02.09 Management of Rain and Waste Water 2022

Introduction

Precipitation and waste water from private households, public institutions, industry and trade, as well as run-off from public road areas, generate large quantities of rain and waste water in Berlin. These need to be drained, and if necessary, treated. In 2022, some 680,000 m³ of waste water from private households, trade, industry and public institutions, as well as rainwater from Berlin and its surrounding areas was treated in the sewage plants per day. This volume corresponds to a rate of almost 8 m³/sec. It therefore represents about 15 % of the run-off of the Unterhavel river below Berlin at average water flow. The amount of waste water produced in Berlin could fill the Großer Wannsee lake in three weeks.

A sewerage network with a total length of 9,768 km, operated by the *Berliner Wasserbetriebe* (BWB, Berlin Waterworks), is used for the disposal of waste water. It was constructed based on two different systems, the **combined** and the **separate sewerage system**, and consists of a total of 4,421 km of waste water drains, 1,927 km of combined water drains and 3,349 km of rainwater drains, as well as numerous other drains and structures, serving special purposes, such as rainwater overflows, retention basins and culverts. With the help of 166 pumping stations and a network of 1,194 km of pressurised sewage pipes, the collected waste water is pumped to the sewage plants.

The combined sewerage system was built from 1873 onwards to drain the entire urban area of Berlin as it was then. It was based on a design by James Hobrecht. However, towns and communities outside the historic city centre of Berlin and Spandau, which were independent until 1920, mainly built systems based on separate drainage. After their incorporation into Berlin, their facilities were combined into today's two systems. Drainage areas are aligned with river courses and canals, and follow elevations. The boundaries of the drainage areas differ from those of the boroughs. About four fifths of Berlin's areas connected to a sewerage system are drained by the separate system, and the remaining fifth by the combined system (SenStadt 2001).

The Separate System

In the separate system, waste water and rainwater are discharged into two separate networks. **Waste water drains** carry household, commercial and industrial waste water to the pumping stations. It is then sent to the Ruhleben, Münchehofe, Schönerlinde, Waßmannsdorf, Wansdorf, and Stahnsdorf **sewage treatment plants** via pressurised pipes. The sewage plants discharge treated water into Berlin's bodies of water.

Pumping stations are usually equipped with **emergency outlets**, via which waste water can flow into the receiving bodies of water in case of a technical defect. Of the 77 emergency outlets, 29 lead to the Spree, 3 to the Dahme, 18 to the Havel, and 20 to the Teltowkanal; 6 connect to standing surface waters, and 1 emergency outlet is connected to other pumping stations via sewage drains. Emergency outlet activity varies greatly from year to year.

Rainwater drains collect precipitation from impervious surfaces, cooling water from factories, and water from drainage ditches. This is carried directly to smaller or larger surface waters. In some cases, very large areas of the city drain into very small receiving waters. In total, the separate sewerage system discharges some 50 million m³ of rainwater into Berlin's water bodies per year (SenStadtWohn 2017). **Rainwater** from the separate sewerage systems is heavily **polluted** by dust, air pollutants, rubbed-off road surface and tire particles, leaked oil, leaves, animal faeces, road grit in winter etc. Especially in small standing waters and canals with a relatively small water volume, heavy rainfalls have been causing fish die-off. This is due to depletion processes caused by organic matter starting to decompose as soon as it is discharged into the water and the resulting oxygen consumption. To reduce the pollution of water bodies, retention basins and retention soil filters have been installed at the main discharge points to treat the rainwater. By 2022, 32 rainwater treatment facilities were put into operation by the Waterworks. More than ten additional facilities have already been set up along the city motorways.

Tab. 1: Treated wastewater volume and receiving waters of the large sewage plants in Berlin and surroundings in 2022			
Sewage treatment plant	**Treated waste water volume in 2022 (m³/day)**		**Receiving water bodies**
	Total	**Of which surrounding (%)**	
Ruhleben	248,708	-	Summer season: Teltowkanal via pipes, at almoust 1 m³/s via Spree; Winter season: Spree
Schönerlinde	106,742	13	Tegeler See via Blankenfelder Graben/ Nordgraben and Lietzengraben via Schönungsteiche; after 2015 partially via Panke into Spree
Münchehofe	38,644	50	Spree via Erpe
Waßmannsdorf	208,800	9	Teltowkanal and Havel via Nuthegraben/ Nuthe
Stahnsdorf	51,900	44	Teltowkanal
Wansdorf	24,716	91	Havelkanal
Total	**679,510**	**14**	

Tab. 1: Treated wastewater volume and receiving waters of the large sewage plants in Berlin and surroundings in 2022

Furthermore, there are some areas along the inner city boundaries which were originally equipped with a combined sewerage system, but later received a rainwater drainage system (a modified combined sewerage system). Rainwater continues to be discharged, however, into the rainwater overflows of the combined sewerage system.

The Combined System

This system almost completely drains the old city centres of Berlin and Spandau also including the area surrounded by the inner S-Bahn Circle Line (city rail). In this **combined sewerage system**, household, commercial and industrial waste water as well as rainwater is collected in **one drain**, and then sent to the next pumping station. From there, the combined sewage usually takes the same route as the sewage from the separate sewerage system. The existing combined sewerage system network is comprised of 16 storage sewers and rainwater overflow basins as well as 9 other facilities, such as weirs (as of 2022), in which the combined sewage is retained when it is raining and fed into the sewage treatment plant with a time delay. During short periods of heavy rainfall, the network is therefore able to collect all of the combined sewage. Long-lasting, heavy rain, however, forms an exception to this rule. As soon as the water has reached a certain level in the drains, or the pumping stations can no longer cope with the volume of water they receive, the combined sewage – which mainly consists of rainwater (at a ratio of about 1:9 of waste water to rainwater) during such downpours – flows untreated into the water bodies via **rainwater overflows**.

The combined sewage overflow depends on the weather. Annual analyses reveal how strongly it fluctuates. Between 2012 and 2022, the number of days on which an overflow of combined sewage was registered ranged between 31 and 69 days per year. The overflow volume ranged between 0.78 to 7.22 million m³ per year.

When analysing days with a recorded overflow of combined sewage, it should be noted that heavy rain often occurs locally and the overflow of combined sewage is confined to a limited area and period of time.

In order to achieve the environmental objectives of the Water Framework Directive and to meet the requirements of the water authorities' permission to discharge combined sewage into Berlin's bodies of water, the BWB and the Senate launched a construction programme to create a total of 300,000 m³ of

retention capacity (current storage capacity is about 264,000 m³) in the inner-city combined sewerage system by 2024. This will considerably reduce the overflow frequency and volume of combined sewage flowing into the Berlin water network.

Areas without Rainwater Drainage

On the outskirts of the city, there are areas which are connected to a sewerage system that does, however, not include rainwater drains. In these areas, rainwater seeps into the ground. **Local rainwater management** therefore means that rainwater is not discharged into a water body. This not only reduces peak runoff during rainfall events in the sewerage system and thus in the water body, it also increases the evaporation capacity in the vicinity of the site, which may improve the microclimate. In addition, it may also increase groundwater recharge (SenUVK, 2018). **Decoupling measures** help to tap into this positive potential. In recent years, decoupling measures and other rainwater management measures have often already been applied in the planning of new construction areas and are now mandatory for new buildings. As part of these measures, more rainwater is retained in the area (SenUVK, 2018, see BReWa-BE, SenUMVK 2021). Areas with local rainwater management still need to be defined accurately. Existing green roofs have already been mapped in the Environmental Atlas Map 06.11.

In rare cases, rainwater from roads is discharged into the waste water drainage system. These roads are marked as such on the map.

Areas without Waste Water Drainage

Despite considerable efforts by the Berlin Waterworks (BWB), not all inhabited areas have been connected to the sewerage network as yet. In those built-up areas of Berlin with no house connections, sewage is collected in **septic tanks with no discharge**, from where it is taken to sewage treatment plants by authorised transport companies.

There are also many areas that are connected to the rainwater drainage system, but do not have waste water drainage. Most of these areas are roads and paths. In some cases, however, this is also true for other areas. Roofs of railway facilities or car parks near green spaces are often connected to the rainwater drainage system. Waste water does not usually accumulate on those surfaces.

Separate maps were developed to document the runoff situation exploring the discharge of rainwater into bodies of water. They show the **catchment areas of the rainwater drainage** (Map 02.09.2 and 02.09.3). Each area connected to the rainwater drainage system is matched to the water body into which the rainwater is discharged.

Statistical Base

The following were used to determine the type of drainage and the catchment areas of the rainwater drainage systems:

- Data on waste water, combined water and rainwater drains (Drainage network map) including the pressurised sewage pipes (ADL) of the Berlin Waterworks, as of December 2022 (BWB 2022),
- Catchment areas of the drainage system of the Berlin Waterworks, as of October 2022 (BWB 2022a),
- Type of drainage of road areas, analysis by the Berlin Waterworks, as of October 2022 (BWB 2022b),
- Urban and Environmental Information System (ISU5) - spatial reference 2020, as of Decemeber 31, 2020 (SenSBW 2022),
- Actual Use of Built-up Areas / Inventory of Green and Open Spaces 2020, as of December 31, 2020 (cf. Environmental Atlas 06.01, 06.02 SenSBW 2020a) and
- Impervious soil coverage data, as of June 2021 (cf. Environmental Atlas 01.02, SenSWB 2021).

The Environmental Atlas data on the “Management of Rainwater and Waste Water” of block and block segment areas was already compiled in 1992 and has been updated several times since then.The current 2022 version includes a separate evaluation of the road areas for the first time.

Methodology

The **type of drainage** and the **catchment areas of the rainwater drainage system** of the block and block segment areas were updated and the road areas were mapped for the first time using the information presented in the chapter “Statisical Base”.

Blocks and block segment areas

The allocation was carried out largely automatically based on the connections located in each block and block segment area, depending on the type of connection. Due to the different mapping scales of the block and block segment areas and the drainage network plans, positions had to be adjusted slightly. The documentation (HYDOR 2023) presents the methodology in more detail. The catchment areas of the rainwater drainage system were largely assigned based on available catchment area data of the BWB’s individual rainwater drainage systems (HYDOR 2023). **Block** and **block segment areas** as displayed on the map were always allocated as a whole to one of the categories or one of the first-receiving water bodies, even in the rare case that individual properties or block segments are drained differently from the rest of the block area. The block and block segment areas were automatically assigned to exactly one type of sewerage system based on the type of connections present and the information as to whether these are connected to combined systems, waste water or rainwater drains. In ambiguous cases, they were allocated based on the predominant type of connection. This means that a new **processing method** was used compared to the 2017 edition. The reason for this was that in the current edition, data on connection points was available for the first time. In contrast to previous editions, all block and block segment areas were taken into account, including green and open spaces. The process of categorising blocks and block segment areas into the prevailing drainage system in the area was refined using available data on land use and the degree of imperviousness for blocks and block segment areas. This was followed by a manual check and corrections where necessary. Whether and to what extent the properties are actually connected to a drainage system or the rainwater from the impervious surfaces is actually discharged into rainwater drains varies greatly at times. The accompanying text to the Map “Surface Runoff from Precipitation” (02.13.1) documents the corresponding data, based on information from the BWB and contains generalised connection rates for a variety of building structure types (SenStadtWohn 2017, Table 1). The proportion of the impervious area that is actually connected to the drainage system depends on the location within the city, the building structure and the degree of imperviousness.

In some cases, the data bases do not provide information on the type of drainage. This is especially true of large-scale **industrial and commercial areas**, where the type of waste water and/ or rainwater disposal is not evident from the BWB’s maps of the drainage networks. Some of these areas discharge their rainwater directly into water bodies via private drains.

In areas with **separate sewerage systems,** rainwater is discharged into water bodies. For every block or block segment area with rainwater drains, the **first-receiving water body** into which the rainwater drain discharges its water was defined. As part of the 2022 update, the information on the first-receiving water bodies was reassigned and subjected to random checks in the process. The results are presented in two Environmental Atlas maps on the topic of “Catchment Areas of Rainwater Drainage”. In the map “Catchment Areas of Rainwater Drainage differentiated”, 259 sections of first-receiving water bodies are presented into which rainwater is discharged. The second Environmental Atlas map “Catchment Areas of Rainwater Drainage”, combines these first-receiving water bodies into groups for a better overview. The map therefore shows the catchment area sections that are connected to the water body via the rainwater drainage system.

Road areas

With the current update, **road areas** were analysed independently of the block and block segment areas for the first time. Whether a road area is connected to a drainage system was evaluated based on its location, rainwater connection points and pipes (BWB 2022b). The sections of the first-receiving water bodies were assigned based on the same method used for the block and block segment areas (HYDOR 2023).

Map Description

02.09.1 Type of Drainage

About 58 % of Berlin's total area is connected to the drainage system. Of that area, 81 % is drained by the separate sewerage system, the remaining share (19 %) by the **combined sewerage system**. This reperesents 11 % of the total urban area. Figure 1 presents the area shares by drainage type. The part of the urban area with separate drainage is divided into the following systems: the **separate sewerage system with waste water and rainwater drainage** accounts for the largest share (22.8 % of the urban area), followed by the **separate sewerage system with waste water drainage but without rainwater drainage** (e.g. in areas where rainwater percolates completely) with 15.2 %. A share of 7.5 % represents areas with **rainwater drainage but without waste water drainage.** These are almost always road areas or isolated block and block segment areas, mainly traffic areas. Areas where rainwater drains into the **overflows of the combined sewerage system** constitute a unique case of the **separate sewerage system**. Thus, 0.9 % of Berlin's area is connected to the waste water and rainwater drainage system and discharges water into the overflows of the combined sewerage system. In addition, 0.4 % of the area only has rainwater drainage and also discharges water into the overflows of the combined sewerage system.

Built-up residential areas without drainage include those block and block segment areas that are not connected to the drainage system and contain areas that are both built-up and impervious. These block and block segment areas are particularly prominent in the current update, accounting for 7.1 % of the total area. This is due to the new method in which the built-up area was evaluated based on the degree of imperviousness (cf. Environmental Atlas Map 01.02, SenSBW 2021). In previous editions, imperviousness was not taken into account, instead certain types of use were associated with being undeveloped and not connected to the drainage system. These areas are mainly drained via septic tanks. Transport companies then take the waste water to sewage treatment plants. Almost half of the areas are allotment gardens and weekend cottage areas, i.e. areas that have not been evaluated thus far. Similarly, a considerable proportion of the areas are block and block segment areas with very few structures, such as parks, cemeteries or forest areas with isolated buildings.

Approximately 35% of Berlin's total area is either **not connected to the sewerage network** or the Berlin Waterworks have not provided information on the areas (private drainage).

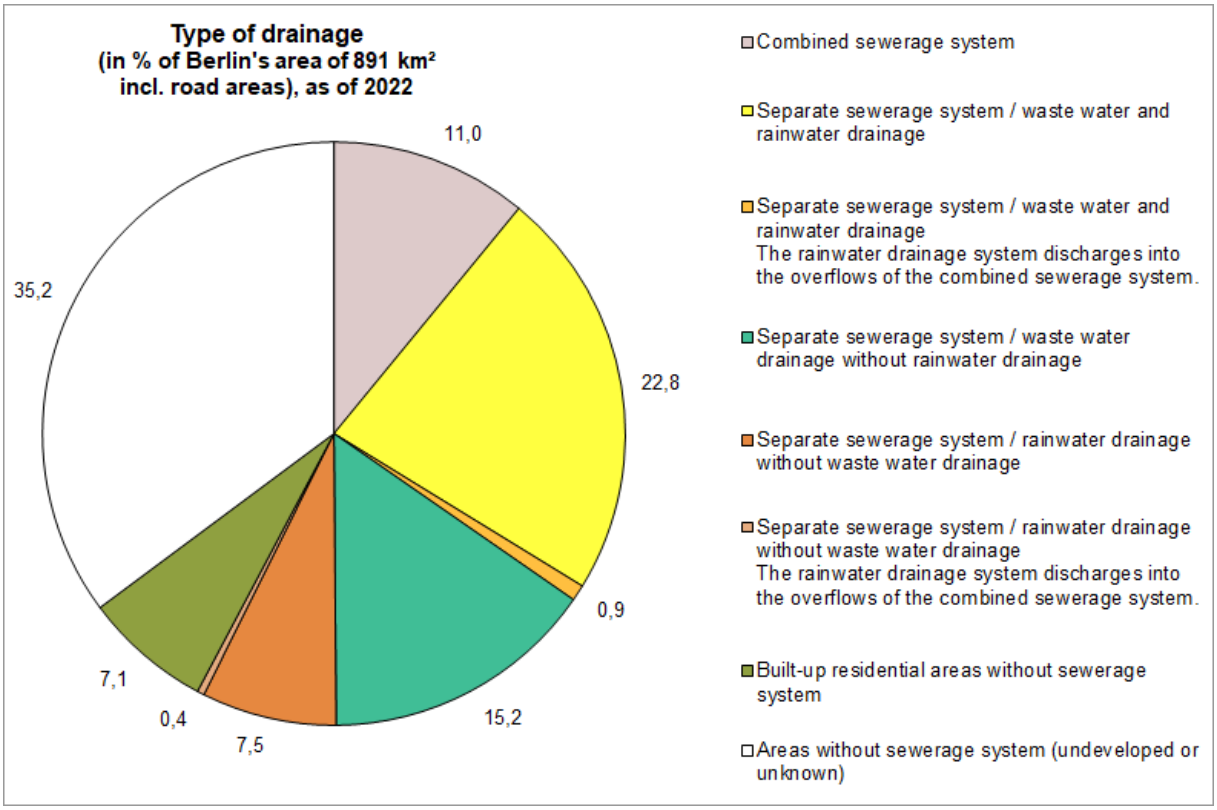

Fig. 1: Type of drainage in % including road areas (891 km²), as of 2022

In recent years, **increased construction activity** and the associated increase in both impervious areas and the efforts of the Berlin Waterworks to **expand the sewerage network** into previously unconnected residential areas have resulted in new areas being connected to the drainage system. At the same time, the decoupling of already connected areas became a goal and has already been implemented in many cases. This is mainly done in areas with combined systems in order to reduce the overflow of combined sewage into water bodies.

Local rainwater management in which the rainwater is not discharged but percolates or is used directly on site, is not yet included in the current map “Type of Drainage”.

A look at how the different systems are distributed across the urban area reveals the following key areas.

In the **inner-city areas** of Wedding, Tiergarten, Mitte, Prenzlauer Berg, Friedrichshain, Kreuzberg Schöneberg, parts of Neukölln and Wilmersdorf, Westend and in the **old town of Spandau**, waste water and rainwater is drained together via the **combined sewerage system**.

The boroughs of Reinickendorf, Lichtenberg, Marzahn-Hellersdorf, Treptow-Köpenick, Steglitz-Zehlendorf and the **outer areas** of the boroughs of Pankow, Neukölln, Tempelhof-Schöneberg, Charlottenburg-Wilmersdorf and the majority of Spandau are connected to the **separate sewerage system**.

In Berlin, the most common type of **separate sewerage system** is that of **rainwater drainage combined with waste water drainage**. Areas with this type of system are mainly found in the outer areas. This is the case for the boroughs of Spandau, Reinickendorf, Pankow, Lichtenberg, Marzahn-Hellersdorf, Treptow-Köpenick, Neukölln, Tempelhof-Schöneberg and Steglitz-Zehlendorf, as well as some south-western parts of Wilmersdorf-Charlottenburg, a small area in the north-eastern part of Mitte, and the Stralau peninsula in the south-eastern part of Friedrichshain.

Rainwater drains which connect to the rainwater overflows of the combined sewerage system were built in some parts of Wilmersdorf, Weißensee and Spandau, as well as areas of Charlottenburg along Schloßstraß in order to reduce the load on the combined sewerage system. In these areas, waste water continues flow into the combined drains. There are also areas without waste water drainage in these regions. Their **rainwater drains also connect to the rainwater overflows of the combined sewerage system**. These are mostly road areas.

In areas with **waste water drainage but without rainwater drainage**, rainwater may percolate in a controlled or uncontrolled manner. These areas are distributed across all regions with separate sewerage systems and are often found on the outskirts of the city.

The development of Category I old settlement areas (main areas to be connected to a sewerage system) has been completed (House of Representatives of Berlin 2009). The development of the Wartenberg settlement area was also completed in 2018. There are still further old settlement areas without sewerage systems. It was decided that the sewage development of five of these areas (Biesenhorst, Buchholz Nord I, Schönholz, Karow Süd, Karow Ost) would be completed by 2030. The strategy for the remaining eight old settlement areas (Schmöckwitz-Werder, Schmöckwitz Schwarzer Weg, Neu-Venedig, Rahnsdorf-Süd, Siedlung Schönhorst, Siedlung Spreewiesen, Gatow Siedlung Habichtswald, Blankenfelde Altsiedlung) will be decided at a later stage.

What is more, there is still a variety of individual roads, that has not yet been connected to the central waste water treatment system either (gap closure areas). These will be developed successively.

02.09.2 Catchment Areas of Rainwater Drainage

Depending on the main receiving water body, the catchment areas of rainwater drainage systems are part of the catchment areas of the **Spree and Dahme** rivers in the eastern and southeastern areas of Berlin, of the **Havel** river in the northern, northwestern and southwestern parts of Berlin, and of the catchment area of the **Teltowkanal** in the south of the city.

Lakes, park lakes, ponds and other drainage basins are spread over the entire area of the city.

Since the combined system prevails within the area of the **inner S-Bahn Circle Line**, and rainwater only rarely enters the water system, it was not assigned to any rainwater drainage catchment area. Exceptions are parts of Tempelhof and Wilmersdorf, north of the urban motorway, which drain into the canals south of the Spree (the Neuköllner Schifffahrtskanal and the Landwehrkanal) and the Alt-Treptow area, which drains into the Spree. Other exceptions include smaller areas that are located in a combined

system area but are connected to a separate system locally, such as the Nikolaiviertel and individual roads that have separate drainage.

Tab. 2: Rainwater discharge into the drainage system - catchment areas and impervious area connected to the system, as of 2022

Water body section number	Catchment areas by water body section	Total area [km²]			of which impervious area [km²]				of which impervious and connected [km²]			
		Block and block segment areas	Road	Total	Buildings (built-up, im-pervious)	other im-pervious area (paths, parking areas)	Road	Total	Buildings (built-up, im-pervious)	other im-pervious area (paths, parking areas)	Road	Total
110	Oberhavel (city border to above mouth of Tegeler See)	0,6	0,3	0,9	0,1	0,1	0,2	0,5	0,1	0,0	0,2	0,4
120	Oberhavel (mouth of Tegeler See to Schleuse Spandau)	3,0	0,8	3,8	0,8	0,7	0,7	2,2	0,6	0,5	0,7	1,8
130	Tegeler See	1,8	0,4	2,2	0,5	0,5	0,4	1,4	0,4	0,3	0,4	1,1
131	Tegeler Fließ	2,3	1,0	3,3	0,6	0,3	0,9	1,8	0,3	0,2	0,9	1,4
132	Nordgraben	8,5	2,0	10,5	2,1	2,0	1,7	5,8	1,6	1,2	1,7	4,5
133	Panke north of Verteilerbauwerk	4,7	0,8	5,5	0,8	0,9	0,7	2,4	0,5	0,6	0,7	1,8
210	Unterhavel from mouth of Spree to Jungfernsee (excl. Wannsee)	13,1	2,9	16,0	2,5	2,9	2,5	7,9	1,9	1,8	2,5	6,3
220	Großer Wannsee	1,2	0,4	1,6	0,2	0,1	0,4	0,7	0,1	0,1	0,4	0,5
230	Kleine Wannseekette	0,8	0,3	1,1	0,2	0,1	0,2	0,5	0,1	0,0	0,2	0,4
310	Müggelspree (including Großer Müggelsee, Dämeritzsee and Erpe)	5,9	1,3	7,1	1,2	1,2	1,0	3,5	0,9	0,7	1,0	2,7
320	Langer See, Dahme and Große Krampe	4,1	1,1	5,2	0,8	0,9	0,9	2,6	0,6	0,5	0,9	2,0
330	Stadtspree to Britzer Verbindungskanal branch-off	5,9	1,3	7,2	1,3	1,5	1,1	4,0	1,1	1,0	1,1	3,2
331	Wuhle	15,6	3,9	19,5	2,7	3,4	2,9	9,0	2,1	2,1	2,9	7,1
340	Stadtspree to Landwehrkanal branch-off	4,5	1,2	5,7	0,9	1,2	1,0	3,2	0,8	0,7	1,0	2,5
350	Rummelsburger See	8,1	1,6	9,6	1,9	2,7	1,4	6,0	1,6	1,8	1,4	4,8
351	Marzahn-Hohenschönhausener Grenzgraben	15,6	2,5	18,2	3,0	4,7	2,1	9,8	2,4	3,1	2,1	7,7
380	Stadtspree to Berlin-Spandauer-Schifffahrtskanal branch-off	4,8	1,2	6,0	1,4	1,3	1,1	3,8	1,1	0,8	1,1	3,0
390	Stadtspree to mouth	6,5	1,0	7,4	1,3	1,6	0,9	3,7	1,0	1,0	0,9	2,9
400	Canals north of Spree	6,5	1,0	7,5	1,3	2,5	0,9	4,8	1,1	2,0	0,9	4,0
401	Panke (from Verteilerbauwerk to Nordhafen)	13,6	3,4	17,0	3,3	3,1	2,9	9,3	2,6	1,9	2,9	7,3
500	Canals south of Spree (Neuköllner Schifffahrtskanal and Landwehrkanal)	4,7	1,8	6,6	1,6	1,4	1,7	4,7	1,4	0,9	1,7	4,0
600	Teltowkanal	47,2	11,1	58,3	12,7	10,0	9,7	32,3	9,0	5,9	9,7	24,6
610	Rudower Arm	18,3	4,5	22,8	4,4	4,0	3,9	12,3	3,0	2,2	3,9	9,1
620	Britzer Verbindungskanal	2,0	0,5	2,5	0,6	0,6	0,4	1,6	0,5	0,3	0,4	1,3
810	Grunewaldseenkette	7,7	2,6	10,3	1,8	1,5	2,3	5,7	1,3	0,9	2,3	4,5
820	Flughafensee	4,8	1,0	5,8	1,6	1,4	0,9	3,9	1,3	0,9	0,9	3,1
830	Biesdorfer Baggersee	2,4	0,7	3,1	0,4	0,6	0,6	1,6	0,3	0,4	0,6	1,2
840	Fauler See/Obersee	1,0	0,3	1,2	0,3	0,2	0,2	0,7	0,2	0,1	0,2	0,5
850	Schäfersee	1,7	0,5	2,2	0,5	0,5	0,4	1,4	0,5	0,3	0,4	1,2
860	Groß-Glienicker See	0,0	0,1	0,1	0,0	0,0	0,1	0,1	0,0	0,0	0,1	0,1
900	Small bodies of water (ponds, water holes, ditches)	9,4	3,1	12,5	2,0	1,5	2,6	6,0	1,2	0,8	2,6	4,6
	Separate sewerage system, total	226,4	54,6	281,1	52,9	53,5	46,7	153,1	39,6	33,3	46,7	119,6
	Combined sewerage system	75,4	22,2	97,6	26,8	20,4	20,9	68,1	23,4	13,6	20,9	57,9
	Total of all areas with rainwater drains (combined and separate systems)	**301,9**	**76,8**	**378,7**	**79,8**	**74,0**	**67,6**	**221,3**	**63,0**	**46,9**	**67,6**	**177,5**

Tab. 2: Rainwater discharge into the drainage system - catchment areas and impervious area connected to the system, as of 2022

Table 2 shows the total area of the catchments for each water body section. Based on the most recent mapping of the degree of imperviousness of the block and block segment areas from 2021 (cf. Environmental Atlas 01.02, SenSBW2021), it is also possible to identify impervious areas within the catchment areas. As already described, however, not all impervious areas within blocks and block segment areas with rainwater drainage are completely connected to the rainwater drainage system. Table 1 of the accompanying text to the Environmental Map 02.13.1 “Surface Runoff from Precipitation” (SenStadtWohn 2017) was used to establish the **impervious area** for each block and block segment area that is **actually connected**. This table contains consolidated actual connection rates for each Urban Structure Type (Area Type), divided into buildings, roads and other impervious areas. The connection rate in the area types of the outer areas therefore indicates that, in some cases, only 30 % of the impervious areas are connected. For road areas, it was assumed that 100 % of the impervious parts are connected. The actual connection rate may vary considerably locally, but the figures nevertheless provide some insight into the characteristic properties of the catchment areas.

Table 5 of the accompanying text to Map 02.13.1 “Surface Runoff from Precipitation 2017" shows the discharge volumes into Berlin’s water bodies grouped together by section. Part of the surface runoff in the area of the combined system enters the water bodies directly via the emergency outlets of the pumping stations and the rainwater overflows of the sewerage network during heavy rainfall. The remaining part is transported to the sewage treatment plants. After appropriate waste water treatment, it is then discharged into the water bodies together with the treated waste water.

The **Teltowkanal** (including the Rudower Arm) has the largest catchment area of the rainwater drainage system with more than 81 km². It is followed by the **Wuhle** with a catchment area of 20 km² and the **Panke** (from the Verteilerbauwerk) with approx. 17 km². Most of the rainwater from the 98 km² combined sewerage system flows into the sewage treatment plants (cf. Environmental Atlas “Surface Runoff from Precipitation” 02.13.1, SenStadtWohn 2017).

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