is going to raise about 5 meters (fig. 57). In the area auf the Augarten the water level is going to change about 2 to 3 meters. At the height of the main bridge there won´t be any visible differences (fig.58).

Those changes in the rivers water level require dam walls up to the Seifenfabrik area.

In dependence of the new developed dam walls the design of the power station includes additional foot- and cycle paths.

The power stations concept also includes the new construction of a bridge at the height of the Seifenfarbik.

It this area a new recreation zone is planned as well. The recreational area will be along the shallow water zone and offers different kind of recreational areas (fig 59).

Currently the Mur´s flow rate is about 1-2 m/s, after finalisation of the power station the flow rate will reduce to 0,2 m/s (fig. 60). [91]

91 Cf. Binder, Klappacher, 2014, 22 ff.

Strategy and interventions

The Mur as habitat and living space is an integral element in the city structure of Graz and the cityscape.
The flood protection of the Mur is already very good developed.
Figure 62 shows the cities promenade, with the shore zone and the upper city level.
In this case the dikes and floodwalls limits are in a specific distance from the shore zone. Which means that this area can be flooded, without affecting the upper city level.
Because of the intensively build- up city structure nearby the urban river zone there is not much space for large area changes.
But nevertheless, gentle and cautious interventions are still possible.
The maintenance of the rivers qualities, like the green belt, have to be preserved and protected. Still the river is origin of the cities location and offers living space for many animals it is possible to attribute even more qualities to the river and the city itself.
Due to the current development of the river promenade the Mur is hardly connected with the upper city structure.

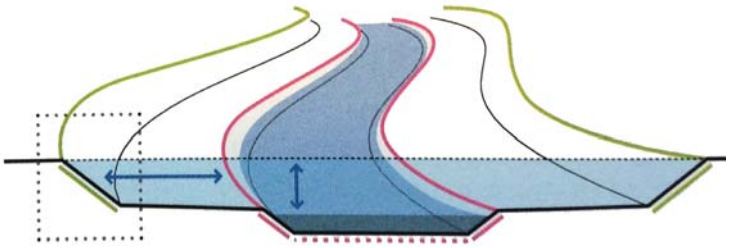


Fig.61
Process area B

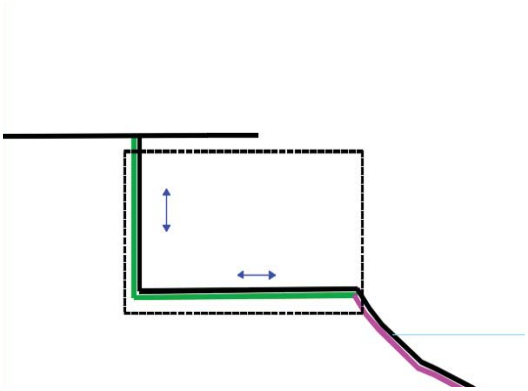


Fig.62
Flood protection
Urban river zone

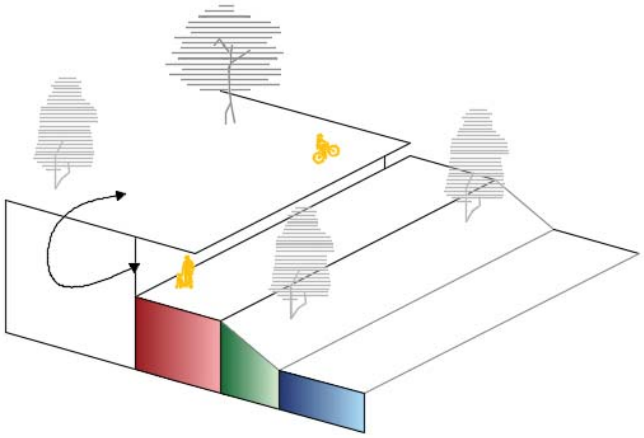


Fig.63
Upper and lower
connection illustration

Trough expanding and increasing the accesses to the water, by offering fluent transitions from upper to lower levels, the river can assume educational and informative qualities as well. By that the design of the rivers environment can raise the awareness and knowledge of the citizens of Graz, visitors and tourists.

To develop the Mur as integrative element of the city, the promenade has to offer qualities to stay, rest and enjoy the environment of the river. Primary aim of the redesign of the cities promenade is to link the qualities of the city with the qualities of the river.

By that specific places of the city, nearby the river get restructured and connected witch the promenade itself. The vegetation, therefore the plants and the water are going to be integrative part of the design and perceptible element of the promenade. Further on the connection between upper and lower level are going to be main focus of the design concept (fig. 63).

The chosen materials should be characteristic for the central city location and are going to be part of the conceptional connection between upper city and lower promenade structure.

Another priority is to increase the public awareness, to appreciate the value of the river and relating thereto advantages in the city. Regarding to increasing the public awareness, the new power station Puntigam is aiming to integrate new created areas in the city structure in the south side of the city centre.

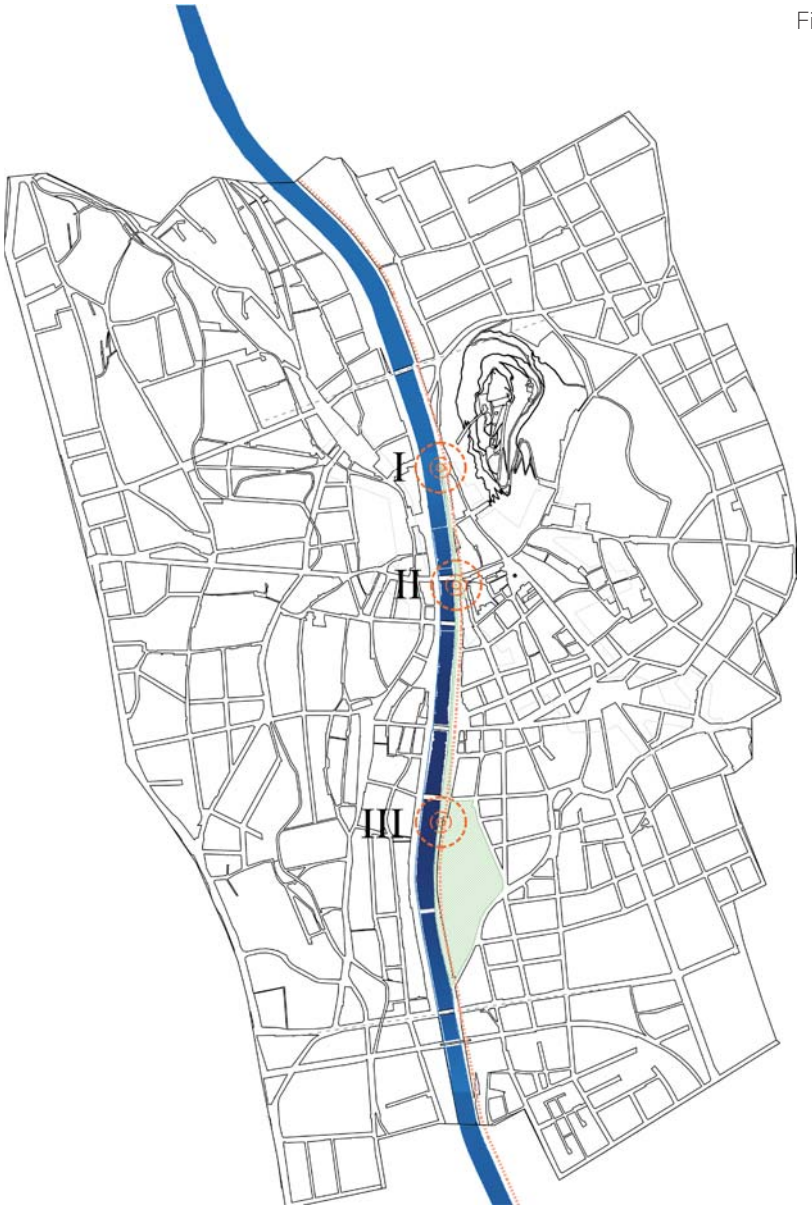


Fig.64
Redesign areas

The design concept focus on three specific areas along the promenade (fig. 64).

The first one is located at the staircases at the beginning of the promenade. Which is designated in figure 64 as **I**.

The second area is next to the main bridge, nearby the Franziskanerplatz. Currently it represents the main access to the promenade from the city itself and is designated in the figure as **II** .

The third area is located at the Augarten designated as **III**. It technically is not part of the promenade itself anymore but it should constitute a new extension zone from the promenades walkway.

Fig.65
Section 01
1:2000

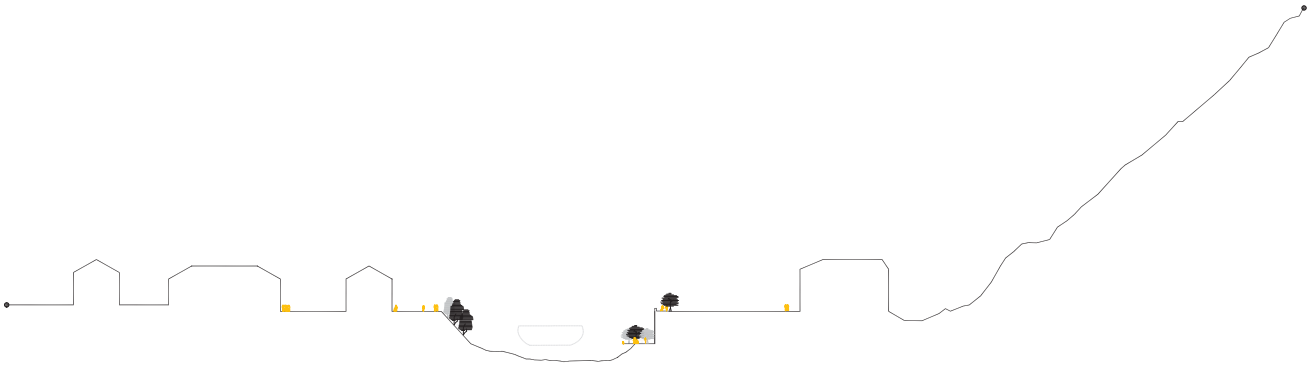


Fig. 66
Section 02
1:2000

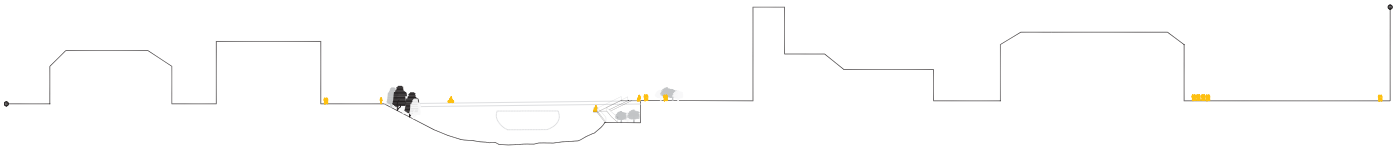
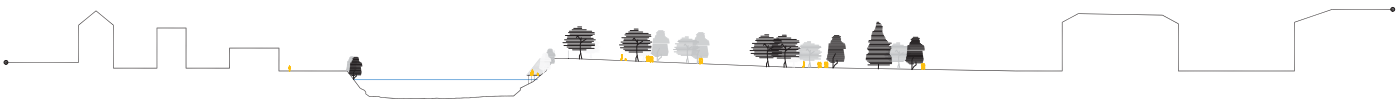


Fig.67
Section 03
1:2000



Section 01 - 03 show the rivers position in the city structure.
Figure 65 illustrates the Mur near the Schlossberg, which is defined as area I in the design concept.

Figure 66 shows the relation of the river in the urban structure near the Kunsthaus.
In the design concept, this area is called urban promenade zone and focuses on the connection of upper and lower level.

Figure 67 illustrates the section of the Augarten.
It shows the relation of the river, the sharp riverbank and the spread of the park area.

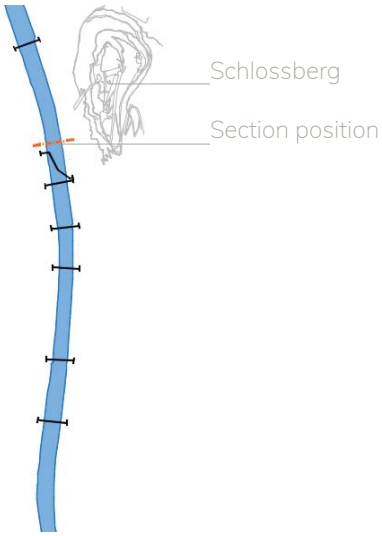
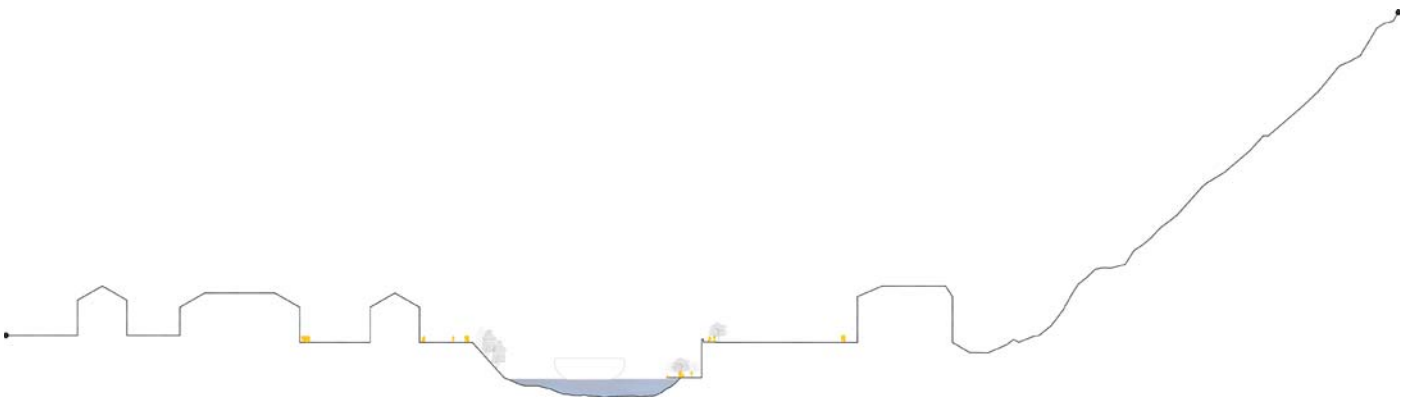


Fig.68
Section 01
Redesign area 01
1:2000



Riverside

The first area concentrates on the promenade- water connection.
Figure 68 shows the section through the river and the city, as well as the west Schlossberg side.
The section illustrates the height differences in the area.
The promenade is located approximately 7 meters under the street level.
The redesigned area can be reached through, already existing staircases.
There has already been designed a small space with benches to stay, but there is no such thing as a connection to the river itself.
The staircases are two opposite facing massive staircases. They connect the Kaiser- Franz- Josef Kai with the promenade.
The supporting wall along the left promenade side is in parts heavily overgrown or bare.
The new design aims to develop qualities to stay, to experience the water from the promenades side and to connect walkway and river itself.
Further on, the element of two levels, concerning upper and lower walkway, should be more perceptible.
Both levels should be integrative part of the urban structure.

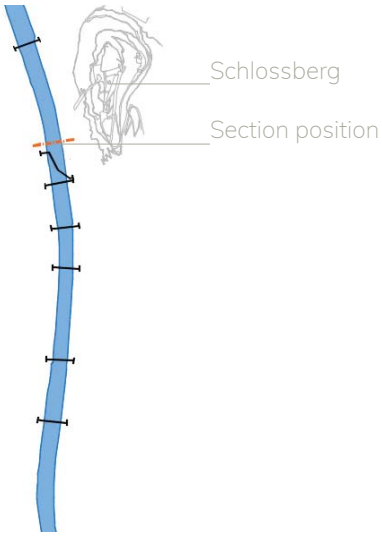
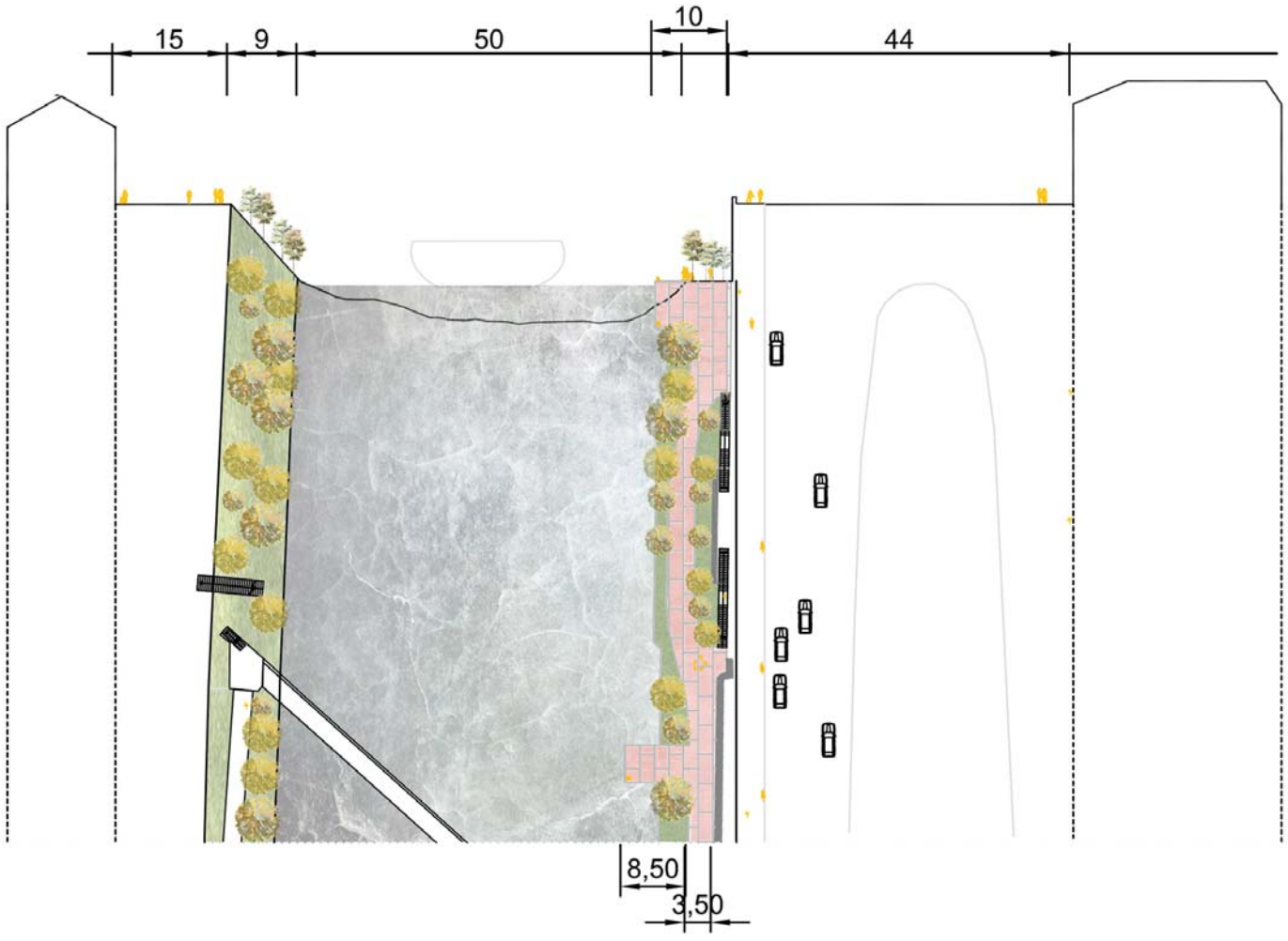


Fig.69

Section 01 and overview
1:100



Therefore, the already existing place will be enlarged.
The walkway will be extended in the direction of the water, that means that selective small areas along the promenade, will be created which should offer places to stay.
Those small extensions are going to constitute new qualities on the riverside. Pedestrians get the possibility to sit and interact with their environment under trees facing the river.
The walkway is going to invite pedestrians to stay near the river, to relax, to listen to the water and experience the environment.
It should be a place to escape the stressful urban life and a location which constitutes a recreation area in between the urban structure and the river side.
The walkway itself is going to be enlarged to offer more space for pedestrians and bicycles. Concerning to the usable space the walkway will be about 2 to 3 meters wide.
The material of the walkway will be changed in light terracotta shaded concrete stones.
The red colour should be a contrast to the green vegetation of the promenade.

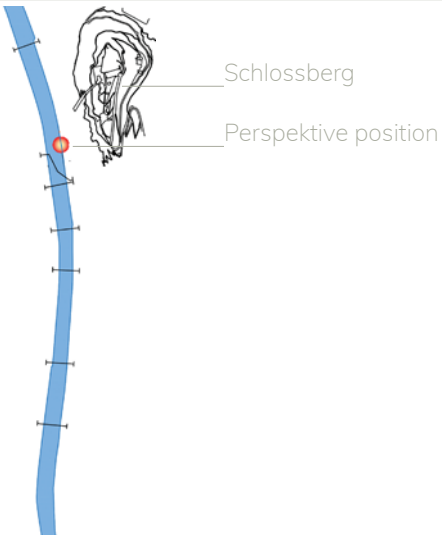


Fig.70
Perspective
Promenade access and extension zone

Till the urban promenade zone, the walkway is about 360 meters long. Pedestrians are able to leave the walkway at the high of the Mur island, and switch to the right bankside.

Figure 70 shows the new designed place, facing the already existing staircases and the promenade in southern direction. The extension zone in direction to the water offers place to experience the water while sitting, pick nicking or just listening to the environment itself.
The flora consisting of trees and low growing plants cool down the climate in summer and provide shade.

Due to the intermediate zone situation between an urban structure and nature the promenade needs care and maintenance.
Overgrowing and neglected places should be avoided. Those measurements should be prompted by the city itself to offer the population, tourists and visitors the best possible stay in Graz.

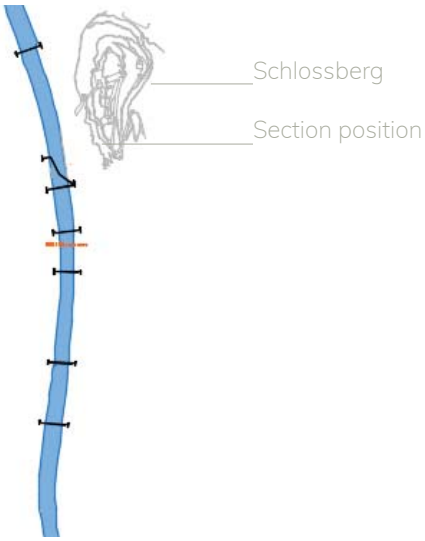


Fig.71
Section 02
1:1000
Along the river

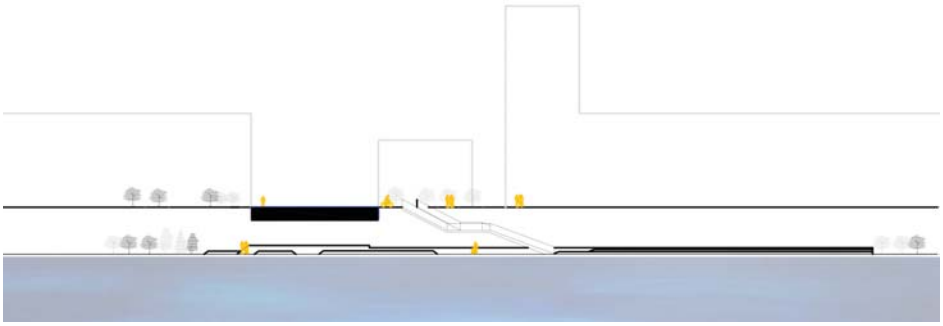
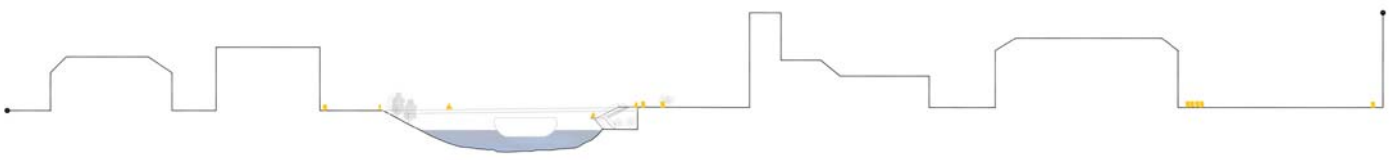


Fig.72
Section 02
1: 2000
Urban promenade zone



Urban Promenade

The next connection with the upper city structure is near the main bridge.
Figure 71 shows the promenade and the surrounding area. The section shows the right side of the river with the Lendkai and the left side with the city centre.
The Franziskanerkloster is nearby the promenade and next to the Franziskanerplatz.

Figure 72 shows the new situation along the river. The upper and lower level are going to be connected with a new ramp including a viewing platform, which allows a fluent transition between both levels.
The Franziskanerplatz is going to be enlarged to secure the integration of the upper structure with the new connection and the lower river level.

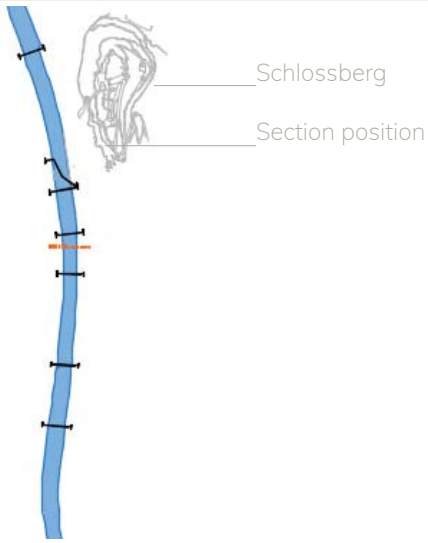


Fig.73
Section and overview urban promenade zone 1:100

The upper structure, in specific the small space near the Franziskanerplatz is currently used as playground and offers a couple of seating options.
The new design aims to enlarge the recreation area and offer a better usable connection to the promenade.
The playground is going to stay the same, while the green and recreation area is going to be extended in direction to the main bridge. The bike and walkway maintain their linear structure along the railings side.
The already existing staircase gets replaced with a curved ramp, including a viewing platform.

The new ramp starts nearby the new green zone and leads pedestrians downstream to the promenade. The curved ramp should offer a first impression of the rivers environment and further offer an overall experience.
The ramp offers a fluent connection from the upper city structure to the lower promenade.
Aim of the new ramp is firstly the visibility of the new connection from the main bridge and the upper walkway and secondly a more pedestrian friendly usability.
People are able to experience the new connection, to stop and stay at the viewing platform and look across the river and the water.

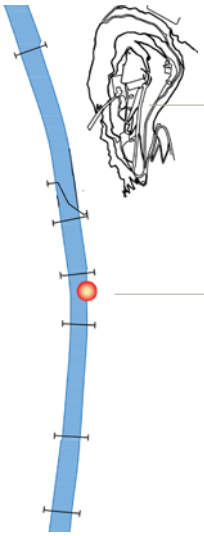


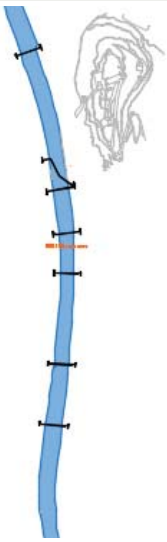
Fig.74
Perspective
Promenade access and extension zone

Figure 74 shows the new extension place from the Franziskanerplatz.

The perspective presents the new ramp access on the right side with the new beige concrete stone ground material which leads visually to the promenades lower level.

The new green area on the left side tunes in the expectant promenades feeling on the lower level.

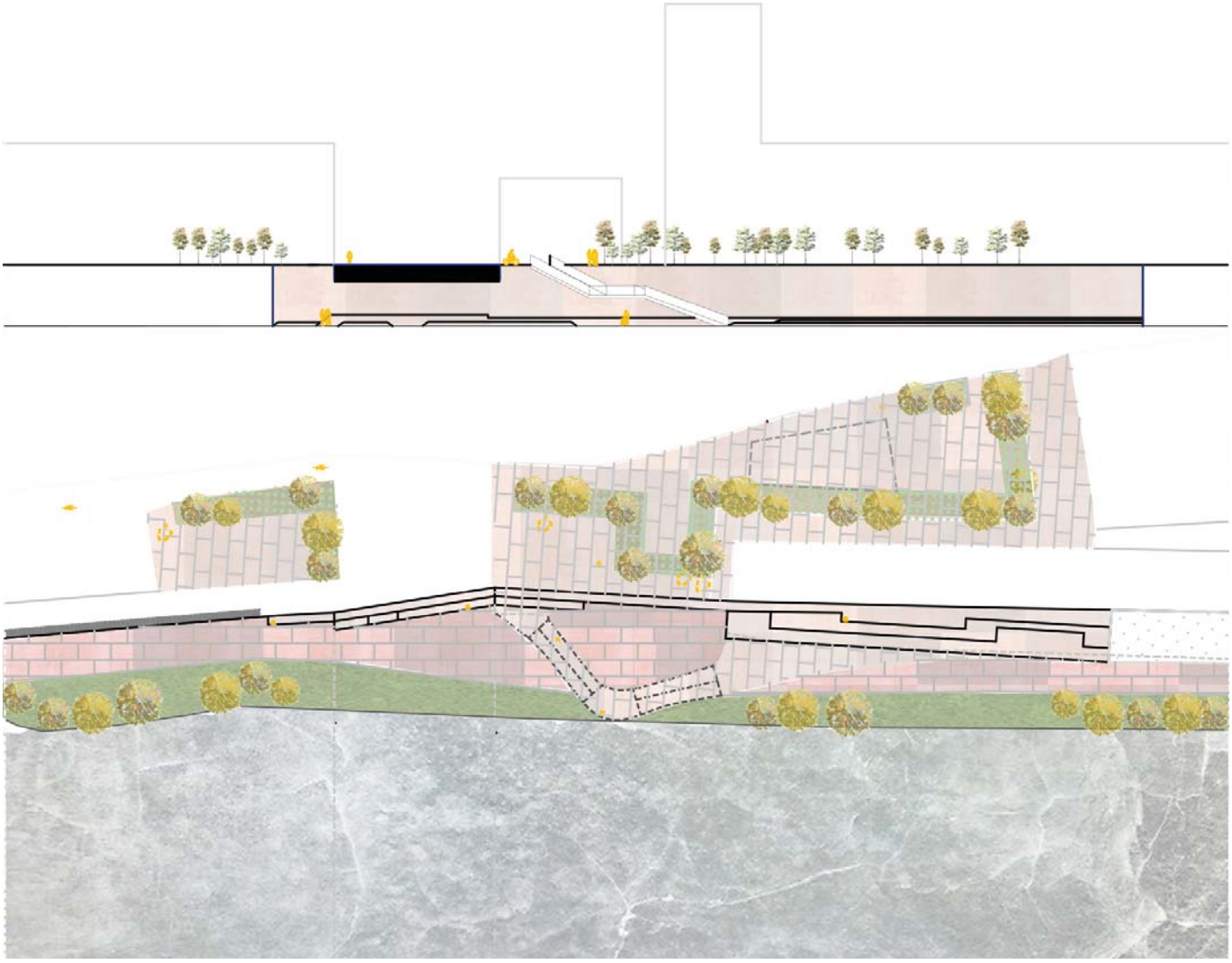
The place constitutes the connection between upper and lower structure and should lead pedestrians to experience the promenade as part of the cities structure.



__Schlossberg

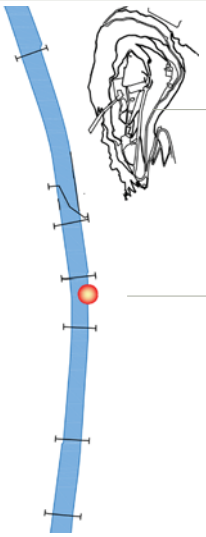
__Section position

Fig.75
Section and top view
Urban promenade zone
1:1000



Reaching the lower level of the structure the promenade offers a new extended recreation area.
The walkway, till reaching this urban area is predominantly characterized through the green vegetation. In the urban area, the vegetation plays less attention.
The main focus of the design concentrates on the connection of upper and lower level and integrate the river and the urban landscape in the situation.
That means that the new design aims to a fluent connection of both levels. The urban promenade area should be included in the urban structure and otherwise the water should be included in the urban area.

Reaching the lower promenade level, the new space constitutes an urban landscape design. The furniture material is chosen to be long living and weather- resistant.
Concrete stone in different colour variations dominate the design. The ground material colour is, like in the first areas walkway, a light terracotta shade.
The furniture colour changes through the different shades of beige and green.



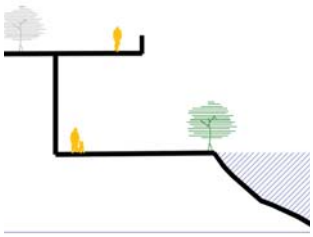


Fig.76
Illustration urban room

Fig.77
Perspective
Urban promenade zone
in southern direction

The material further on covers the vertical wall and continues to cover the ceiling above the walkway, which actually is the overhang from the walkway above.
Through this material application the lower promenade should be constitute as an urban room which opens up to the waterside of the river. Figure 76 illustrates the principle and the connection between urban room, greening and water.
The new urban space aims to invite pedestrian, to experience their environment and helping to realise the importance of the water urban- structure connection.

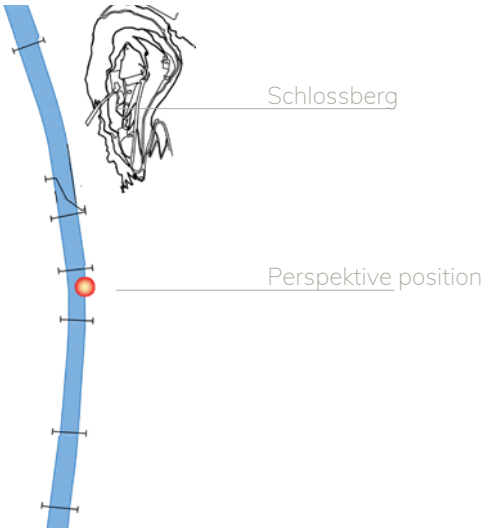


Fig.78
Urban promenade zone
in northern direction

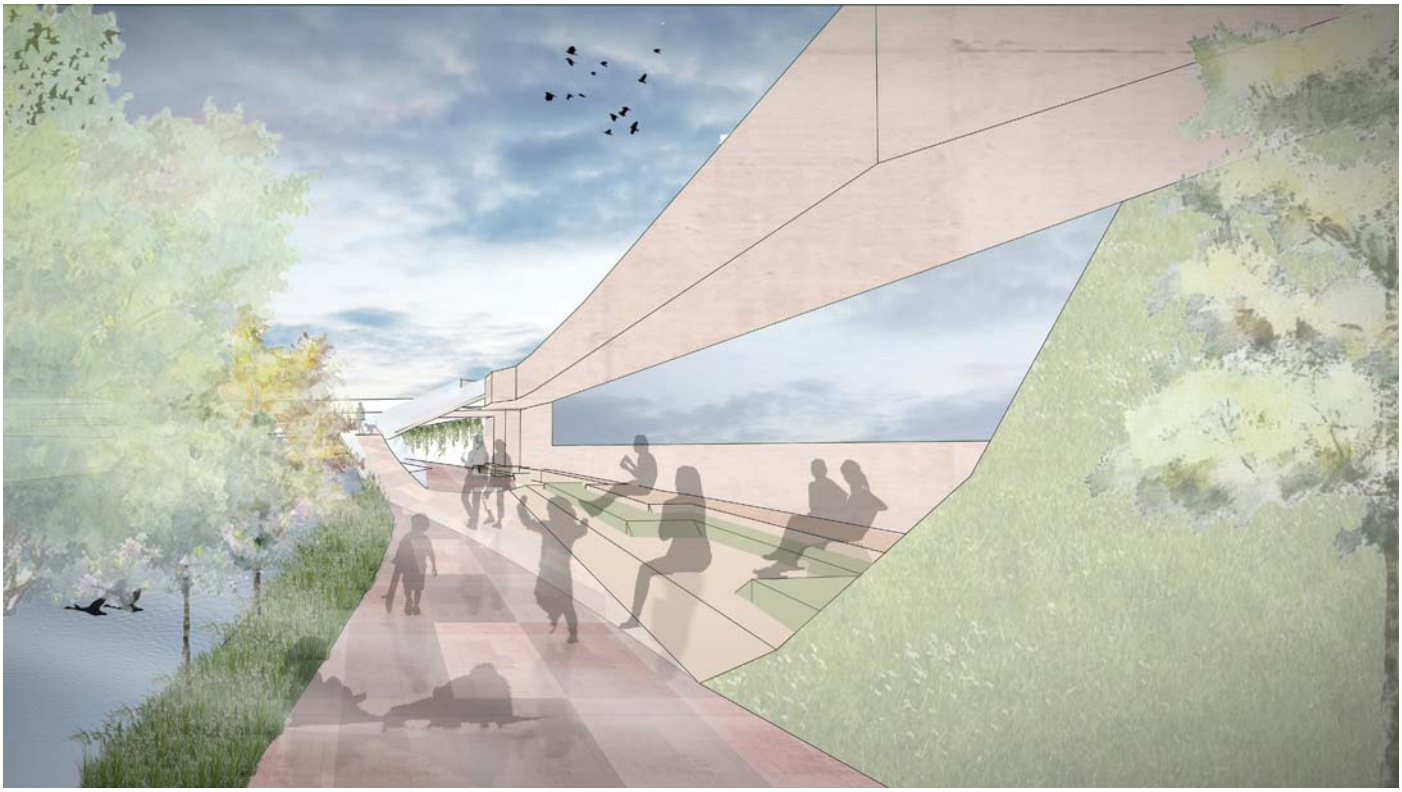


Figure 77 and 78 are showing the new urban promenade zone.

Figure 77 presents the view under the main bridge in southern direction. It shows the new material like the light terracotta shaded concrete stones on the walkway and the beige ones on the supporting wall and the overhang.

Due to the changing water movement, induced by the new power station, the old railing has been removed to open the view to the water and offer a new promenade-water connection.

Figure 78 presents the view in northern direction. The new seating possibilities are created in small height differences. Therefore pedestrians are able to acquire the available space and offers as they need and wish. The material appears in different kind of beige and green shaded concrete.

The upper space and ramp have the same ground material like the wall and overhang.

The ramps ground material expands to the seating possibilities and visualize, with the wall, the overhang and the upper place, a closed material circle. This type of material selection should strengthen the connection between upper and lower level.

Fig.79
Preservation walkway

Close to nature

The following walkway along the river requires not as much changes as the urban part (fig. 79).
The ground material of the way changes from concrete stone to a solid soiled one. The walking experience changes from the urban part of the promenade to a more natural one. The vegetation gets stronger and the plantings provide pleasant shade.
The design concept declares this area of the promenade as preservation zone. The concept intends to preserve the natural form of the walkway till the promenade ends at the height of the Augarten.
Nevertheless, the lush vegetation and the diversity of the walkway is going to be occasion to inform and teach pedestrians about their environment.
Installations of information panels are going to help, those who want to know more about the nature, learn more about their environment.
The design concept declares that the boards contains information about the plantings, the various types of animals which live in this area and even about interesting historical facts.

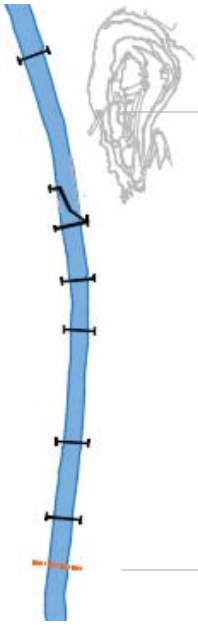


Fig.80
Preservation walkway

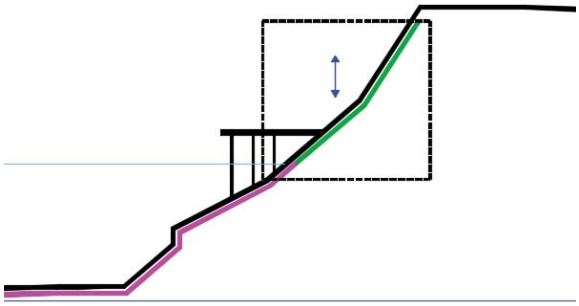


Fig.81
Section 03 Augarten
1:1500

Fig.82
Front view walkway
Augarten
1: 1500

Along the river

The promenade ends at the height of the Augarten, there the walkways connects with the upper levels way and passes to the Augarten.
In this area, the flood protection type changes from the artificial promenade zone to a more natural one.
The shore zone is very sharp, and therefore the water fluctuation happens vertical (fig. 80).
Currently the walkway along the park and the river is separated through a stone fence and a sharp shore area.
Figure 84 shows the section of the river and the dimension of the Augarten. The park is a well attendant place in Graz and offers a large recreation area.
Despite the very good position of the park near the river the park itself is hardly connected to the water.
River and park are separated through a sharp shore zone, which will be intensified due to the future power station.
Because of the increasing water level, a lot of plants are going to be removed, therefore the shore zone cannot be entered anymore.

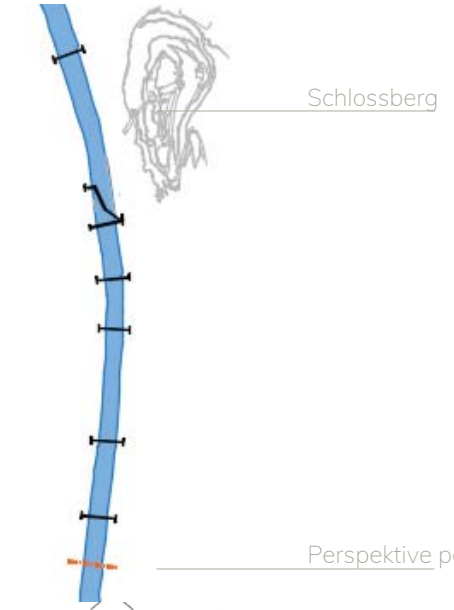


Fig.83
Section and top view walkway
1:1500

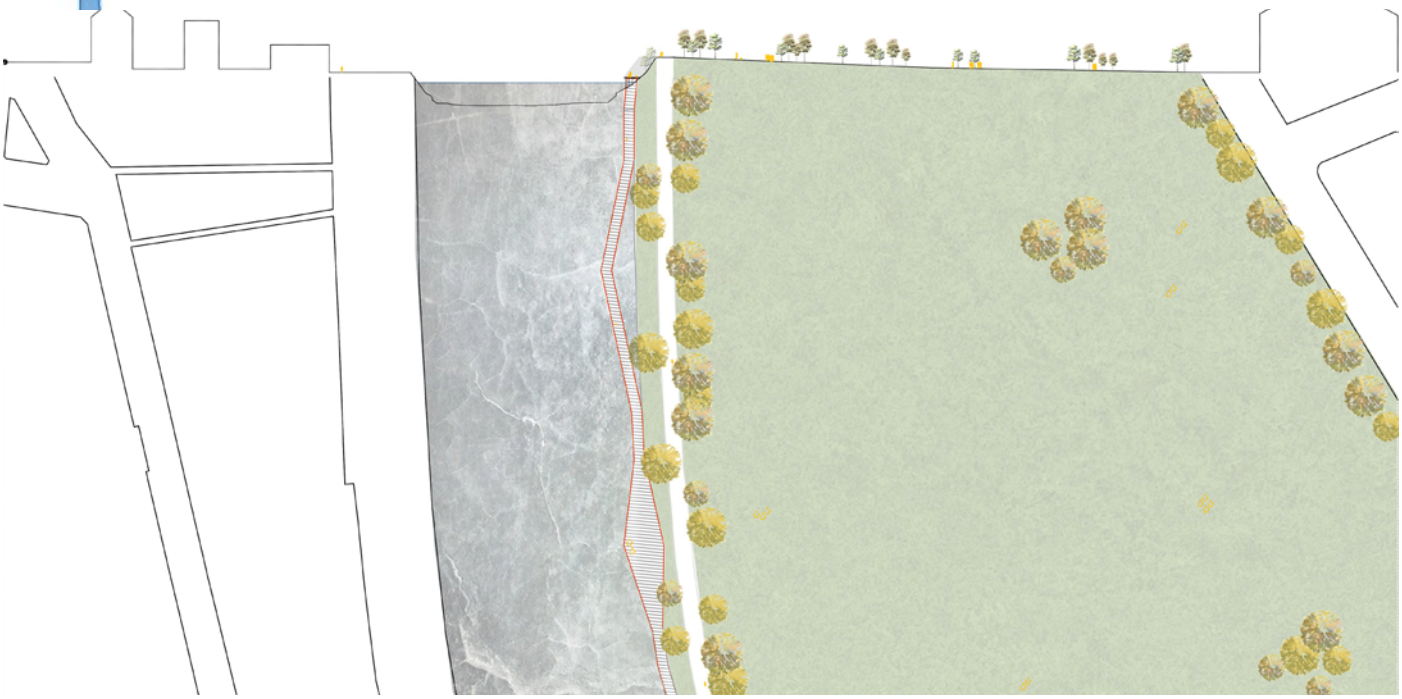
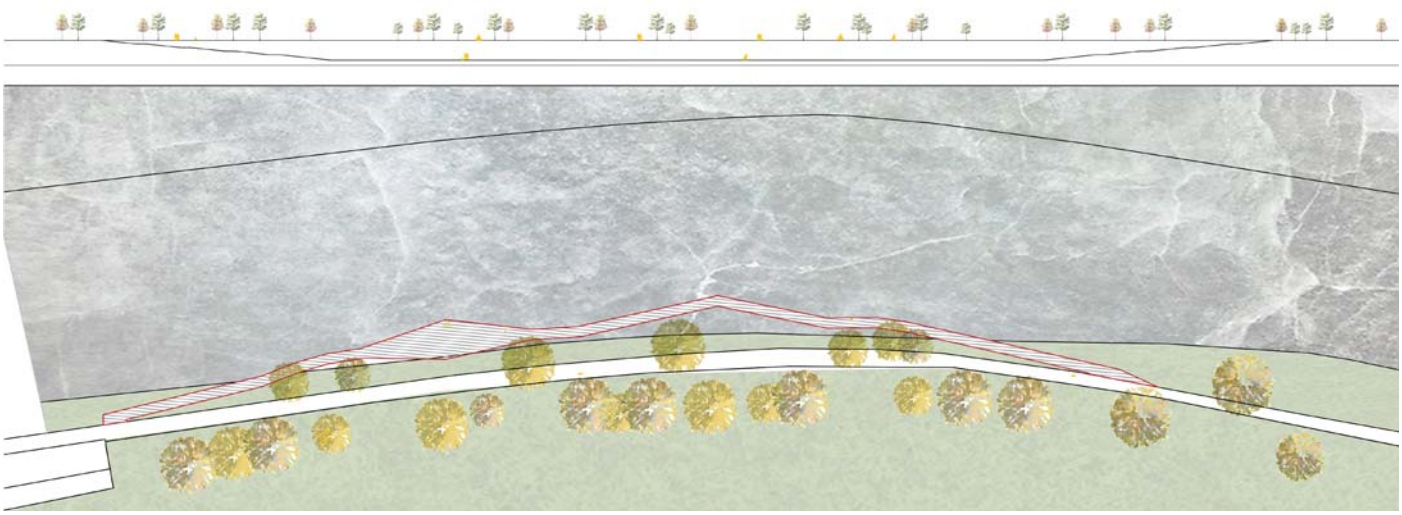


Fig.84
Front and top view walkway
1:1500



The design concept reacts to the changes of the power station in the way of creating a linear walking platform (fig.83 and 84) along the river.

The wooden walkway starts shortly after the northern border of the park. It passes the park parallel about 300 meters long and the walkway is 3 meters wide.

The walkway lies about 6 meters under the upper level. The design refers the two-level structure of the urban river and the promenade zone.

The lower walkway is going to maintain the water connection for pedestrians and preserve the interaction with the park zone and the river.

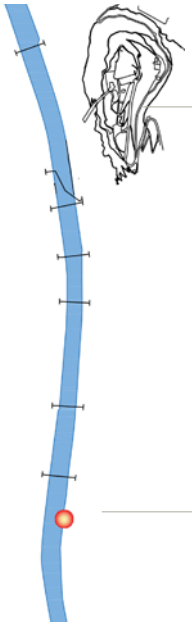


Fig.85
Walkway along the Augarten
Southern direction

The walkway aims to lead pedestrians along the water and functions as an extended path structure. At several places, the linear walkway changes the parallel shape and leads a little bit on the water.

At the lower end, the path forms a small platform in direction to the water and the opposite side to the Augarten. There pedestrians are invited to enjoy the view and the environment, by getting leaded along the river.
The material of the walkway is going to be red wood, which picks up the appearance of the promenades path and should strengthen the natural appearance of the park and the appearance of the walkway itself.

Fig.86
Red concrete stone

Fig.87
Climbing plants

Fig.88
Climbing facilities

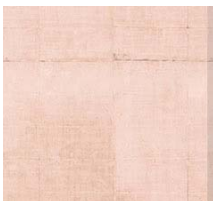


Fig.89
Beige concrete stone

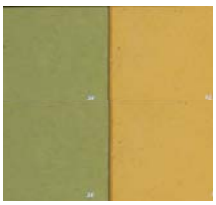


Fig.90
Green and beige stone

Fig.91
Red wood

Material selection

The promenade is dominated by weather- resistant stone. The walkway is going to be covered in terracotta shaded stone slabs (fig.86), which should be a contrasting design to the green belt. The platforms along the river in the first section of the concept are going to be stone slabs as well. This material continues to the end of the urban promenade zone. There the ground changes to a soiled based one.

The wall on the left side of the walkway along the promenade is about 7 meters high and in parts strongly overgrown by climbing plants (fig. 87).

The wall also offers climbing possibilities (fig. 88) for children. The climbing wall is often used by pedestrians mostly children to stay and play for a little while.

Therefore, the plants and the already existing offers along the walkway are preserved.

The urban promenade zone and the linked furniture are also kept in weather- resistant stony surfaces. The wall, the ramp, the overhang and the upper place are covered in beige shaded concrete stones (fig. 89).

The furniture and the different levels of them show a light to dark changing beige and green (fig. 90). The urban room which results from the overhang continues the material of the ramp and the upper place.

Fig.92
Moodboard












Fig.93
Walkway along the Augarten / night

Lighting concept

The rivers shore zone is living space of thousands of different kinds of insects.
The design concept from 2002 provided that the lightning near the river is very gentle and mild, due to preserve the natural habitat of all animals.

The new design concept includes a new lighting system in the urban promenade zone and the new Augarten area for a better visual orientation in the night and for safety reasons as well.
The preservation area lightning is going to be preserved to protect the natural appearance and the thereto relating natural circumstances.

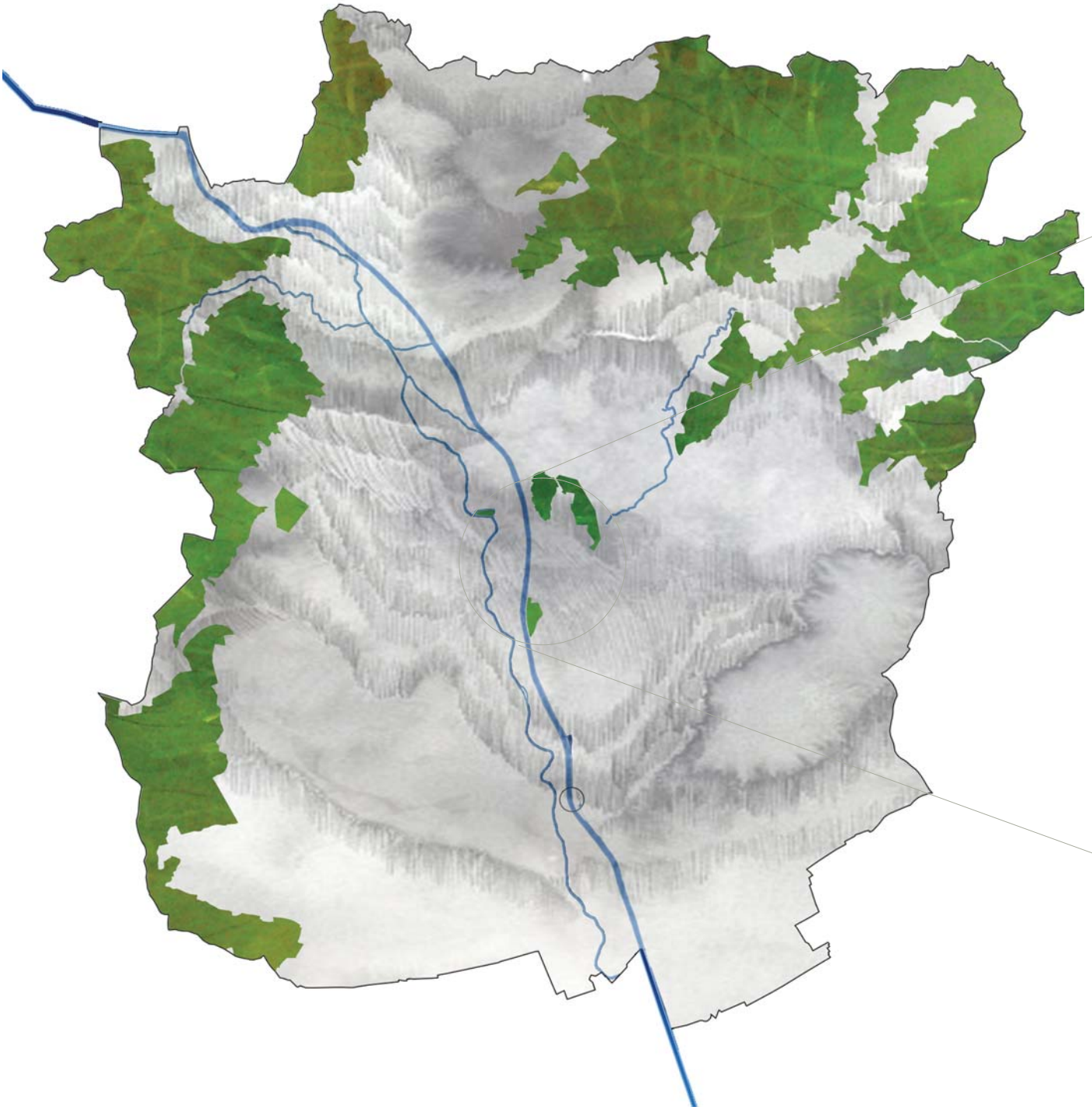
Fig. 94
Night situation
Urban promenade

Fig. 95
Night situation
Urban promenade

The urban promenade zone should offer qualities to stay during the day and in the evening as well.
The urban space should be lightened to create an atmospheric mood in the evening, to guarantee the best orientation and to ensure safety during the night.

Fig 94 and 95 show the lighting system in the urban promenade area. The design concept includes spot lights in the ground. Especially on the walkway border in direction to the water to strengthen a good visibility of the edge. The spot lights are also highlighting the ramp connection.
The overhang border is going to be lightened as well to highlight the outer edge and to visualize the level differentiations of the sitting possibilities.

The light conditions should create a pleasant atmosphere in the evening, to enjoy and appreciate the promenade by the water.
Further on the spot lights should highlight the walkway edge to guarantee good orientation and to keep pedestrians safe.
The Augarten extension area (fig. 93) is going to be equipped with spot lights as well.
The wooden walkway, leading on to the water, should offer an atmospheric walking possibility in the evening.

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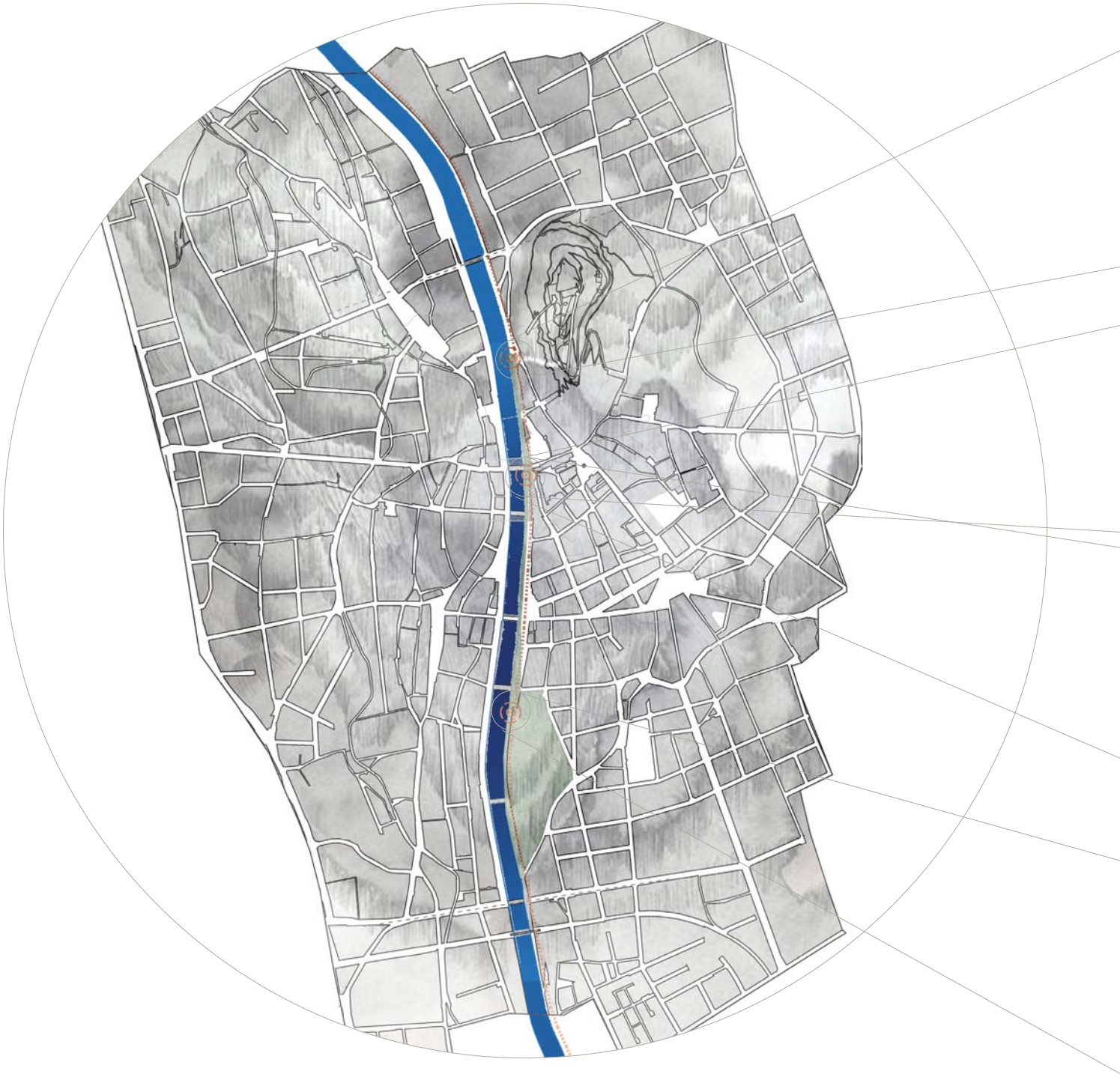


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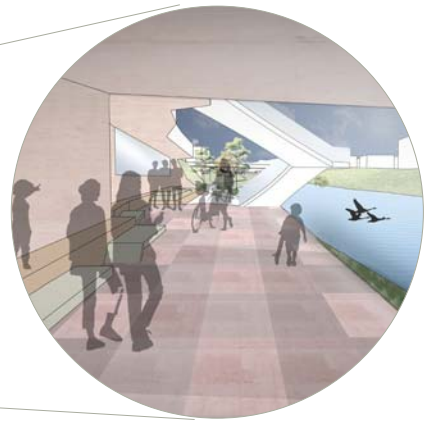

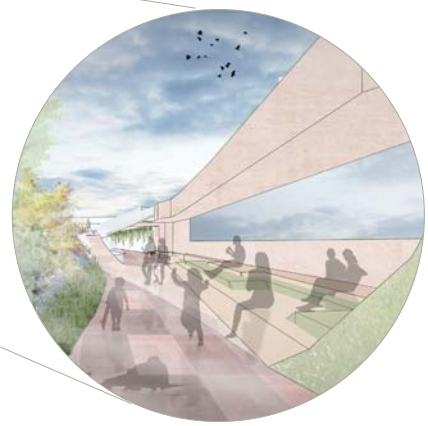

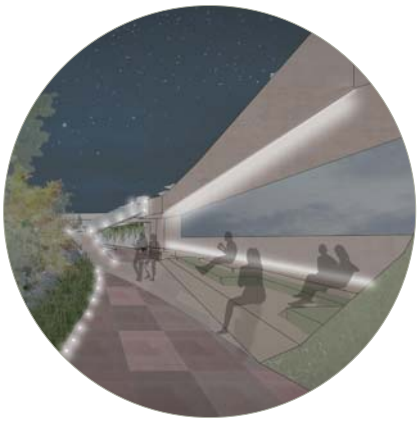

Conclusion

The form and function of running waters in cities is a valuable and a preserve able element in an urban structure.

The developed design of the rivers environment of Graz concentrates on a two-level structure including both, upper and lower level. By that pedestrians are going to understand and experience the structure of the promenade and the upper level.

The left-over space near the river bank, which was not part of the infrastructure, should be integrated in the cities network.

The new design includes small selective areas near the river, which leads onto the water and offer space for pedestrians to enjoy the waters in direct connection to the river and the greenery.

The enlarged walkway along the river should invite pedestrians and cyclists who want to enjoy the quiet and nature near the river.

The urban promenade zone constitutes the link between the dense urban structure and the quiet river area. A new designed ramp offers a fluent transition between both levels. The upper level also contains a redesigned urban recreation area. The existing place gets enlarged to implement the promenades transition into the urban space above.

The inner-city structure can benefit from the rivers positive characteristics, by connecting the urban structure with the river itself and integrate both system in one infrastructure.

Therefore, the promenade should function as linking element between river and urban space. Further on, the promenade presents the urban space which kind of results from the encounter of urbanism and river course.
This room constitutes the interspaces which offer so much qualities and even offer new areas for recreation in a high density urban structure.
The furniture of the promenade is defined as a multifunctional urban landscape, which offers elements each pedestrian can acquire.
The extended Augarten walkway continues the two-level system by reviving the promenades structure principle.
The walkway leads onto the water and pedestrians can enjoy and experience the rivers environment.
The design concept offers more space and greenery and emphasizes the importance of recreation areas in a dense urban structure.
Strengthen the positive aspects of a city and integrate them in the daily life of each person is an essential task to make a city more attractive. By designing these fluent transitions from upper to lower structure, the potential of the urban structure should be strengthened.

The inhabitants of Graz should have the opportunity to experience the infrastructure of the city in their daily life. Both levels, upper and lower, are connected to one structure which shows the qualities of the local circumstances. This merging system combines each quality of every specific element.

The two-layer structure in the city centre has already been defined in the year 2002, by building the promenade walkway along the river.
At that time both levels were not as good connected as they should have been.
In the further process of analysing the infrastructure of Graz and link the results of the analysis with the specific structure of Graz this designing conclusion has been developed.

Because each river and each city has different circumstances and different requirements. The theoretical part of this thesis offers fundamental designing recommendations, concerning different river situations in an urban context.
In the further process, the situation of Graz can be classified in a specific type of a process area.
Which means, that the formation of the near river environment can be divined in structural qualities. Each of those qualities requires different design methodologies and can finally be transformed to a design concept.

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List of figures