



# RESIN

SUPPORTING DECISION –  
MAKING FOR RESILIENT CITIES

## RESIN

# City Assessment Report Bratislava

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## Executive Summary

RESIN is a 3.5-year EU-funded interdisciplinary research project investigating climate resilience in European cities that launched on 6 May 2015. The project combines existing approaches to climate change adaptation and disaster risk assessment to develop guidelines and tools to support cities in adapting to a changing climate.

Four city assessment reports written on the RESIN cities Bratislava, Bilbao, Greater Manchester and Paris will allow the cities as well as RESIN project partners to assess, which adaptation and critical infrastructure protection strategies, plans and measures are already in place or planned. It will also enable a better understanding of the options and decision-support tools and products that may best be suited to the specific local context of each of these four European cities and which of them might best be tested within the course of the project. It will also enable the local government, the stakeholders in the cities as well as the RESIN partners to better understand each city's needs in the adaptation and critical infrastructure protection process.

This report presents the City of Bratislava's plans, strategies and activities it has adopted and is undertaking in light of climate change.

At first, the city's demographic and economic features are described (e.g., average age of inhabitants, ethnic diversity, unemployment and GDP per capita, health and vulnerability of people, housing and territorial development). The report also shows the first results of a spatial analysis of vulnerable population groups and areas. The report then showcases the city's critical infrastructure features and the measures it takes to protect them as well as adapt to climate change. Thus, important critical infrastructure protection and climate change adaptation plans and strategies at national and local levels are discussed. The report also highlights the steps the city itself has taken to at the same time ensure the sustainable development of the Slovakian capital. In addition, several international projects have been conducted to make the city more resilient. Current and potential financial sources, which are needed to propose and implement the measures necessary, are also introduced. The role and the involvement of stakeholders in implementing of critical infrastructure protection and climate change adaptation measures are also detailed. Each City Borough has, for example, its own Mayor, City Borough Council and Borough Office. The connections and interactions amongst these municipal actors as well as other governmental, non-governmental or private stakeholders, which are important in decision processes, are described in detail in the report. Principles of the decision making processes at the city level and also at the City Borough level explained.

To conclude, Bratislava's challenges, opportunities, achievements, and needs for continuing to adapt to climate change impacts and further protect its (critical) infrastructure are summarised.

For more information on the project partners, background and aims, please visit <http://www.resin-cities.eu/>.

# 1 Introduction

Bratislava represents one of the four model cities of the RESIN project. This report will not only highlight the complex features of the Slovak capital. It will lay a particular focus on showcasing where the vulnerabilities of the city as well as its people are and also take a look at the status of its critical infrastructure. The challenges, opportunities and achievements as well as the city's needs to adapt to climate change impacts and protect its critical infrastructure will round off the report.

Secondary data sources and input from official information sources were used as input for this report. Data was mainly obtained from studying territorial planning documentations, scientific articles, research studies and census results were used (e.g. Population and Housing Census 2011). Other important data was also sourced from the Statistical Office of the Slovak Republic, the Cadastral Office and the Slovak Hydro-Meteorological Institute.

## 2 Bratislava and its features

Bratislava is the capital city of the Slovak Republic, the political, economic and cultural centre of the country. The city is situated in the central Europe bordered by Austria and Hungary (Fig. 1) on both sides of the Danube River, the second-longest European river. Bratislava has a total area<sup>1</sup> of 367.9 km<sup>2</sup>. The northern part extends to slopes of the Little Carpathians Mountains (Male Karpaty with an altitude 102-550 metres above sea level). The southern sector is of a lowland character; it is a part of the geographical unit of the Danube Lowland (Podunajska nizina) with an altitude of 200 metres above sea level. Bratislava is situated in the moderate climatic zone, with a mean annual temperature of 10 °C and precipitation ranking between 500 and 700 millimetres. Forest land on the city's territory covers approximately 8,095 ha, which is roughly 23% of the city area, or 190 m<sup>2</sup> per capita. Agricultural land is about 13,851 ha (Tab. 1). Administratively Bratislava is divided into five districts (state local government). For self-governance purposes, the city is divided into 17 City Boroughs (Fig. 1). The built-up areas of Bratislava are formed by three fundamental kinds of surface: continuously build-up older areas serving chiefly for housing and services; looser housing, industrial, transportation, and recreational areas; and finally, large residential areas from the socialistic period, usually designed as dormitories, on the city fringes. The whole territory of Bratislava comprises many areas with non-urban function, for example, agricultural land, forests, and water.<sup>2</sup>

In comparison with that of other European capitals, the population of Bratislava is quite young (in 2001 a mean age was 38 years and in 2013 mean age was 41 years), relatively low mortality (in 2011) and high share of family households (about 70%). The city has a comparatively high level of economically active people (more than 55% of all permanent residents). The most positive characteristic of Bratislava's population is high proportion of residents with completed university education (more than 24% of adult population).<sup>3,4</sup>

Administratively Bratislava is divided into five districts (state local government) and 17 City Boroughs:

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<sup>1</sup> Territorial Plan of the capital city Bratislava, 2007.

<sup>2</sup> Divinský, B., 2002. Bratislava, Slovakia. In: Encyclopedia of urban cultures. Cities and culture around the world. Published under the auspices of the human relation area files at Yale University. Volume 1. A Scholastic Company, Danbury, Connecticut. ISBN-13: 978-0717256983

<sup>3</sup> Divinský, B., 2002.

<sup>4</sup> Statistical Lexicon of Municipalities of the Slovak Republic 2011, Published Date: 29.09.2014, Statistical Office of the Slovak Republic (last update: 29.09.2015)

- District: Bratislava I – consists of City Borough Stare Mesto
- District: Bratislava II – consists of City Boroughs Ruzinov, Vrakuna and Podunajske Biskupice
- District: Bratislava III – consists of City Boroughs Nove Mesto, Raca and Vajnory
- District: Bratislava IV – consists of City Boroughs Karlova Ves, Dubravka, Lamac, Devin, Devinska Nova Ves and Zahorska Bystrica
- District: Bratislava V – consists of City Boroughs Petralka, Jarovce, Rusovce and Cunovo.



Fig. 1: Administrative units of Bratislava (Hrnčiarová et al., 2006)

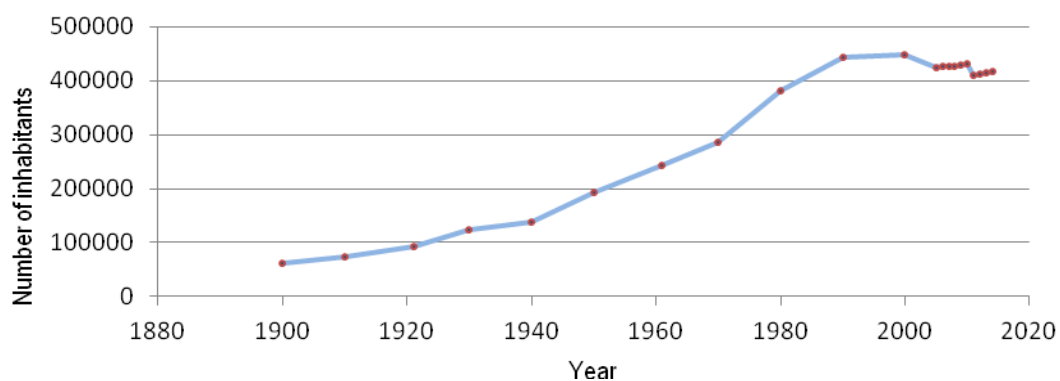
**Tab 1:** Area of land types in districts (local state government) of Bratislava [ha]

District	Arable land	Gardens	Orchards	Vineyards	Grassland	Agricultural land	Forest land	Water areas	Built-up areas	Other areas	Total area
Bratislava I	1	1	159	-	7	168	-	50	543	199	959
Bratislava II	3142	15	492	65	40	3754	1052	473	2696	1275	9249
Bratislava III	608	522	428	35	170	1763	3161	96	1678	769	7467
Bratislava IV	2149	128	603	85	539	3505	3209	335	1380	1237	9666
Bratislava V	4362	-	122	91	86	4661	673	832	1232	2023	9421

(Source: Statistical Yearbook of the land resources in Slovakia (according to the land registry to January 1, 2013))

## 2.1 Demographic development

Bratislava is the largest city in Slovakia with more than 417,000 inhabitants (state to 2014 year). Figure 2 presents the demographic development in Bratislava from 1990 to present. The city is growing continuously.



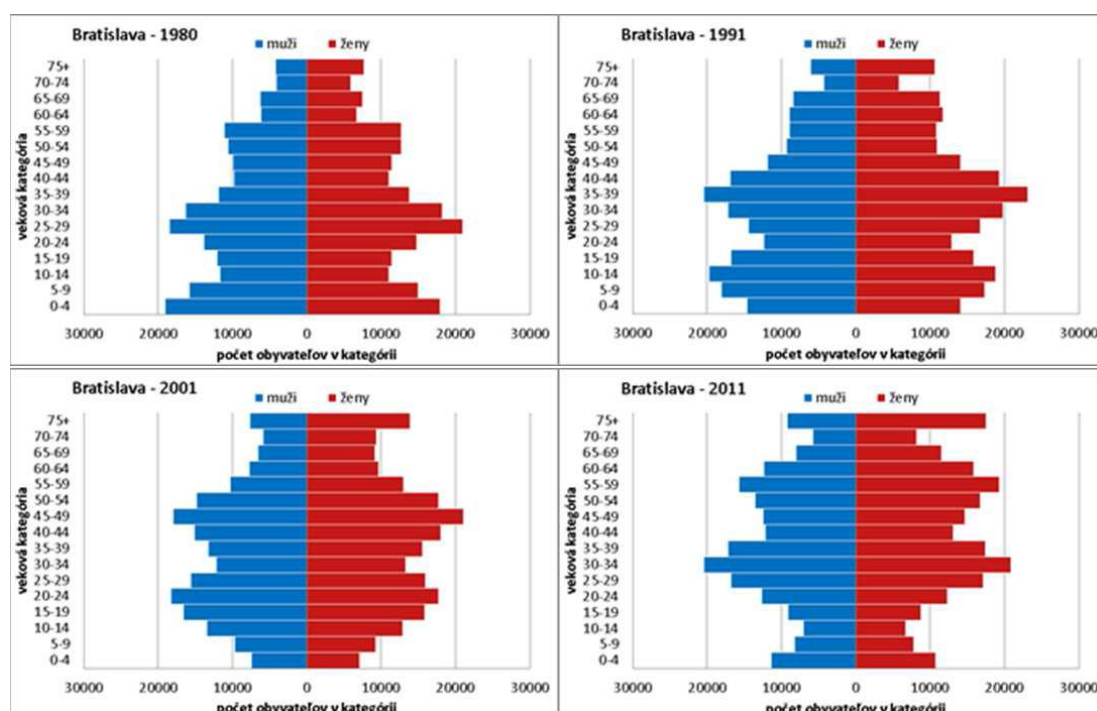
**Fig. 2:** Population development in Bratislava during the period 1900-2014 (Source: Statistical Office of the Slovak Republic, Database SLOVSTAT)

The following demographic indicators (Tab. 2, 3, 4; Fig. 3) are based on data which were collected for statistical processing (the latest results of population census 2011, a new sub-national population forecast on the NUTS-IV level with time-horizon 2035). These data are administered and registered by Statistical Office of the Slovak Republic.

**Tab. 2:** Overview of selected demographic features of Bratislava

Size of population – City (2014)	Total	Male	Female
	417,389 (31.12.2013) <sup>5</sup>	192,2566	218,9725
Size of population – Agglomeration (last available census)	494,546 <sup>7</sup>		
Expected size of Bratislava (2025)	438,951 <sup>8</sup>		
Further comments on demographic development of city and agglomeration	Population decline is expected in the future. The process of population aging will be continuing.		

The population density in Bratislava is 1,135 inhabitants per km<sup>2</sup> (2013). The challenge of “aging population“, and the relevant other changes in the demography are shown in the demography ”pyramids“ from 1980, 1991, 2001 and 2011 below (Fig. 3).



**Fig. 3:** Demographic pyramids 1990, 1991, 2001 and 2011 /blue colour is for men, red for women population (Source: Statistical Yearbook, Statistical Office of the Slovak Republic, 2012)

<sup>5</sup> Territorial transport general of capital city Bratislava, 2015

<sup>6</sup> Population and Housing Census 2011, Statistical Office of the Slovak Republic, 2011

<sup>7</sup> <https://www.enviroportal.sk/indikator/detail?id=521>

<sup>8</sup> Šprocha, B., Vaňo, B., Bleha, B., 2013: Prognosis of population development in districts SR until 2035, Bratislava.



**Tab. 3:** Districts with the oldest population in Slovakia – present time and prognosis (Bleha, Šprocha, Vaňo, 2010)

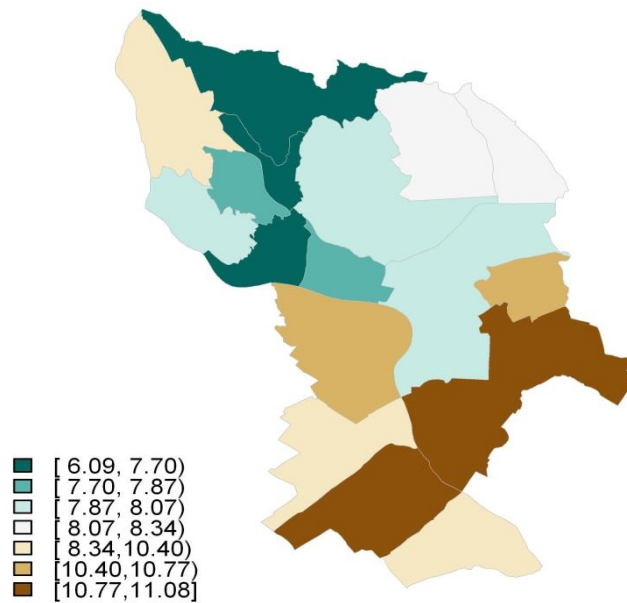
2012		2035	
District	Average age	District	Average age
Bratislava I	44.49	Bratislava I	49.89
Bratislava III	42.63	Bratislava V	49.26

## 2.2 Unemployment and GDP per capita

Bratislava belongs to the regions with very low unemployment's rate. According to Eurostat the unemployment rate by NUTS 2 – Bratislava region was in 2001 less than 4%, in 2010: 6.2% and in the larger urban zone 3.9%. The proximity to their national metropolis (to Vienna ca. 60 km and to Budapest ca. 200 km) makes from the so called “Golden triangle” (Vienna – Bratislava – Győr/Budapest) a dynamically evolving region. Bratislava is a centre of industry, services and education. The GDP per capita is in Bratislava region 184% (Eurostat, 2013<sup>9</sup>) of the EU average and is the highest level of all regions in the new EU member states.

Figure 4 shows the distribution of unemployment throughout Bratislava in 2001. High levels of unemployment are clustered in the Southern districts of Bratislava, while intermediate levels of unemployment are found in the Eastern neighbourhoods. The Northern districts show the lower unemployment rates. This map demonstrates a clear pattern of social deprivation by levels of unemployment, illustrating a North-South divide.

<sup>9</sup> ESA 2010: <http://ec.europa.eu/eurostat/web/esa-2010/overview>. The methodological changes that were implemented with ESA 2010, combined with revisions of population data resulting from the population censuses of 2011.



**Fig. 4:** Area Distribution of Unemployment in Bratislava [%] (Source: INEQ-CITIES Atlas, Indicator is derived from Population and Housing Census 2001 (Source: Statistical Office of the Slovak Republic, <https://www.ucl.ac.uk/silva/ineqcities/atlas/cities/bratislava>))

## 2.3 People moving away/to city

The city is a target of daily mobility to work and schools. About 150,000 people per day – approximately one-third of the local economically active commuted from nearby or even distant regions of Slovakia. The greatest numbers of employed people in the service sector (about 70%) are concentrated in Bratislava and in such highly skilled areas as research, development, in industry (about 24%), higher education and education (about 10%). Only 1% of people work in agriculture.

Bratislava was the most attractive city for internal migration from 2005-2009 (Fig. 5).

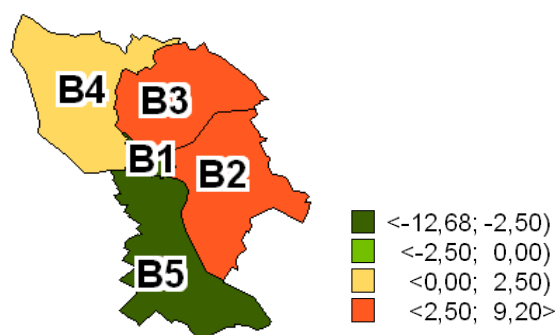


Fig. 5: Migration increases and decreases in the population in Bratislava during 2005-2009 (Jurčová, 2010<sup>10</sup>)

## 2.4 Ethnic diversity and inhabitants with foreign citizenships in Bratislava

Bratislava had in its history very high ethnic diversity. After the formation of the Czechoslovak Republic in 1918, Bratislava remained a multi-ethnic city, but with a different demographic trend. After active Slovakisation, the proportion of Slovaks and Czechs increased, while the proportion of Germans and Hungarians fell. In 1938, 59% of population were Slovaks or Czechs, while Germans represented 22% and Hungarians 13% of the city's population. The city utterly lost its multicultural character and much of its vitality. Since the 1950s, the Slovaks have been the dominant ethnicity in the town, making up around 90% of the city's population.

Tab. 4: Five main nationalities in Bratislava (or inhabitants with foreign citizenship) in 2011 and 2013

	Foreign citizenship(s)	2011	2013
Nationalities (or inhabitants with foreign citizenship) <sup>11</sup>	Hungarian citizenship	14,119 (3.38%)	14,477 (3.46%)
	Czech citizenship	6,228 (1.5%)	6,765 (1.62%)
	German citizenship	963 (0.23%)	1471 (0.35%)
	Ruthenian citizenship	747 (0.18%)	753 (0.18%)
	Ukrainian citizenship	454 (0.11%)	713 (0.17%)

At present foreigners continue to represent only a small share of population in Slovakia's total population, so the current share of migrants in local populations remains limited. The total number of

<sup>10</sup> Jurčová, D., 2010: Migration flows in Slovakia, INFOSTAT – Institute of Informatics and Statistics, Demographic Research Centre, Bratislava, 127 p.

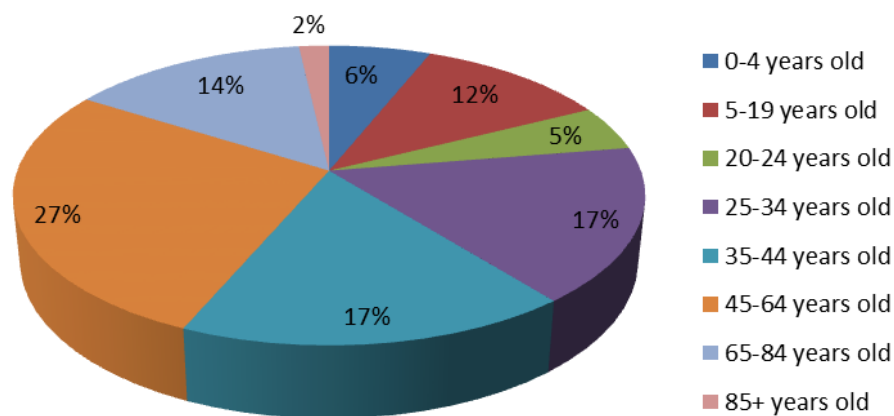
<sup>11</sup> Population and Housing Census, 2011: Resident population by nationality and municipalities, Statistical Office of the Slovak Republic

foreigners in Slovakia was 22,100 in 2004 and still to the end of 2014 this number is only 76,000 people.

The city part of Bratislava – Bratislava – Nove Mesto is among the most ethnically diverse areas in Slovakia. According to data supplied by the Border and Immigration Police, people from 96 different countries lived in the district in 2012. The total number of foreigners was 2,837 (469 of whom were Vietnamese), which is 7.73 % of the total population.<sup>12</sup> Current number of population with an ethnic migration in Bratislava is only about 0.24%. More detailed information on citizens with a background of ethnic migration and their distribution across the city are not available for Bratislava city. By Hlincikova (2015) current city-level policies do not yet include an inclusive city strategy, or policies seeking to better meet the needs of migrant residents and boost their engagement with wider society. The future image of the neighbourhood and the place of migrants within it will depend on the authorities' responses to the challenges of diversity.

## 2.5 Average age – Age distribution – Elderly/young – Birth rate – Death rate

Some of the City Boroughs (Dubravka, Lamac, Devinska Nova Ves, Vrakuna, Ruzinov) are represented by the very diverse age structure of inhabitants. This fact complicates the traffic planning, due to the very variable interests for travelling. The general feature for the whole city is the issue of the aging society – that could lead to the increase of the number of one person households. The last mentioned challenge is especially important in the City Boroughs with the variable age structure of its inhabitants mentioned above.



**Fig. 6:** Average age distribution in Bratislava (Source: Population and Housing Census 2001, Statistical Office of the Slovak Republic)

## 2.6 Health

Indicators pertaining to the condition and length of life of Bratislava's population are the best in the country. Towards the end of the 1990s, the death rate stabilised below 9%. Infant mortality fell in 1990

<sup>12</sup> Hlincikova, 2015.

to 6% and similarly in 2011, life expectancy was in 1990 71 years for men and 77 years for women, and in 2011 it was slightly higher.<sup>13, 14, 15</sup>

## 2.7 Vulnerability

When it comes to the vulnerability of Bratislava's people, heat and flooding prevail.

There are two studies on the vulnerability of the people towards heat. One study from the GRaBS project defined two categories of people vulnerable to heat in the city: *i)* people over 75 years old and *ii)* small children from 0-4 years of age. The second assessment of vulnerable population groups was realised in the frame of preparation of the Adaptation Strategy on Adverse Impacts of Climate Change on the territory of Bratislava, capital of Slovak Republic (2014).

The Strategy of Adaptation on Adverse Impacts of Climate Change in Bratislava also assessed vulnerability to flooding. A preparatory study looked at three parameters: the exposure of the population in areas at risk of flooding and the adaptive capacity (social conditions, education, level of health care, insurance) as well as the sensitive groups (elderly population, physical or mental health problems etc.)

## 2.8 Housing and territorial development

The main area of sub-urbanisation is the previous rural area on the southeast and eastern part of Bratislava city, as well as the northern part. The sub-urbanisation process, which started in the early 1990s, has had an immense impact on the city's traffic situation for the worse. The model of Bratislava's settlement structure still remains monocentric. The City Boroughs with the prevailing function of housing are located in compact areas such as Petržalka, Vrakuna, Karlova Ves or Dubravka - Lamac. It is expected, that the trends of suburbanisation will continue in the future as well, but will be weaker.<sup>16</sup> There is a lack of social housing in Bratislava. The affordability of housing has also decreased in recent years.

Bratislava has a land use plan for the city and land use plans of zones for selected important localities. In 2009 the city approved the Programme of Economic and Social Development, which was updated in 2015. However Bratislava has also other strategic documents.

## 2.9 Economic state

The only sector in which Bratislava is not dominant is agriculture. In other sectors the capital city leads. The sale and maintenance of motor vehicles, according to the Statistical Office of the Slovak Republic contributes to 68%. In industry, wholesale and retail trade it contributes to 39% and its share of construction is 25%. Figure 7 shows the result of comprehensive analyses of the business environment in Bratislava, published by the Business Alliance of Slovakia.

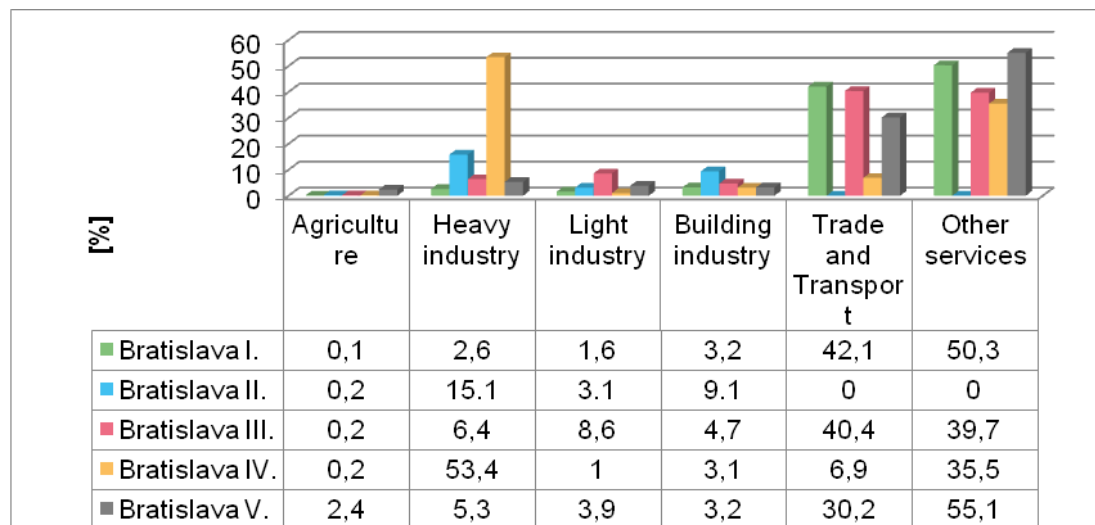
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<sup>13</sup> Divinský, B., 2002.

<sup>14</sup> Statistical Yearbook, Statistical Office of the Slovak Republic, 2011

<sup>15</sup> Program hospodárskeho a sociálneho rozvoja Bratislavského samosprávneho kraja, 2013.

<sup>16</sup> SWOT analysis of the current state of Territorial transport general for Bratislava, 2015.



**Fig. 7:** Structure of the business sector in Bratislava (Source: Competitive regions 21, 2010, Business Alliance of Slovakia)

## 2.10 Gainfully employed population

Bratislava is the capital city of the Slovak republic and there are some huge differences between it and other regions of country; differences in quality of life, GDP, unemployment rates, wages and many more areas.

In the Bratislava region, active employment accounts for only 14 percent, but its regional GDP as well as GDP per capita is about 3 times higher than in other regions. The average Slovak GDP per capita is EUR 12,000; while in Bratislava it is as high as EUR 30,000 and remaining region vary around EUR 10,000.

Bratislava is home to as much as a third (36%, 58,400) of all registered Slovak businesses (164,700). The remaining 64% of businesses is spread across remaining 7 Slovak regions quite evenly – around 9% per region. This statistic explains Bratislava’s low unemployment rate: high rates of employment follow logically from the fact that the majority of Slovak businesses are located in Bratislava, especially when high numbers of commuters from other regions are taken into consideration. The capital city dominates with only 5.4% of unemployment at the end of 2011 (Slovak average of unemployment at the end of 2011 was 13.6%).

There are also huge differences in average net nominal wage between the capital Bratislava and other Slovak regions. The value of the average net nominal monthly wage in Bratislava is EUR 878, while for remaining regions it varies between EUR 545 and EUR 639. So on average Bratislava’s wages are 50% higher than in the rest of Slovakia.

**Tab. 5:** Economic features

<b>Most important economic sectors (2014)<sup>17</sup>.</b>	<b>Trade, services, traffic and other services</b>	<b>In individual districts in Bratislava city the percentage of workers is from 35% to 90%</b>
	Industry	In individual districts in Bratislava city the percentage of workers is from 5% to 50%
	Construction	About 10-15%
	Agriculture	About 1% workers
<b>Specification of services</b>	Services	Commerce and trade Traffic Finance Information and communication Tourism

## 2.11 Transport and critical infrastructure features

In the case of the increase in the average number of trips (from the actual rate 2.3 to the 3.5, the average in European cities), the traffic system based on the actual prevailing individual car mode will collapse. A long-term problem is the high number of commuters. In 2015 it was 422,282 commuters in the inner city and 195,119 in functional areas.

A positive feature is that the total percentage of citizens walking, cycling or taking public transport to work is 73.9%. To promote the use of public transport, the city has introduced a new bus fleet, simplified ticket purchases via mobile phones and created an integrated system of regional tickets. Usage rates of these modes of transport are very much dependant on the distance of travel (cf. Tab. 6).

<sup>17</sup> Bratislavský samosprávny kraj, 2014.

**Tab. 6:** Transport features

	Distance in km	Pedestrian transport	Public transport	Cycling	Individual motorized transport	Share of all transport depending on the distance of travelling
Most commonly used transport modes used in city	0-2	91%	10%	42%	17%	35%
	2-5	7%	35%	32%	31%	26%
	5-10	1%	37%	16%	33%	25%
	10-20	1%	17%	8%	17%	12%
	>20	0%	1%	2%	2%	1%

(Source: Annual Report of Bratislava Transportation Company, Inc., 2013; <http://cyklokoalicia.sk/2013/04/bratislava-zaznamenava-boom-cyklistov>)

According to currently available data, 52.4% of Bratislava inhabitants own bicycles; however, the modal share of bicycle transport is only 1.6%. Some other sources, e.g. the organisation *Cyklokoalicia*, an NGO dealing with the promotion of cycling describes in its report the increasing trend of the modal share of bicycle transport since 2012<sup>18</sup>.

## 2.12 Other critical infrastructures under the responsibility of the city and its boroughs

Critical infrastructure is determined in Slovakia by Act. no. 45/2011 Coll. During work on the Strategy of Adaptation to Adverse Impacts of Climate Change on the Territory of Bratislava, capital of the Slovak Republic (City Hall, 2014) some vital sectors – i.e. critical infrastructure sectors – for the functioning of a city were determined and further assessed: health care and social services, water management including drinking water supply, food supply, energy supply, transport and related infrastructure, biodiversity including green spaces and forestry, and the built environment. The city partially influences or controls the above-mentioned ‘critical’ infrastructure(s), especially transport and water supply. For these, Bratislava’s water company and Bratislava’s transport company are responsible, which are partially directed by the city.

The city also has also done a partial spatial mapping and/or analysis of its (critical) infrastructure. The analyses were elaborated by the working group, composed mainly by city office employees and experts from external institutions during regular working meetings. The spatial mapping was done in consideration of risks and vulnerabilities linked to climate change impacts. Based on the description of the “critical infrastructure”, involving 11 sectors, the city has does not consider those sectors included e.g. in the European Programme for Critical Infrastructure Protection (EPCIP) (i.e. Information and Communication Technologies, ICT, the financial sector, the chemical industry, space and research facilities) as critical.

<sup>18</sup> <http://cyklokoalicia.sk/2013/04/bratislava-zaznamenava-boom-cyklistov/>



## 2.13 Social services and health care

The city and its boroughs have important competences in providing social services (and limited competences in health care provision). The Community Plan of Social Services of the City of Bratislava was approved in 2012 with detailed measures for the implementation of social services for the years 2013-2018. Bratislava has also a concept for reducing the extent of homelessness in Bratislava (2013). It included priority solutions for the years 2013-2015. Since 1994 Bratislava is a member of the Association of Healthy Cities and since 2012 a signatory of the Covenant of Mayors.

## 2.14 Water management (incl. drinking water supply)

**Supply of drinking and service water:** The drinking water for Bratislava and its agglomeration is provided by the Bratislava Water Company (BWC). Distribution is done through a public water supply system of a length of 1,886 km. The drinking water is produced in seven central water treatment facilities from 176 raw water sources with an overall capacity of over 6,300 l/s. The main source is deep ground-water of a naturally very high quality. BWC considers an online water quality monitoring system to be essential for the high quality of drinking water supplied. BWC is also responsible for the operation of waste water systems of Bratislava and for performing all physical, chemical, biological and microclimatic analysis of surface water, drinking water and waste water in the west of the Slovak Republic.<sup>19</sup>

**Collection and treatment of waste water:** Sewage networks cover the public sewer system, and except for some minor edge locations, virtually the entire built-up area of Bratislava. Problems remain during torrential rainfall in some critical areas is not capable of carrying these water amounts. The concept for a number of technical measures to deal with this situation has already been developed in order to find solutions. Insufficient regulation creates a barrier to a comprehensive solution.

**Flood protection:** A new system of the Danube flood protection was developed between 2007 and 2010. This system is designed to protect citizens of the Slovak capital even in the case of a momentous flood (1000 year event). Despite built flood protection measures, local flooding problems still persist, especially in the smaller tributaries of the Little Carpathians. The issue is particularly acute in the area northeast of Bratislava, which forms part of the Small Carpathians.

## 2.15 Energy supply

**Electricity supply:** It is largely dependent on a superior system of overhead lines of 400 kV EHV.

**Gas supply:** The city provides gas to more than 92 households.

**Heat supply:** The largest producer of heat in the Bratislavská teplárenská, (BAT), whose centralized heating system supplies heat to the five boroughs.<sup>20</sup>

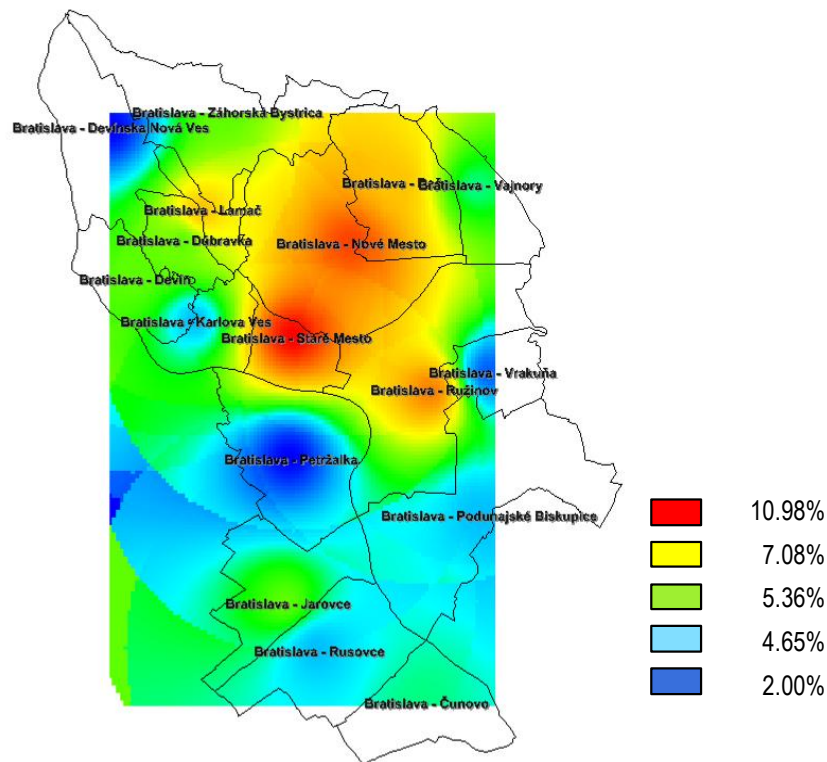
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<sup>19</sup> Bratislavský samosprávny kraj, 2014

<sup>20</sup> Bratislavský samosprávny kraj, 2014.

## 2.16 Identification and assessment of critical localities, critical infrastructure and the most vulnerable groups of people

The first spatial mapping and analysis of vulnerable population groups and areas was done in Bratislava city in 2008-2011 within the framework of the project “Green and Blue Space Adaptation for Urban Areas and Eco Towns” (GRaBS) (see example in Fig 8). The main results were percentages of people over 75 years old compare to the whole number of the inhabitants calculated for individual city boroughs of Bratislava.



**Fig. 8:** Results from GRaBS project (2009-2011) – mapping of health-based index – the percentages of people over 75 years old in relation to the total number of inhabitants is shown on the map (calculated for individual City Boroughs of Bratislava). (Input data – from the Statistical Office of the Slovak Republic)

To provide the data for constructing vulnerability indices for the City of Bratislava, vulnerability indices were especially concerned with human vulnerability. These provide a means of creating a health-based index that is appropriate for assessing the vulnerability of people to climate hazards in general. Each of these vulnerability indices was mapped and classified in table form into four quintiles.

The second assessment of vulnerability in Bratislava city was realised in 2013, within the framework of Bratislava’s participation in the capacity-building program funded through the EU project Cities Adapt. The methodology was based on the base of IPCC methodology. The individual City Boroughs were evaluated in terms of vulnerability. Moreover, based on the risk assessment considering the probability of occurrence and possible consequences of the negative impact of climate change, vulnerability among inhabitants was classified into three categories. These assessments were realized as a part of the Strategy of Adaptation on Adverse Impacts of Climate Change on the territory of Bratislava, capital of Slovak Republic that was approved by the City Council Resolution in

September 2014. The **Project Steering Committee** integrated the climate change risks with non-climatic stress, e.g. we considered the issues of demographic changes, physical or mental health, social conditions of the population, education, level of health care, insurance, GDP, financial crises, air pollution, PM10 etc. So far it has only been processed at a general level and will need to be more accurate and detailed. In total, more than 80 adaptation measures/actions were proposed.

## 3 State of adaptation and critical infrastructure protection plans and activities in Bratislava

Strategic documents related to adaptation and critical infrastructure protection are being developed at national and local levels. Each of these documents uses appropriate data at the relevant level.

### 3.1 Existing data and assessments – Baseline review

The City of Bratislava has its own geo-information portal, the ambition of which is to provide citizens with comprehensive spatial information by using a public computer network. The proposed modern solution enables the timely provision of up-to-date information on the actual status of City spaces in an easy comprehensible manner.

Currently, by the use of special functions, data is added to databases in the form of regulations, records, drafts and maps. These comprise data on waste handling, on the state of public greenery, on transport organisation, municipal real estate, geodetic documentation of buildings, current street names, and applicable guidelines for new investment objectives and their implementation.

The organisation and structure of data in the digital environment increases the work effectiveness of City Hall by limiting duplicate data entries and by ensuring immediate access to fresh data.

The basic building block of the City portal for spatial information is the computer base of the digital technical map of the City. The map contains information on the geometric arrangement of buildings above and below ground, with indication of the relief and technical infrastructure of buildings. New information is entered into the database progressively according to the surveying of new buildings. Information outputs are produced in the form of cartographically processed maps on a scale of 1:500 or in the form of record of map pages stored on CD-ROM. The City also provides spatial information and specific purpose maps from its collection of maps on a scale of 1:10,000 or 1:2,000 or orthophotographic maps in digital form and cartographic form for the purpose of building design, architectonic studies and general building schemes.

The city also includes additional layers other than the common ones such as topography, land-use, transport, greenery etc. The add-on layers contain information on e.g., heat islands (in selected parts of town) or about flood risks.

The GIS department of the local government will also include more information from these projects:

- **Green and Blue Space Adaptation for Urban Areas and Eco Towns (GRaBS)** by the Regional Environmental Centre Slovakia (2008-2011) – for more information see chapter 2.16
- **Urban climate in Central European cities and global climate change:** The project aims to raise public awareness on those issues in four Central European cities. One of the pilot cities is Bratislava. The modelling approach (model MUKLIMO\_3) is designed to evaluate possible changes in urban heat load under future climate conditions. The project was co-financed by the International Visegrad Fund as a standard grant (No. 21410222), in the years 2014-2015.
- **Land-use plan of Bratislava**, capital of the Slovak Republic (approved on May 5, 2007 by the Resolution of the City Council of Bratislava, No. 123/2007 and its binding part has been

declared as one of Bratislava's generally binding regulations, No. 4/2007; the land-use plan has had ten amendments since 2007).

### 3.2 Important adaptation and critical infrastructure protection reports and strategies at national level

There are a number of national level policies in place, which need to be taken into account to understand what is happening and/or possible at the city level in Bratislava. The most important of these national policies are:

- **Climate change impacts and possible adaptation measures in various sectors in Slovakia (report of the Slovak Hydro-Meteorological Institute, 2011)**

Impacts, vulnerability and adaptation assessments were completed for 8 sectors. The report provides results of an analysis of the trends and impacts of climate change on sectors such as water management, agriculture, forest management, biodiversity, transport, the energy sector, economy, tourism, human health and other services. The report includes a proposal of adaptation measures for the conditions of the Slovak Republic, which focuses on examining the consequences and costs of adaptation measures in selected sectors of economic activity. The report is available at this website: <http://www.shmu.sk/sk/?page=1817> (Slovak only).

- **Adaptation Strategy of the Slovak Republic on Adverse Impacts of Climate Change (NAS) (Ministry of Environment SR, 2014)**

The NAS was adopted by the government (Resolution No 148/2014) in March 2014. It defines objectives, principles and criteria to prioritise proposed measures. It creates a framework for adaptation processes in Slovakia. The Government will be provided with information on the progress and accomplishment of the objectives of the strategy in May 2016. Currently there is no action plan. NAS is available in Slovak only but an executive summary is available in English here: <http://climate-adapt.eea.europa.eu/countries/slovakia>

### 3.3 Important adaptation and critical infrastructure protection plans and strategies across sectors within the city

There are also a number of critical infrastructure protection plans in place, or at least plans that target them, most of which at city level:

- **Land-use plan for Bratislava, capital of the Slovak Republic:** The aim of the land-use plan is to systematically and comprehensively address the spatial arrangement and functional use of land and lay down its principles. It proposes the material and chronological coordination of activities, which influence the environment, ecological stability, and cultural-historical values of land, land development and landscape in accordance with the principles of sustainable development. The plan is available here: <http://www.bratislava.sk/uzemny-plan-hlavneho-mesta-slovenskej-republiky-bratislavy/d-80478>

- **Program of Economic and Social Development of the capital city Bratislava for the years 2010-2020** (2009, binding document approved by the City Council Regulation No. 1020/2010 in July /2010): The city of Bratislava is committed to addressing the issue of climate change and related appropriate adaptation measures since 2010 in the approved Program of Economic and Social Development for the years 2010-2020 (City Hall of Bratislava, 2009). In 2015 the programme was updated in terms of its financial aspects in 2015 and a binding document

approved by the City Council Regulation no. 351/2015 on 10 December 2015). Several measures approved in the financial part relate or directly support adaptation and mitigation measures to adverse effects of climate change. The programme can be viewed at <http://zastupitelstvo.bratislava.sk/samosprava/uznesenie/id:1530>

- Strategy of Adaptation to Adverse Impacts of Climate Change on the territory of Bratislava, capital of Slovak Republic (elaborated by the members of the project Steering Committee, City Hall, 2014):** The Strategy of Adaptation is a binding document and was approved by the City Council Resolution no. 1659/2014 on 24 September 2014 (see website <http://bratislava.sk/uznesenie-c-1659-2014/d-11044992>). The strategy was elaborated by a Project Steering Committee. It consists of a chairman, (the chief architect), and a number of other members, who are employees of Bratislava City Hall, i.e. representatives from the departments of strategy project management and financial resources, the environment, territorial system coordination, social affairs, transport, infrastructure etc., as well as representatives of scientific organizations (i.e. Geographical Institute of the Slovak Academy of Sciences and Comenius University in Bratislava) and non-governmental organizations.

The Strategy of Adaptation aims to deal with potential risks, prevention of the consequences of the risks of climate change. It was approved by the deputies of the City Assembly in Bratislava in September 2014. The objective of the Strategy of Adaptation is to ensure appropriate mechanisms for the city against the increased risk impacts of climate change, to reduce the vulnerability by appropriate adaptation measures within individual sectors (areas) and provide the necessary information and tools to facilitate the process of decision making and management.

The Strategy of Adaptation structure expresses how Bratislava city would like to work on and approach adaptation, mentions the milestones and short, medium, and long term objectives of the strategy. The Strategic Action Plan is included as well (see Tab. 7).

**Tab. 7:** The proposal of actions planned after the completing the project - short, medium and long term strategic goals (Strategic Action Plan)

Strategic Action Plan - planned strategic measures after completing of the project	Strategic measures		
	Short term	Medium	Long term
	2013-2015	2016-2020	2020-2030
Develop an Action Plan on climate change (2014-2020)	X		
Incorporate requirements for adaptation and mitigation measures to climate change in the planning and evaluation process of all relevant strategies, plans, programs, legislation activities (projects) and in the process of approval and authorization (decision)	X		
Provide education and training of municipal employees and city organizations in order to get qualified experts in the issue	X		

of climate change			
Engage internal and external stakeholders in the implementation of adaptation and mitigation measures to climate change and gradually achieve effective mutual inter-sectoral and institutional coordination	X	X	
Gradually prepare proposals to obtain funds to finance, respectively co-finance necessary measures	X	X	
Ensure improving availability of data and creating useful information for better analysis tools (mapping, visualization and communication systems).	X	X	
Define adaptation and mitigation measures taking into account, modernization and strengthening of existing systems	X	X	
Gradually raise general awareness of all stakeholders, including residents, about climate resilience	X	X	
Define and operate a monitoring system of important impacts of climate change in different sectors	X	X	
Actively involve the business sector in issues of climate change measures through the implementation of projects.	X	X	
Define and gradually implement key measures to reduce the vulnerability of all sectors in the city	X	X	
Develop and put into the planning and decision-making practice a methodology for identifying and evaluating risks (vulnerability) and their impact on the economy, the environment and human health		X	
Monitor and evaluate the performance of the tasks of the Action Plan of measures to climate change to r. 2014-2020 and develop an updated Action Plan to the years 2021-2030		X	X
Actively engage citizens in issues of action on climate change through community projects		X	X
Monitor the implementation of the Action Plan of measures on climate change to the years 2021-2030			X
Reinforce Bratislava as a leader in climate resilience in the Central Europe			X

(Source: Strategy of Adaptation on Adverse Impacts of Climate Change on the territory of Bratislava, capital of Slovak Republic, City Hall, 2014)

The **Project Steering Committee** took into account the hazardous locations evaluated by simulating summer temperatures, age indicators (sensitive groups of population), physical and mental health, social conditions of the population etc. The most sensitive population group are people over 75 years, children up to 4 years, acutely socially vulnerable groups (e.g. homeless people). Vulnerability was evaluated on the basis of the general concept of sensitivity, exposure and adaptive capacity. Vulnerability was understood as a “function of the character, magnitude, and rate of climate variation to which a system is **exposed**, its **sensitivity**, and its **adaptive capacity**” (*IPCC, 2001*). The detailed assessment included these indicators:

- Increasing average annual temperatures, compounded by the heat island effect (urban heat island)
- increasing the number of extremely hot days in summer
- declining relative humidity with an overall decline in rainfall - prolonged drought and desertification (gradual drying), uneven rainfall, the change in their location (more precipitation in winter, decrease in snow coverage) as a consequence
- increase in frequent torrential rainfall
- increase in the frequency and intensity of extreme hydrological phenomena (floods and droughts, storms, snow storms and calamities)

A sectoral approach (taking into account interdependencies) was used in the evaluation of projected climate change impacts in Bratislava and impacts were evaluated in the following key sectors (areas):

- Possible consequences of the impact of climate change on public health and social services
- Possible consequences of climate change impacts on water and water management
- Possible consequences of climate change impact on greenery, forests and biodiversity
- Possible consequences of climate change impacts on waste management
- Possible consequences of the impact of climate change on agriculture and food production
- Possible consequences of climate change impacts on energy and energy infrastructure
- Possible consequences of the impact of climate change on urban environment, quality of the living environment, technical infrastructure and land development
- Possible consequences of climate change impacts on transport and transport infrastructure.

The training provided and the process of preparing a draft Strategy of Adaptation enabled Bratislava city to launch a project called “The City of Bratislava is preparing for climate change - pilot application of the measures in the field of sustainable rainwater management in urban areas”, which was submitted on 28<sup>th</sup> June, 2013 to the call “Adapting to climate change - prevention of floods and droughts” managed by the Slovak Governmental Office and was successfully approved.

The Strategy of Adaptation on Adverse Impacts of Climate Change on the territory of Bratislava is available on the website

[http://www.bratislava.sk/MsZ/Archiv/MsZ\\_14\\_07\\_03/064\\_Adaptacne%20strategie.pdf\\_\(in Slovak\)](http://www.bratislava.sk/MsZ/Archiv/MsZ_14_07_03/064_Adaptacne%20strategie.pdf_(in_Slovak)).

- **Action Plan for Adaptation on Adverse Impacts of Climate Change for Bratislava, capital of the Slovak Republic, for the years 2016-2020 (under preparation – elaborated by the members of the project Steering Committee, City Hall, expected data of completion: September 2016):** The Action plan is being prepared on the basis of the Resolution of the City Council no. 1659/2014 from 24 September 2014 that adopted the Strategy of Adaptation on Adverse Impacts of Climate Change on the territory of Bratislava and required the elaboration of the Action Plan. In the frame of the Action Plan for Adaptation the expected impacts of climate



change will be assessed, priority areas identified and actions for people vulnerable to different risks will be formulated (the necessary investments and actions). The aim is to create wellbeing with better conditions of life, learning, work, and for visitors and also for saving money and ensuring business continuity (see also Chapter 6, strategic objectives). The Action Plan for Adaptation is being addressed and will be implemented through two already ongoing and completed projects: **"The City of Bratislava is preparing for climate change - pilot application of the measures in the field of sustainable rainwater management in urban areas "** (period: 2014-2017) and the RESIN project 'Climate Resilient Cities and Infrastructure' (period: 2015-2018).

### 3.4 Important adaptation and critical infrastructure protection plans and strategies for specific sectors within the city

There are also a number of sectoral policy papers and strategies available for the city of Bratislava. Some of them are listed here per sector:

Social services - Community Plan of Social Services of the City of Bratislava (2012): includes a detailed implementation plan for community social services. It also outlines the objectives and assignments of social services for the years 2013-2018. A concept for a solution to the problem of homelessness in Bratislava (2013) includes priority solutions for 2013-2015.

- Energy - **Action Plan for Sustainable Energy Development in Bratislava, capital of Slovakia** (2014): This is a comprehensive short and medium-term strategic document that defines the activities of the city aimed at reducing CO2 emissions. The Action Plan was processed further to enable the city to sign up for the pan-European commitment the Covenant of Mayors. Bratislava has sent a request to the European Investment Bank to help in financing technical assistance to implement the Action Plan for Sustainable Energy Development of the City of Bratislava.
- Transport - **Territorial Transport general for Bratislava, capital of the Slovak Republic** (2016). The goal of this document was to update the prospects of transportation, parameters and services in the city to outline a proposal for their realisation. The document proposes a regulation of urban spatial development from the perspective of transportation and related services. The prognosis of transport has also been up dated, which is key for the proposal of individual transportation subsystems. The document also provides a systematic overview of relevant policies related to national, regional and international frameworks for transportation development and the latest outlooks in this area, with regard to the specific needs and potentials of the City of Bratislava.
- Transport - **Action plan for bicycle and pedestrian transport in Bratislava, the capital of the Slovak Republic (2016)**. This strategic document focuses on development of non-motorized transport, defines concrete actions that have to be taken in the city to support bicycle and pedestrian transport and includes a timetable for their realisation. It is a consecutive document to other related strategic documents of the City of Bratislava and the National strategy for development of cycling transport and cycle touring in the Slovak Republic (Ministry of Transport, Construction and Regional Development of the Slovak Republic, 2013).
- Construction - Building - **Advice on housing reconstruction** (2014-2015): The sustainable management of rainwater for residential buildings was part of the workshop topics of the project.

- Urban planning - **Green Infrastructure and Forestry**: Proposal for the Conception for the support of the recreational function and development of the Bratislava forest park (2014): Approved by the City Council in October 2014, the new Concept for Urban Forests in Bratislava commits to several tasks in cooperation with the city, including reducing the projected production throughout the territory of the park and developing a master plan for the Forest Park zone. A building ban will be applied to this area.

### 3.5 International activities supporting adaptation and mitigation activities

In the recent years Bratislava city and its boroughs were actively involved in international activities, programs and projects related to the preparation of climate actions. Bratislava is still only at the beginning of handling impacts of ongoing climate change. In 2009, Bratislava included a climate change agenda into the Programme of Economic and Social Development for the first time. Therefore, for Bratislava to engage in international activities, this is a very important "driving force" and commitment that helps the city to move forward faster. Key obligations related to the mitigation and adaptation measures of Bratislava city arise from the signed international documents and participation in EU projects:

- **Covenant of Mayors**, signed by Bratislava City in 2012 (Regulation of the City Council No. 545/2012 on April 26, 2012). By signing the Convention, Bratislava committed to meet and exceed the aim of the European Union – and by 2020 to reduce CO<sub>2</sub> emissions by 20.7%. Tasks related to the Covenant of Mayors are carried out through the Sustainable Energy Action Plan approved by the City Council in February, 2014.
- In 2012, the Bratislava successfully participated in the **EU Cities Adapt Programme**: This participation resulted in the development of a strategy for adaptation to the adverse impacts of climate change in Bratislava, which was approved by the Resolution of the City Council No. 1659/2014 on 24 September 2014.
- Bratislava is involved in two European projects dealing with tasks related to improving housing stock: "**European Cities Urban Serving as Green Gate towards Leadership in Sustainable Energy**" (EU GUGLE, 7th FP, duration of the project is from 2013 to 2018), EPO URBAN (2012-2016).
- **Mayors Adapt** was signed by Bratislava City in 2014 (Resolution of the City Council No. 1658/2014 on September 24, 2014). Mayors Adapt is realised through the Adaptation Strategy (City Hall, 2014) and will be realised through the Action Plan for Adaptation for the years 2016-2020 (under development).
- In 2014 Bratislava began work on the project "**The City of Bratislava is preparing for climate change - pilot application of the measures in the field of sustainable rainwater management in urban areas**" (supported by EEA Grants and Norway Grants grant, project duration: 2014-2017).
- Project H2020 **RESIN** No. 653522 "Climate Resilient Cities and Infrastructures" (2015-2018): Bratislava is one of the core cities in the project.

Bratislava is a member of several international organizations whose activities are related to the improvement of city management and sustainable development (e.g. EUROCITIES, the Union Capitals of the European Union, the Union of Capitals of Central and Southeast Europe, International

Federation of Housing and Planning, International Association of Public Transport). Since 1994 Bratislava is a member of the Association of Healthy Cities. Bratislava also signed the Agreement on Transboundary cooperation with Lower Austria, which aims at deepening cross-border cooperation activities in various fields.

### 3.6 Decision-makers in planning

Planning decisions are made at several levels (i.e. local, regional, national) in Slovakia. The division of tasks related to decision-making on environmental issues including climate change is determined by the Act No. 525/2003 Coll. on state administration of environmental affairs. In Slovakia there are three levels of government authorities for the creation and protection of the environment: Ministry for the Environment, regional offices and district offices. State Administration of environmental affairs is also carried out by the municipalities and towns to the extent determined by special regulations (on waste, water, air, environmental protection and landscape conservation, on public water supply and on regulation in network sectors, etc.)

#### **Decision-makers and supporters at the national level and an influence on the city (with respect to climate change topics)**

In Slovakia the High Level Committee for Coordination of Climate Change Policy chaired by the State Secretary of the Ministry of Environment of the Slovak Republic plays an important role in the policy and decision-making process with respect to climate change. Other members are the State Secretaries of the Ministry for the Economy; the Ministry of Agriculture and Rural Development, the Ministry of Transport, Construction and Regional Development, the Ministry of Education, Science, Research and Sport, the Ministry of Health, the Ministry of Finance, the Ministry of Foreign and European Affairs and the Head of the Regulatory Office for the Network Industries. The Ministry for the Environment is responsible for the development of the national environmental policy and measures regarding climate change and adaptation. The coordination of activities (i.e. information transfer, adaptation measures monitoring etc.) are organised as follows:

- the National Contact Point (the Ministry of Environment of the Slovak Republic) communicates with international organizations and coordinates national activities in cooperation with the Working Group for Adaptation;
- the Working Group for Adaptation provides adaptation activities in its area of competence, cooperates with professional institutions and other relevant organizations, is responsible for preparing the documents for the Coordination Committee for Climate Change Policy and for decision-making; the High Level Committee for the Coordination of Climate Change Policy defines the main tasks and gives overall lines for further policy-making processes on adaptation.

#### **Decision-makers in planning in Bratislava city and its boroughs**

The process of the decision making within the city government (and similarly in the city boroughs) is determined by the Rules of Procedure of the City Council. Following these rules the mayor assesses the material and determines a commission to prepare material related to the issue, e.g. climate change adaptation. This committee is composed of deputies (e.g., members of the City Council) and relevant experts. The commission's findings and comments are compiled by its secretary and prepared for the City Board, which consists of 10 members elected by the City Council from its deputies for an entire term. The City Board then screens these. They also prepare a session for the City Council. With the mayor's approval, this draft of City Council resolutions is prepared at the same

time as the material is presented to the City Council. It then makes a decision during the session (e.g., an initiative or activity for climate change adaptation).

Advisory bodies also play an important role in the planning process in Bratislava. They advise on strategic and conceptual topics. The Chief Architect has a key role assigned to the area of urban planning and architecture. He or she is responsible for land-use planning documents, preparing spatial plans and paving the way for binding decisions of investment activities in the city. There is also a Senior Council of Bratislava, which deals with questions related to the elderly. The City Hall is the executive body for the City Council and Mayor. The following departments are responsible for specific issues linked to climate change adaptation and mitigation:

- Department of the Chief Architect is responsible for planning and adapting plans
- Department of Transport is responsible for transport issues
- Department of Territorial Planning and the Territorial System is responsible for the master plan
- Department for the Environment and Green Space Management is responsible for planning any environmental issues (inc. waste management) and green space management
- Department of social issues is responsible for any social issues and partly for health (this issue is not in the direct competency of the city and is the responsibility of Bratislava’s self-governing region)
- Department of Projects and Strategies is responsible for administration and management of the city’s projects.

### 3.7 Background information about political commitment at the city level and its boroughs

Decision-making powers related to climate adaptation lie with the City Council and individual deputies. Responsibility for implementing these decisions lies with the Mayor, the City Board, the City Council, the City Commissions, and the City Magistrate's Office/City Hall. According to the current situation in Bratislava the main initiative in the adaptation planning has the City Council and individual deputies. The number of members of the City Borough’s Council depends on the size and population in each City Borough (Bratislava has 17 City Boroughs). In Bratislava the civil sector is also strong. There are numerous active NGOs and community initiatives, universities, scientific and research institutions. Examples of projects acquired as an initiative of the city or its boroughs and on the initiative of universities, research institutions, the local community or NGOs are:

- Project “GraBS” (Regional Environmental Centre Slovakia, in 2008-2011)
- EU program CityAdapt (Bratislava City, 2012-2013)
- Implementation project “The City of Bratislava is preparing for climate change - pilot application of the measures in the field of sustainable rainwater management in urban areas” supported by EEA grants and Norway Grants (Bratislava City, 2014-2017)
- Concept for the support of the recreational function and development of the Bratislava forest park (prepared by several NGOs from Bratislava City; the concept represents an example of formulating participatory forest-related policy, 2014)

- “Urban climate in Central European cities (incl. Bratislava) and global climate change” (Slovak Hydro-Meteorological Institute, 2014-2015)
- H2020 RESIN project “Climate Resilient Cities and Infrastructures” (Bratislava City in cooperation with Comenius University in Bratislava, 2015-2018)

Political commitment of Bratislava city in the field of climate mitigation and adaptation:

- Resolution of the City Council No. 1659/2014 from 24. 09. 2014 that adopted the Adaptation Strategy to the adverse impact of climate change and required the elaboration of the Action Plan
- Signatory of the Covenant of Mayors (2012)
- Signatory of the Mayors Adapt (2014).

### 3.8 Legal framework for planning and implementation

Original competences for Bratislava and its boroughs result from the Act. 369/1990 Coll. on municipalities. The city and its 17 boroughs perform a wide range of government competencies and powers transferred from the state government by the cross-cutting and sectoral acts. The legal framework for the adaptation planning process is Act No. 50/1976 Coll. on Land-Use Planning and Building Order (the Building Act). Yet, the Act on Land-Use Planning and Building Order does not pay special attention to climate change; it only briefly addresses the management of rainwater. The Ministry of Transport, Construction and Regional Development SR prepared methodological guidance in 2014, including a draft of the recommended adaptation measures. For the adaptation planning are important also other acts such as those on waters; forests, nature and landscape protection, regional development, EIA/SEA, etc.

The City and its boroughs approved the generally binding regulations of the city related to the issues of territorial development, air quality, greens, etc. In addition other generally binding regulations (decrees) have been adopted by the local state government such as the Action Plan for securing air quality for the city boroughs of Bratislava.

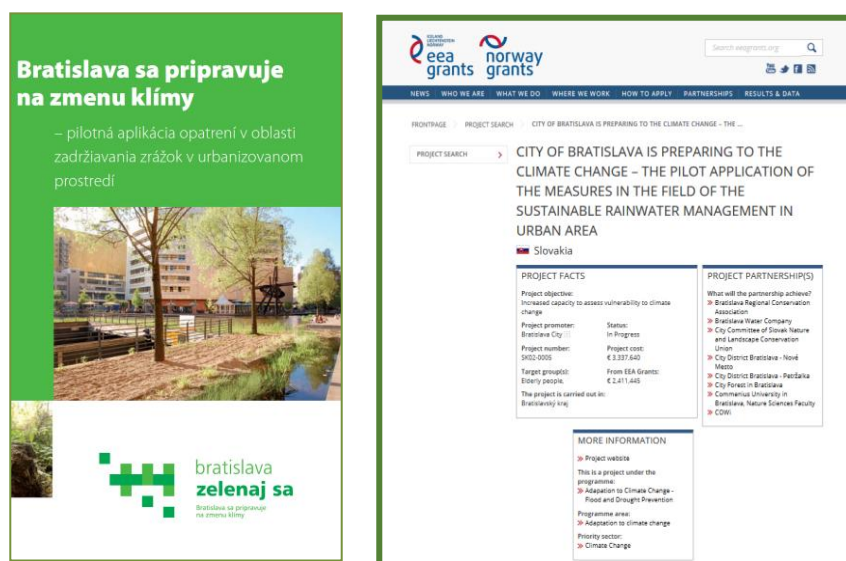
Based on the analysis and assessment of vulnerabilities and potential risks of all key areas more than 80 measures, which contribute to reducing the vulnerability and respectively increase the resilience (resistance) of the city and its boroughs, were proposed in the **Adaptation Strategy** approved by the City Council in September 2014. These results helped to determine the spatial distribution of the adaptation measures. Detailed elaboration of all measures will be included to the Action Plan for Adaptation, which is planned to be finalised in **2017**.

## 4 Implementation of adaptation and critical infrastructure protection measures

### 4.1 Implementation of adaptation measures

With grants from the European Environmental Agency (EEA) as well as from Norway, the city of Bratislava is currently piloting measures in the field of sustainable rainwater management in urban areas (2014-2017). The main objective of the project is to enhance the resilience of Bratislava against the adverse impacts of climate change (Fig. 9). The Action Plan for Adaptation will promote the delivery of climate change adaptation through different types of adaptation measures (with a special focus on the rainwater management) and cooperation among decision makers, planners, stakeholders, the private sector and local communities. The main target groups are the inhabitants of Bratislava city, especially the vulnerable groups (i.e. elderly people and children).

Partners of the project are local NGOs (Bratislava regional Conservation Association and City Committee of the Slovak nature and Landscape Conservation Union), City Boroughs (Nove Mesto, Petrzalka), city organisations (City Forest in Bratislava and Bratislava Water Company) and the Comenius University in Bratislava and COWI<sup>21</sup>.



**Fig. 9:** The report about pilot application of the measures under the project “City of Bratislava is preparing for Climate Change ” (Source: <http://eegrants.org/project-portal/project/SK02-0005>)

The **adaptation measures** are planned and realised in the different parts of Bratislava city with a special focus on the Boroughs of the Stare Mesto, Nove Mesto, and Petrzalka. These measures are as follows:

- Construction of sustainable rainwater collection infrastructure and management (i.e. construction of the new infiltration bio-swales, realisation of bio-retention water systems with

<sup>21</sup> COWI is a leading consulting group. The COWI Group is organised into three regions - Denmark, Norway and Sweden. Theirs priority is to think sustainability into all of their activities and to make a positive contribution to the world.

rain water infiltration and detention; with main implementing bodies being the City of Bratislava and City Boroughs New Town and **Petržalka**)

- Construction of green roofs on a home for elderly people (with main implementing bodies being the City of Bratislava))
- Trees and greenery planting, revitalisation and increase of green space ratio and accessibility (in main historical squares and the in the central part of the city as well as in city boroughs; with implementing bodies being the City of Bratislava and City Borough New Town)
- Reconstruction of the impermeable surface of public spaces to a new rain-water porous and permeable surfaces (in the Freedom Square; with the main implementing bodies being the City of Bratislava and City Borough New Town).
- Further information about the project can be found on Climate-ADAPT platform website (<http://climate-adapt.eea.europa.eu/metadata/case-studies/eea-grants-supporting-the-city-of-bratislava-to-implement-climate-adaptation-measures>)

In the Figures 10, 11, 12, 13 and 15 there are several examples of adaptation measures from the ongoing project currently being implemented.



**Fig. 10:** Planting new trees and planting trees in previously only paved squares in the Old town. (Photo source: Office of the Chief Architect, City of Bratislava)



Fig. 11: The “Frontiersman Square” (Námestie Hraničiarov) – revitalisation of public space by City Borough Petržalka, (Photo source: Office of the Chief Architect, City of Bratislava)



Fig. 12 The “Frontiersman Square” (Námestie Hraničiarov) – revitalisation of public space in City Borough Petržalka, (Photo source: Office of the Chief Architect, City of Bratislava)





**Fig. 13:** Park on Svoradova Street – example of revitalisation of public place with implementation of demonstration solutions to capture rainwater, permeable surfaces, adding benches and other equipment (Source: <http://www.zelenarchitektura.sk/2015/06/bratislava-sa-pripravuje-na-zmenu-klimy/>)



**Fig. 14:** Construction of new green areas for residents of Bratislava as an area of short-term recreation of a model capturing rain water and other model elements of management of rainwater, planting greenery, creating space for sports and recreational activities by citizens (Borough Bratislava – Nove Mesto) (Source: <http://www.banm.sk/byvaly-cyklisticky-stadion-nahradi-sportpark-%E2%80%9Ejama%E2%80%9C/>)



Fig 15 Central line of trees planted between two road corridors, by City borough – Petržalka (Photo source: Office of the Chief Architect, City of Bratislava)

## 4.2 Implementation of critical infrastructure protection measures

There are a number of critical infrastructure protection measures being implemented in the sectors of water and flood protection, transport, energy, social services and health, and green infrastructure. Table 8 provides an overview of different strategic documents already implemented, under preparation or planned to be implemented in the coming years.

The already mentioned project “The City of Bratislava is preparing for climate change - pilot application of the measures in the field of sustainable rainwater management in urban areas” (supported by EEA grants and Norway Grants, 2014-2017) also includes a **grant scheme aimed at raising awareness and supporting citizens in their efforts in saving drinking water and using rain water instead on their properties**. A total amount of € 50.000 has been made available for this type of activities. The donation is a contribution of maximum € 1000 per project. Eligible applicants are private home owners, NGOs and businesses.

The donation is to cover a maximum of 50% of total costs for the project implementation (using sustainable drainage systems in gardens, establishing green roofs or walls, etc., building infiltration trenches, building rain water reservoirs, use of permeable materials etc.). The grant scheme comes with consultancy for applicants and dissemination activities.

**Tab. 8:** Examples of implementation infrastructure protection measures in selected sectors realised or prepared for realisation in the years 2007-2015

Implemented (critical) infrastructure protection measure	Type of (critical) infrastructure covered	Main implementing body
<p>Between the years 2007-2010 the <b>new system of the Danube flood protection</b> was developed.</p> <p>Technically flood protection is addressed by fixed and mobile barriers.</p>	<p>Water and flood protection</p> <p>The system was completed in 2010 and is designed to protect citizens of Bratislava even in the case of a centennial flood. Bratislava is currently prepared for a millennial flood, with the exception of the boroughs of Karlova Ves, Devín and Devínska Nová Ves, which are protected against centennial flooding.</p>	<p>The physical infrastructure is the property of the Slovak Republic and is administered by the Slovak Water Management Enterprise (SVP), s. p. Bratislava SVP and Bratislava Water Company cooperate on the operation of flood control works.</p>
<p>Cross-sectoral programme includes measures for the operation of green infrastructure, management of rainwater, measures to strengthen social services, energy efficiency, sustainable transport, etc.</p>	<p>Cross-cutting sectors</p> <p>The city Bratislava approved the Programme of Economic and Social Development (PESD), 2009. In the year 2015 the city Bratislava approved Indicative financial part of PESD for the years 2015-2020.</p>	<p>City of Bratislava and its organisations (private and public)</p>
<p>The measures are applied to all relevant sectors where there is access to sustainable energy development: e.g. modernization of buildings, public lighting, public transport, building cycle tracks, consultancy and public education.</p>	<p>Energy</p> <p>Action Plan for the Sustainable Energy for Bratislava (2014) defines the activities of the city aimed at reducing CO<sub>2</sub> emissions. It was treated following the Bratislava's signature of the pan-European initiative, the Covenant of Mayors. The total reduction in CO<sub>2</sub> emissions within the city of Bratislava should reach 20.74%.</p>	<p>City of Bratislava, its organisations and other organisations (private and public)</p>
<p>The measures are aimed at broadening the outreach and mobile forms of social services in the city.</p>	<p>Social services and health</p> <p>These measures are the part of the Community Plan of Social Services City Government Bratislava for the years 2013 – 2018. Bratislava's homelessness strategy should enter into force in 2016.</p>	<p>City of Bratislava in cooperation with private providers of social services, representatives of the City Boroughs and the Bratislava self-governing region</p>
<p>Policy development and maintenance of green areas (realization in 2016-2020)</p>	<p>Green areas – green infrastructure</p> <p>It is an active policy to protect the city's green spaces. It is a part of the measures approved under the</p>	<p>City of Bratislava, its organisations and other organisations (private and public).</p>

Implemented (critical) infrastructure protection measure	Type of (critical) infrastructure covered	Main implementing body
<p><b>Strengthening sustainable transport</b>, e.g. improving the infrastructure for pedestrians, cyclists and public transport, measures to extend cycling, new tramway radials, and a new parking policy etc.</p>	<p>indicative financial part of ESDP for the years 2015-2020.</p> <p><b>Transport</b></p> <p>Transport General for the Bratislava city (2016) defines the future needs of the city transport infrastructure. The document defines the mid-term targets for the development of transport infrastructure, sets out the development priorities and identifies measures and resources to achieve them.</p>	<p>City of Bratislava and the implementation will be carried out in cooperation with the city Public Transport Company Bratislava and other organisations.</p>
<p><b>Implementation is underway (2017)</b></p>		
<p><b>Cross-sectoral documents</b>, includes adaptation measures for the sectors for most relevant climate change impacts: green infrastructure &amp; blue, management of rainwater, measures to strengthen social services, energy efficiency, sustainable transport, health &amp; wellbeing, etc.</p>	<p><b>Cross cutting sectors</b></p> <p>Action plan of adaptation on adverse effects of climate change on the area of the capital city of Slovak Republic. The Action Plan for Adaptation has been in preparation since 2015 as part of the project supported by the EEA Grants and Norway Grants: Bratislava is preparing to the climate change.</p> <p><b>SMART TWIN CITY Bratislava - Framework</b> – this document will provide prospects on the development of the cross border region of Bratislava in terms of the smart city concept, with regard to the different challenges the city is facing including climate change impacts.</p>	<p>The implementation of the Action Plan for Adaptation will be carried out by the City of Bratislava, its city districts as well as the city's organisations and other organisations.</p> <p>This document will require involvement of municipal authorities and different organisation from both countries- the Slovak Republic and Austria.</p>

### 4.3 Role and involvement of stakeholders in implementing measures

It is vital to gain an understanding of which stakeholders are involved in implementing measures for climate change adaptation and critical infrastructure protection. Fig. 14 provides an overview of those stakeholders that are already or will be engaged in the implementation of the abovementioned measures, particularly in the sectors of transport, water, energy, social services and green infrastructure as well as waste management and the ITC sector.

### **First (inner) circle**

Local governments at the city level and at the city borough level play a key role. These two bodies have most responsibilities together with city organisations. They are responsible for land-use planning, public transport, drinking water supply, flood protection, green infrastructure planning and administration, social services, crisis management, security and civil protection of citizens and waste management.

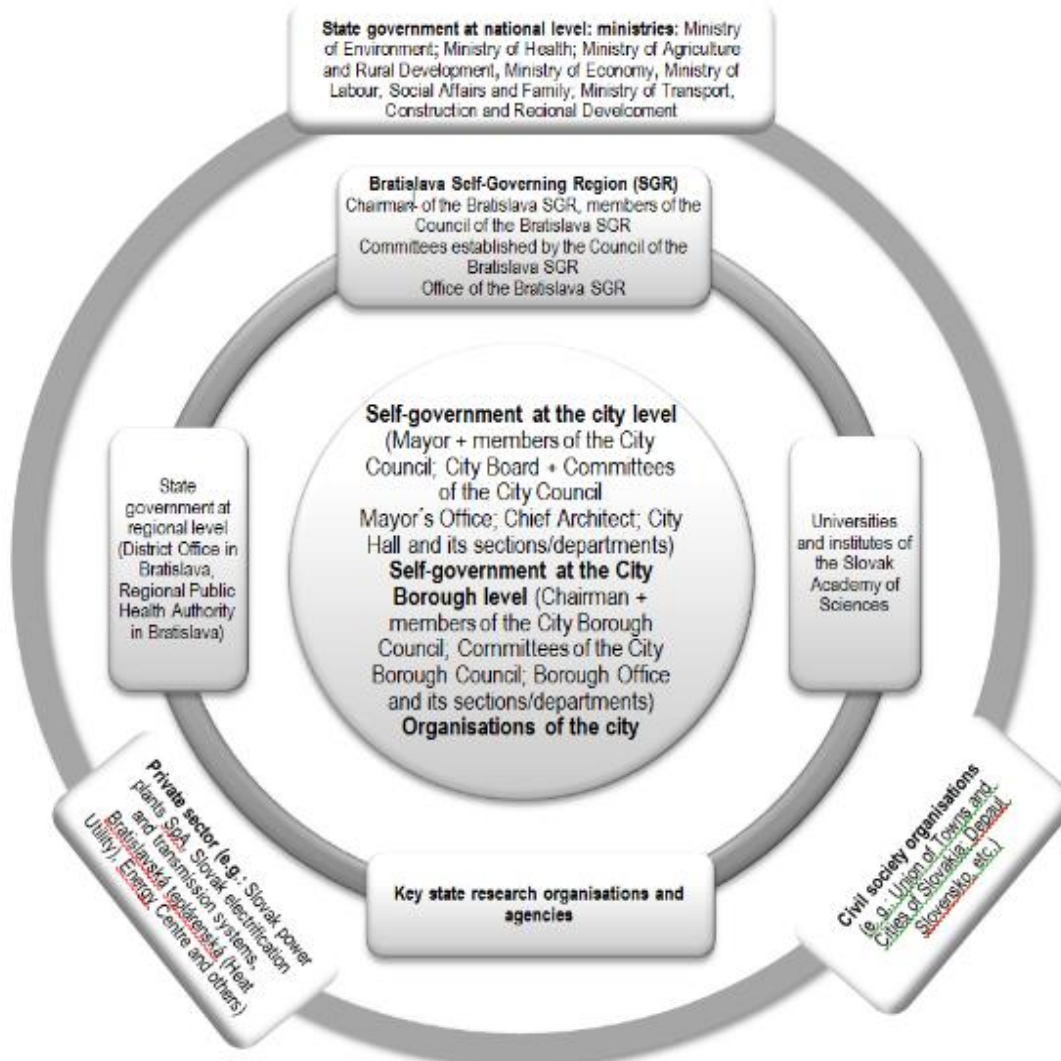
City level governance:

- 45 members of the City Council and Mayor (decision-making process)
- City Board + Committees of the City Council (authorities/organs of the City Council with advisory position)
- Mayor's Office
- Chief Architect
- City Hall and its sections/departments

Governance at the City Borough level (17 City Boroughs where each City Borough has own Mayor, City Borough Council and Borough Office):

- Members of the City Borough Council/Local Council and Mayors of the City Borough
- Committees of the City Borough Councils and also Board of the City Borough (authorities/organs of the City Borough Council with advisory position)
- Borough Office and its sections/dept. (responsibilities: land-use planning of zones and building regulations, environment and waste management. social issues. management, maintenance and construction of local roads, footpaths, cycle tracks etc.)

City organisations of relevance here are the Bratislava Water Company, Waste disposal, Bratislava Integrated Transport, Urban Forests Bratislava, the Zoological Gardens and general investors of Bratislava city.



**Fig. 14:** Overview of key stakeholders engaged (or that will be engaged) in the implementation of adaptation measures in Bratislava city and its boroughs

## Second (surrounding) circle

Where primary stakeholders comprise the inner circle of city partners, the city's next main partners are: the Bratislava self-governing region, the state government at regional level and selected ministries (i.e. state government at national level), key state research institutions and agencies, universities and scientific institutions. Key stakeholders at this secondary level are:

- Bratislava Self-Governing Region (SGR): Members of the Council of the Bratislava SGR and Chairman of the Bratislava SGR; Committees established by the Council of the Bratislava SGR; Office of the Bratislava SGR (Department of Land-use Planning, GIS and environment, Department. for Social Issues, Department of Transport, the department for road transport and railways, and the department for roads)

- State government at regional level is represented by the regional Public Health Authority and the District Office in Bratislava, which encompasses the following departments: Department of Environmental Protection, Department of Land and Forestry, Department of Construction and Housing Policy, Department of Crisis Management and the Department of Road Transport and Roads.
- State government at national level is represented by the following ministries: Ministry of Environment (and Slovak Environmental Inspection); Ministry of Health (and Office of Public Health of the Slovak Republic); Ministry of Transport, Construction and Regional Development
- Key state research organisations and agencies: Slovak Hydro-meteorological Institute, Water Management Research Institute, Water Management Construction, Slovak Water Management Enterprise, Bratislava Branch of the enterprise, Danube Floodplains PLA, PLA Malé Karpaty, PLA Záhorie,
- Universities and institutes of the Slovak Academy of Sciences (SAS) (examples): Faculty of Natural Sciences Comenius University in Bratislava, Institute of Geography SAS., Institute of Landscape Ecology SAS, Slovak University of Technology in Bratislava
- Civil society organisations (examples): City Committee in Bratislava of the Slovak Union of Nature and Landscape, Regional Association for Nature Conservation and Sustainable Development, BicyBa, o. z., Bratislava, Depaul Slovensko, The People in Peril, Fairtrade Slovakia, Pontis Foundation, Bratislava and dozens of other local community organisations and civic initiatives.

### **Tertiary (surrounding) circle**

Tertiary city partners include state government institutions at national level, private sector organisations, other state research institutions and agencies and other universities and civil society organisations:

- State government at national level is represented by the following ministries: Ministry of Agriculture and Rural Development, Ministry of the Economy, Ministry of Labour, Social Affairs and Family (and devices and services for the elderly, children, socially underprivileged and homeless people and social assistance)
- Key state research organisations and agencies: Slovak Environmental Agency, State Nature Conservancy, Research Institute for Soil Science and Conservation, Bratislava, National Forest Centre in Zvolen, Slovak Innovation and Energy Agency, SEA – Slovak Agency for Energy etc.
- Private sector (examples): Slovak power plants SpA, ZSE SpA, Slovak electrification and transmission systems, Bratislavská teplárenská (Heat Utility), Energy Centre, Dalkia and other private companies etc.
- Civil society organisations (examples): Union of Towns and Cities of Slovakia, Bratislava, Daphne - Institute of Applied Ecology, Bratislava, CITENERGO Association etc.

## 4.4 Financial framework and incentives for implementing measures

The adaptation actions will be financed through a number of local, national, and foreign financial sources e.g.:

- Budget of the city and its boroughs
- Operational Programmes (e.g. “Environmental Quality”, “Integrated Regional Operational Programme” and the Operational Programme for Transport)
- JESSICA (Joint European Support for Sustainable Investment in City Areas)
- ELENA (European Local Energy Assistance – financial support from the European Investment Bank)
- IIE (Intelligent Energy for Europe)
- Fund for rural development (e.g. expertise in self-governance and regional NGOs)
- Financial mechanism of the EEA and Norwegian grants and co-financed by the National and municipal budget (15%): This financing mechanism is part of a programme that focuses on adaptation to climate change issues, the protection of water retention capacity of soil, forest and meadows; restoring forest ecosystems, increased soil erosion protection and revitalising waterways; improving the definition of flood plains and areas at risk during flooding; and informing the public about flood prevention measures and preparedness.
- EU programme Horizon 2020
- Life+ Programme (EU's financial instrument supporting environmental, nature conservation and climate action projects throughout the EU)
- INTERREG projects
- Visegrad Fund (i.e. short and long term grants supporting collaboration among Visegrad countries in the culture, research and other activities with the purpose being to facilitate and promote the development of closer cooperation among citizens and institutions in the region as well as between the V4 region and other countries, especially in the Western Balkan and Eastern Partnership regions)

These funds provide financial support through various grants and thematic projects. Examples of special funds for community and local NGOs’ activities include small environmental funds established by large companies, e.g. Orange, Slovnaft, banks, non-profit funds like EkoPolis Foundation and other sources. Local and regional self-government also plays a limited role.

## 4.5 Communication throughout implementation processes

The target audience throughout the implementation process are, depending on the measure concerned, the region, local government, interested environmental NGOs, community initiatives, the wider public, experts (domestic and foreign), city administrators, architects and urban planners, students, other interested groups (young people, elderly people, etc.) and representatives of private firms..



A specialized web page ([www.bratislavazelenajsa.com](http://www.bratislavazelenajsa.com)) and Facebook page (<https://www.facebook.com/bratislavazelenajsa/>) provide updates through various media such as interviews, press releases, press conferences, provide information on workshops, conferences and cooperation with other organisations, e.g. the Slovak Hydro-Meteorological institute, the French Embassy, the Environmental Partnership, Union of Slovak cities and others.

#### **4.6 Monitoring and Evaluation of adaptation and critical infrastructure protection measures**

The City of Bratislava has not yet devised a methodology for monitoring and evaluating the effect of adaptation measures. Identifying indicators for monitoring the progress and effects of adaptation measures is a complex undertaking. Yet, the preparation of a set of such indicators and suitable methodology is planned for the near future. For now, only the costs of adaptation measures that will be implemented within the selected operational programmes for the period 2014 to 2020 will be monitored. For the purposes of monitoring, selected climate measurements will in the near future be collected through measuring devices, which are financed from the budget of the "City of Bratislava is preparing to the climate change - pilot application of the measures in the field of sustainable rainwater management in urban areas" project. The results will feed into the indicators. The City of Bratislava and the Slovak Hydro-Meteorological Institute will sign an agreement on the implementation of the monitoring process (focused on selected climatic characteristics) using new monitoring devices.

## 5 Bratislava's challenges, opportunities and achievements in adapting to climate change impacts and protecting (critical) infrastructure

The vision of the city is that the local government and its city districts will - through active cooperation with external partners and citizens - gradually implement necessary adaptation and mitigation measures with the aim of ensuring adequate quality of life, a healthy natural environment, healthy citizens and long-term security.

### 5.1 Main challenges with regards to adaptation

Some of the main challenges Bratislava is facing in adapting to climate change are:

- **Development and maintenance of green areas:** Need for political support and leadership to protect the city's green areas and work on and approve the program for tree maintenance.
- **Improvement of rainwater management:** Need to implement measures oriented at retaining and entrapping rainwater in the urban area, decreasing the proportion of impermeable areas, creating bio-retentive systems for entrapping and soaking up rain water and building above ground and subterranean reservoirs for rainwater collection.
- **Establishment of a complex monitoring system for environment quality and evaluation of the effect of adaptation measures:** Need to develop and establish a methodology for monitoring and evaluating the effect of adaptation measures and at the same time the need to create a new or improved warning system for critical climatic situations (to be resolved in cooperation with the Slovak Hydro-Meteorological Institute).
- **Creation of a town Health Officer position in the City Hall:** Need to create this position, whose task would be the coordination of medical and hygienic hotspots in the city area, including the negative impact of the climate change as expected summer heat waves, new vector borne diseases, etc.

### 5.2 Main challenges with regards to protecting its (critical) infrastructure

Some of the main challenges and opportunities Bratislava is facing in protecting its critical infrastructure are:

- **Flood protection:** Although built flood protection measures are in place, local flooding still poses a challenge, especially in the smaller tributaries of the Little Carpathians. The issue is particularly acute in the area northeast of Bratislava as part of the Small Carpathians.
- **Collection and treatment of waste water:** Torrential rainfall remains a threat as in some areas the current drains are not capable of carrying the volumes of storm water that accumulate.

- **Strengthening social services:** Particularly social services are in need of support, coordination and setting up new structures (especially for vulnerable population groups) across the city and region.
- **Increasing energy efficiency:** Need to implement actions to improve the energy efficiency of buildings.
- **Construction of cycling infrastructure:** Need to extend, renovate and plan the infrastructure to accommodate the cyclists.

### 5.3 Bratislava's achievements in terms of adaptation to date

The City of Bratislava's achievements in the arena of climate change adaptation are mainly:

- **Involvement in international scientific projects:** This has enabled the city to gain valuable experiences and help it prepare for climate change adaptation, e.g., through the "Green and Blue Space Adaptation for Urban Areas and Eco Towns" (GRaBS) project and RESIN.
- **Working out the Programme of Economic and Social Development of the capital city Bratislava 2010-2020:** This cross-cutting sectoral strategic document addresses the issue of climate change and related adaptation measures and protective measures for critical infrastructure.
- **Participating in the EU-funded CityAdapt project (2012-2013):** The participation of Bratislava in this project led to the preparation of the Adaptation Strategy for Adverse Impacts of Climate Change on the territory of Bratislava (City Hall, 2013), which was approved by the City Council in 2014.
- **Signing of Mayors Adapt:** Mayors Adapt will be realized through the Strategy of Adaptation and the Action Plan for Adaptation for the years 2016-2020 (the last mentioned one is under the preparation).
- **Successful implementation of the "Bratislava is preparing itself for climate change - pilot application of the measures in the field of sustainable rainwater management in urban areas" project** supported by EEA Grants and Norway Grants (2014-2017): A number of adaptation measures have been achieved as part of the project since 2015, e.g., an increase in the area and accessibility of urban green spaces, tree planting, construction of green roofs, sustainable rainwater management) and also the creation of the Action Plan for Adaptation.

### 5.4 Bratislava's achievements in terms of protecting its (critical) infrastructure so far

The achievements in terms of protecting its critical infrastructures by the City of Bratislava are so far:

#### Water (drinking water, treatment of waste water and flood protection)

- New system for flood protection of the Danube was developed between 2007 and 2010: This system is designed to protect citizens of the Slovak capital even if a 1000-year flood event should occur.
- Monitoring of drinking water quality, which is performed by the Bratislava Water Company. This company also owns the online water quality monitoring system.

- Introduction of a separated sewage system in some city districts (with a special system for rain water drainage).

### **Energy**

- Bratislava signed the Covenant of Mayors as approved by the City Council regulation on April 26, 2012. The Covenant of Mayor's objectives are realized through the Sustainable Energy Action Plan (approved in February 2014).

### **Transport**

- A strategic document for the development of public transport in Bratislava for the years 2013-2025 was approved in 2013. Several measures for the promotion of the use of public transport have been realised, i.e. the city has introduced a new bus fleet, simplified ticket purchases via mobile phones and created an integrated system of regional tickets.
- A territorial transport systems is under preparation for Bratislava.

### **Social and health services**

- Bratislava has been a member of the Association of Healthy Cities since 1994.
- The Community Plan for Social Services of the City of Bratislava was approved in 2012: This plan includes detailed measures for the implementation of social services for the years 2013-2018. Bratislava has also a concept for a solution to problems related to homelessness in Bratislava (2013). It included priority solutions for the years 2013-2015.

### **Green infrastructure and urban forests**

- A proposal of the concept for the support of the recreational function and development of the Bratislava forest park was approved in October 2014 by the City Council resolution.
- Built environment and its renovation with an emphasis on quality, green areas, water management, waste and rain water management
- Bratislava is involved in two projects, which are dedicated to the improvement of the refurbishment and renovation of residential buildings, concretely to projects: „European Cities Serving as Green Urban Gate Towards Leadership in Sustainable Energy“ (EU GUGLE, FP 7) and EPO URBAN, which is dedicated to create the pools of experts, that are providing the free consultation services for those who are planning to renovation works with the aim to achieve the higher energy efficiency, the sustainable rainwater drainage systems, create the green roofs on buildings, foster the sustainable practices in waste management, etc.

## 6 Bratislava's needs for adapting to climate change impacts and protecting (critical) infrastructure

An important document, which is currently being prepared and which analyses and evaluates **Bratislava's needs for adapting to climate change impacts and protecting (critical) infrastructure** is the "Action plan of adaptation on adverse effects of climate change on the area of the capital city of Slovak republic in years 2016-2020". The Action Plan for Adaptation has been in preparation since 2015 as part of the project and it is planned to be finalised in early 2017. This strategic document links up with the Adaptation Strategy approved by the City Council in September 2014 and with other commitments adopted by the city. The Action plan for Adaptation also comes from actual tasks, which were defined in the Programme of Economic and Social Development for the period 2015-2020. The Action Plan for Adaptation will be approved not just by the City Council, but also by councils of all city districts. Currently its draft is in the process of review.

Five key strategic adaptation goals representing the main needs for the city were proposed based on the proposals of working group members:

### 1: RISK AND VULNERABILITY ASSESSMENT

In order to identify the vulnerable groups of citizens and critical infrastructure and risk-prone areas, the first goal is to do a risk and vulnerability assessment (including a spatial analysis) considering the expected increase in the number of extremely hot days and average daily temperature, irregularity and changes in rain distribution in terms of time periods as well as intensity and increase in the number of extreme weather situations, especially windstorms, local floods and decrease of water resources capacity.

### 2: MAINSTREAMING ADAPTATION INTO POLICIES AND DECISION-MAKING

By mainstreaming adaptation to climate change into decision-making and approving acts, local politics and regulations as well as strategies and planning processes, Bratislava can increase its capacity to respond to changing risks and impacts related to a changing climate.

### 3: AWARENESS, INFORMATION SHARING, PARTICIPATION AND COOPERATION

The goal is to implement adaptation measures, which will support awareness raising among scientific and lay audiences about the effects of climate change on life in the city and deepen their understanding of the importance of green and blue adaptation measures. In order to reach this goal, the city has to be active in communication and cooperation with all relevant stakeholders (city districts, local communities, non-governmental organizations, partner organizations of the city, the regional government, research organizations etc.) in mainstreaming and implementing adaptation measures.

### 4: CLIMATE NEUTRAL CITY

Through innovation, the goal is to harmonize future and existing adaptation and mitigation measures across all relevant sectors with the aim to initiate a shift towards an emission neutral city.

### 5: EVALUATION OF THE ADAPTATION PROCESS OF THE CITY

Continuously monitor and evaluate the fulfilment of the Action Plan tasks and consequently increase the functionality and quality of the self-evaluation system

In order to fulfil the 5 strategic goals, actions in the following sectors or areas of adaption will be taken:

- Citizen health & wellbeing;
- Green and blue infrastructure;
- Urbanized areas (special focus on public space);
- Water security;
- Transport;
- Energy industry;

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