01.06 Soil-Scientific Characteristic Values (Edition 2009)

Overview and Statistical Base

In addition to a survey of the distribution and heterogeneity of the particular soil associations in the municipal area (cf. Map 01.01), data on their **ecological properties** are of great importance for statements regarding the qualities, sensitivity and pollution of the soil. This involves primarily characteristic values regarding the chemistry, the physical state and the water balance of the soil. The quality of these characteristic quanta is determined primarily by the soil associations, but it is substantially influenced by current land use.

The soil-scientific characteristic quanta described here have been derived from the soil associations under consideration of land use (cf. Maps 06.01 and 06.02). The assumption was that given a certain land use, the quality of the characteristic soil values for certain soil associations would be identical, in the context of the required precision of statements, for all lots of such a combination.

The characteristic quanta for every **combination of land use and soil associations** were determined as representative values from existing documents. The data were primarily taken from the assistance manual for the maps of soil associations (Dissertation, Grenzius 1987), in which landscape segments and sample profiles on particular soil associations are documented, based largely on measurements by the Institute for Soil Science at the Technical University of Berlin. In addition, various other soil-scientific maps were evaluated. Moreover, it was possible to access the results of the extensive soil analyses of the heavy-metal investigation program for humus content and pH values.

If no measurements were available for certain combinations, the values were assessed by expert evaluations, using data of comparable uses or comparable soil associations. Due to the in many cases very different number of measurements available per combination and the great variety of analogical evaluations, **the precision of the values given varies greatly**.

For most characteristic quanta, the data refer to the topsoil (0 - 10 cm) and the subsoil (90 - 100 cm) separately.

Due to the map scale, the units given in the legend of the soil map refer to soil associations the soils which in many cases show very heterogeneous soil-ecological qualities. The **complexity** of the ecological conditions, with the assigned typical values which refer to a single characteristic soil type of the respective soil association, is **represented in greatly simplified terms**. Therefore, the soil-scientific database contains, in addition to the representative value (e.g. typical pH value), the maximum and minimum values available from the corresponding evaluations.

For these reasons, the maps are therefore designed **only as general maps** for the scale 1:50,000, and cannot replace site-specific investigations in particular cases.

01.06.1 Types of Soil

Description

The soil type of a particular soil is determined by the grain size composition of its mineral components. **Coarse soil** (grain diameter >2 mm) and **fine soil** (grain diameter <2 mm) types are distinguished. In addition, in very wet locations, **peat** is formed by the accumulation of incompletely decomposed plant material, which overlays the mineral soils.

Fine Soil Types

Fine soil types are formed from certain proportions of the grain fractions clay, silt and sand. The main soil types are subdivided into **clay, silt, loam and sand**, with loam representing a grain mixture of sand, silt and clay. Soil type is an important identification value for the derivation of such ecological qualities as nutrient and pollutant retention capacity, hydrologic budget and retention capacity, and filtration and buffering capacity for pollutants.

Coarse Soil Types

All mineral components of the soil >2 mm in diameter are described as **coarse soil** types, or the soil skeleton. The proportion of coarse soil has an effect on water permeability, air and nutrient balance, and the capacity to bind nutrients and pollutants. The higher the share of coarse soil, the more permeable a soil is, due to the large pores, while the capacity to bind and the nutrient level depend on the type of fine soil.

Types of Peat

Peat is formed in a water-saturated environment from the accumulation of incompletely decomposed plant material. It is characterized by a high water-retention capacity and a very high cation exchange capacity. Various types of peat can be distinguished, according to the type of plant remains and the formation conditions. Bog peat is rich in alkalines and nutrients, and in many cases, even in carbonates. Transition-mire peats include plant remains from both low and high-nutrient locations.

Methodology

The fine, coarse and peat soil types, each differentiated between topsoil and subsoil, were determined for each soil association. The data were essentially taken from the profile sections by Grenzius (1987). Some values have been supplemented by expert evaluations.

The mapped **fine soil** types are summarized in Table 1. Since the types of soil are in many cases different in the topsoil and the subsoil, respectively, due to the material of which the soil was originally formed, to the soil development and to its use, they have been examined separately. In addition, soil types occurring frequently within a soil association are identified as the main soil type, and distinguished from the more rarely occurring soil types, known as subsidiary soil types.

Type of soil	**Designation**	**Mapped** in Berlin	**Type of soil**	**Designation**	**Mapped** in Berlin
fS	fine sand	x	Su2	weakly silty sand	x
gS	coarse sand		Su3	medium silty sand	x
Ls2	weakly sandy loam		Su4	strongly silty sand	
Ls3	medium sandy loam	x	Tl	loamy clay	
Ls4	strongly sandy loam	x	Ts2	weakly sandy clay	
Lt2	weakly clay loam		Ts3	medium sandy clay	
Lt3	medium clay loam		Ts4	strongly sandy clay	
Lts	sandy clay loam		Tt	pure clay	
Lu	silty loam	x	Tu2	weakly silty clay	
mS	medium sand	x	Tu3	medium silty clay	
Sl2	weakly loamy sand		Tu4	strongly silty clay	
Sl3	medium loamy sand	x	Uls	sandy loamy silt	
Sl4	strongly loamy sand	x	Us	sandy silt	x
Slu	silty loamy sand		Ut2	weakly clay silt	
Ss	pure sand		Ut3	medium clay silt	x
St2	weakly clay sand		Ut4	strongly clay silt	
St3	medium clay sand		Uu	pure silt	

Table 1: Types of Soil and their Occurrence in Berlin (partially from Soil-Scientific Mapping Directive 1994)

Those soil associations which have largely the same fine soil types for the topsoil and for the subsoil were combined to a **soil type group**. The assignment of soil type groups has thus been done merely for the sake of a readable map with an easily comprehensible number of legend units. For details or further calculations, more precisely differentiated data are available. Soil associations occur which consist of the same soil types, both in the topsoil and in the subsoil. However, the majority of soil associations differ in terms of soil types between the topsoil and the subsoil.

The combination of the types of soil of the topsoil with those of the subsoil resulted in 14 soil type groups of fine soil (<2 mm), which are represented by the legend units of the map.

However, the soil associations of a soil type group may differ within this group with regard to peat or stone content (soil skeleton, coarse soil >2 mm) of the topsoil and subsoil, so that these have been represented by additional designations.

The **coarse soil types** in the Berlin soils are compiled in Table 2. Their occurrence in the topsoil and the subsoil, respectively, is distinguished.

Type of Coarse Soil	Designation
o2	Low proportion of round stones
x2	Low proportion of sharp stones
x3	Medium proportion of sharp stones
fG1	Very low proportion of fine gravel

Table 2: Designations of Coarse Soil Types Occurring in Berlin Soils (Soil-Scientific Mapping Directive 1994)

The **types of peat** occurring in Berlin are compiled in Table 3. For the representation of their ecological qualities and the ascertainment of their characteristic values, a distinction is made between peat occurring in the topsoil and the subsoil, respectively. If several peat types occur in a soil or a soil association, only the characteristic type of peat is taken into account (characteristic peat type).

Type of Peat	Designation
Hn	Bog peat
fHn	Fossile bog peat
Hu	Transition-mire peat

Table 3: Name of Peat Types Occurring in Berlin Soils (Soil-Scientific Mapping Directive 1994)

01.06.2 Utilizable Capillary Capacity of Flate Root Plants

Description

Utilizable capillary capacity is quantity (nFK) of water in l/m^2 or mm which soil can carry and is usable for plants.This kind of water stays in pores of soil due to the binding capacity and plants can use it. nFK depends on type of soil humus content, compaction and stone contents. Fine soil can store more water than coarse soil, water seep away quickly in coarse soil therefore plants cannot use it. High humus contents and peat shares increases water storage.

Methodology

nFK values of soil asssociations and soil types were taken from profile section drawings by Grenius (1987). There are two types of zones: flate root zone (0-3 dm) and deep root zone (0-15 dm). Minimum and Maximum value of nFK for flate root zone are defined by soil type of soil association, who shows the highest and lowest nFK values. Additionaly typical nFK value is determined for respective rootzones. In this map only the typical value of flate root zone is given.

Detailed research of Soil Associations on eastern part of Berlin based on geology was carried out by AEY (1993).

In 2005 nFK-values indicated by Grenzius (1987) were also slighltly distinguished and further corrected. Results were summarized in six levels (Tab.1) by Grenzius (1987). None of these levels were in Soil-Scientific Mapping Directive (1994).

nFK [mm]		**nFK Level**	
flate root zone (0-3dm)	**deep root zone (0-15dm)**		
< 20	< 60	1	very low
20 - < 40	60 - < 120	2	low
40 - < 60	120 - < 180	3	medium moderate
60 - < 80	180 - < 240	4	moderate high
80 - < 110	240 - < 320	5	high
>= 110	>= 320	6	very high

Table 1: Utilizable Capillary Capacity for Flate and deepzone in (mm) and their evaluation according to GRENZIUS (1987)

01.06.4 Utilizable Capillary Capacity of the Effective Root Zone

Description

An assessment of the hydrologic budget via the utilizable capillary capacity in the effective root zone (nFK_{We}) yields a differentiated analysis of the water available to plants at any location. The different rooting depths and root zones are taken into account, in accordance with soil type and use. Thus, forests and groves have a considerably greater root zone than, e.g. garden uses. In sandy soils, the effective root zone is lower than in loamy soils. In loamy soils, precipitation water is retained longer than in sandy soils, so that it is advantageous for plant roots, in terms of the water and nutrient balance, to develop a larger root zone than in sandy substrata. In boggy soils, the effective root zone only extends down to the zones affected by groundwater, so that only the top 20-30 cm usually serve as a root zone. The reason for the shallow root zone is the lack of air in the permanently water-saturated zones. Therefore, with the exception of some specialist plants, roots are confined to the upper zones, which conduct both sufficient air and water.

The additional water supply to the plants from the capillary rise of the groundwater during the vegetation period, which decisively influences the nFK_{We} at low land-parcel intervals, was not taken into account in the present investigation.

Methodology

The ascertainment of the nFK_{We} for soil associations in dependence on actual land use was carried out by the soil science branch of the TU Berlin in the context of an expert report (Plath-Dreetz/ Wessolek/ Renger 1989).

First, the effective root zones for Berlin locations appropriate to the respective uses were taken from Table 1. Based on the depth of the effective root zones, the usable capillary capacities ascertained for each zone for the sample profiles documented by Grenzius (1987) were added up to form the nFK_{We}. Appropriate correction factors for organic substances were taken into account. Since different soil types appear within a soil association, a range is derived which can be described by the minimum and maximum value of the nFK_{We} per soil association. In addition, the typical nFK_{We} value for the respective soil association, which is represented in the map, is determined depending on use.

	Farmland Gardens Cemeteries	**Grass-land**	**Forest**	**Parks**	**Allotment Gardens**
Sands	6	5-6	10	7	6
Loams	7	6-7	12	8	7
Boggy soils (groundwater influenced)	-	2-3	4	4	4

Table 1: Depths of the Effective Root Zone (in dm), by Soil Type and Use (Plath-Dreetz et al. 1988)

The results were compiled in five stages (Tab. 2):

nFK_{We} [mm]	**Stage**	**Designation**
< 60	1	very low
60 - < 140	2	low
140 - < 220	3	medium
220 - < 300	4	high
>= 300	5	very high

Table 2: Gradation of the Utilizable Capillary Capacity of the Effective Root Zone (Soil-Scientific Mapping Directive 1994)

01.06.5 Humus Quantities

Description

The organic fraction of soils consists of the transformed remains of dead plants and animals. The **humus** is formed by mulch and humin materials. The high sorption capacity of the humin materials, the high share of nutrients available to plants, and favorable qualities for the hydrologic budget characterize many soil functions. The humus content of mineral soils is determined by soil genesis and use. Such uses as horticulture with introduction of compost, or intensive pasturing favor humus enrichment, while other uses show a considerably lower organic-substance content (cf. Tab. 1).

Wet vegetation locations, e.g. flood-plain soils and mires, have high biomass production but low humus reduction. The enriched organic substance is present in the form of **peats** of varying degrees of decomposition. Fens and bogs have organic substance contents of 15 - 80 %, depending on their use and the degree of decomposition of the peat. The prerequisite for a high of organic substance content is permanent wetness in the topsoil and near-natural utilization, such as an extensive pasturing.

The **humus quantity** represents the quantity of organic substance present at a location for a defined soil lot, depending on soil type and land use. The amount of humus is primarily an indicator of the nitrogen stock and the easily mobilizable nitrogen proportion. But other important nutrients such as potassium, calcium, magnesium and phosphorus are also released and made available to plants by means of the decomposition and humification of organic substances. In addition to the availability of nutrients, the amount of humus functions as a nutrient and water reservoir, and is able to bind pollutants to a high degree. The humus quantity of a soil depends on the humus content and the thickness of the humus zone. This differs according to soil type and use. Thus, for example, damp boggy locations with high biomass production and low decomposition have a high humus quantity, and sandy dry soils with low vegetation coverage have a low humus quantity.

Methodology

The average humus content of mineral soils depending on soil type and use was taken from investigations by Grenzius (1987) and soil analyses performed under the heavy-metal investigation program (1986, 1987). These data were initially evaluated by Fahrenhorst et al. (1990) and the average humus content ascertained for the characteristic soil type of the various soil associations at different uses An expansion of the database using various specific mappings was carried out in 1993 (Aey 1993). A rough orientation, purely by use, is compiled in Table 1.

Use	**Humus content [Mass %]**
Residential areas	5
Mixed areas	3
Core areas	3
Trade and industrial areas	3
Special uses, supply facilities	3
Weekend home areas	6
Forest	4
Grassland	12
Farmland	3
Parks, green spaces, city squares	3
Cemeteries	4
Allotment Gardens	6
Fallow areas, meadow-like vegetation	3
Fallow areas, bushes, trees	4
Camping and sports facilities	4
Tree nurseries	4

Table 1: Average Humus Contents by Use, compiled from Fahrenhorst et al. (1990)

The humus contents of peats formed at wet locations are not taken into account for mineral soils; their contents and thicknesses are listed separately in the investigation of humus quantity.

Humus quantity was ascertained from humus content of the humus layer, taking into account peat quantity [mass %] and the effective retention density and thickness of the organic zones.

Humus quantity ascertained for the various locations was broken down into five stages, according to Table 2.

Humus Quantity [kg/m^2]	**Stage**	**Designation**
0 - < 5	1	very low
5 - < 10	2	low
10 - < 20	3	medium
20 - < 100	4	high
100 - < 2000	5	very high

Table 2: Gradation of Humus Quantity, according to Results from Berlin Soils (Gerstenberg & Smettan, 2005)

01.06.7 pH Values of Topsoil

Description

The pH value (soil reaction) influences the chemical, physical and biological qualities of the soil. It affects the availability of nutrients and pollutants, and provides information about the ability of the soil to neutralize acids or bases. It is important for the filtration and buffering capacities of soils. Thus, at low pH values, no acids can be neutralized in the soil, the heavy-metal connections increasingly dissolve and the available nutrients are largely washed out.

Methodology

The pH values were derived from existing documents for the soil associations, taking land use into account. The data were essentially taken from the profile sections in Grenzius (1987). Some values have been supplemented by expert assessments, in most cases using a great variety of different soil-scientific reports. If there were no measurements, the values were assessed using data of comparable uses or comparable soil associations. In addition to the representative values (typical pH values) for the topsoil and subsoil, the respective maximum and minimum values were also determined.

In the map only pH-value of topsoil was given. This pH value of topsoil is more important for determination of soil functions than pH value of subsoil and shows greater operational differences.

The gradation of pH values, was carried out according to the Soil-Scientific Mapping Directive (Bodenkundliche Kartieranleitung) (1994) in the levels1 - 12, from extremely alkaline to extremely acidic (cf. Tab. 1). This gradation permits the soil reaction to be differentiated according to its alkalinity or acidity.

pH value	**pH level**	**Designation**
>=11	1	extremely alkaline
10 - < 11	2	very strongly alkaline
9 - < 10	3	strongly alkaline
8 - < 9	4	medium alkaline
7.5 - < 8	5	weakly alkaline
7 - < 7.5	6	very weakly alkaline
6.5 - < 7	7	very weakly acidic
6 - < 6.5	8	weakly acidic
5 - < 6	9	medium acidic
4 - < 5	10	strongly acidic
3 - < 4	11	very strongly acidic
< 3	12	extremely acidic

Table 1: pH Level (Soil-Scientific Mapping Directive, 1994) changed

01.06.8 Sum of Interchangable Basics Cation of Topsoil (S-Value)

Description

Interchangable cations of soil usually subdivided into acidic and basic cation. Acidic cations such as hydrogen ions (H-ion) causes hydrolysis, so release H-ion,above all Al; the sum is called as H-value. Basic cation are in first line Ca^{2+}, K^{+} Mg^{2+} and Na^{+}, in agricultural soil (after fertilizing) also, NH_4^{+} (where mostly Ca^{2+} is more than 80 % dominant). The sum of it makes S-value. Its concentration could be givenin mol_c/kg, quantity in mol_c/m². Percentage share of S-Value of Interchangable cation is named as Alkaline Saturation.

S-value describes the quantity from soil related to plants nutrients cations and is also important for fertility of soil.

Methodology

Quantity of basic interchangable Ions (S-Value) for topsoil (here 0-3 dm) can be calculated through multiplication of effective cation interchagable capacity (KAK_{eff}) with Alkaline saturation, considering storage thickness and coarse soil share.

Calculation of effective cation interchangable capacity is given in map 01.06.09. Alkaline saturation can therefore be calculated from pH value ($CaCl_2$).

Ascertainment is accomplished using the pH value typical of the location of the topsoil,(cf map 01.06.07) and the alkaline saturation according to Table 1. Then a linear interpolation between these pH stages of this table is carried out.

pH ($CaCl_2$)	**BS [%]**	**pH ($CaCl_2$)**	**BS [%]**	**pH ($CaCl_2$)**	**BS [%]**	**pH ($CaCl_2$)**	**BS [%]**	**pH ($CaCl_2$)**	**BS [%]**
3	2	4	18	5	47	6	77	7	97
3.1	3	4.1	20	5.1	50	6.1	80	7.1	98
3.2	4	4.2	23	5.2	53	6.2	82	7.2	98
3.3	5	4.3	25	5.3	56	6.3	85	7.3	98
3.4	6	4.4	28	5.4	60	6.4	87	7.4	99
3.5	7	4.5	31	5.5	63	6.5	89	7.5	99
3.6	9	4.6	34	5.6	66	6.6	91	7.6	99
3.7	11	4.7	38	5.7	69	6.7	93	7.7	100
3.8	13	4.8	41	5.8	72	6.8	95	7.8	100
3.9	15	4.9	44	5.9	75	6.9	96	7.9	100

Table 1: Relationship between Alkaline Saturation (BS) in % and pH ($CaCl_2$) of Mineral Soil Zones in Berlin (Grenzius 1987)

In table 2 S-values are classified into 1-10 levels (extremely low –very high).

BS [mol_c/m².**]**	**Level**	**Designation**
<1	1	extremely low
1- < 2	2	very low
2-<3.5	3	moderate to very low
3.5-< 5	4	moderate low
5 -<10	5	low
10-<25	6	moderate
25-<50	7	medium
50-<100	8	moderate high
100-<200	9	high
>=200	10	very high

Table 2: Gradation of S-Value (Schlichting et al. 1995 Gerstenberg and Faensen-Thiebes 2005)

Subdivision of low level values have marginal difference,to show for evaluation of function “living space for near naturalness and seldom plant societies” necessarly accurate level of poor nutrient soil.

01.06.9 Mean Effective Cation Exchange Capacity

Description

The effective cation exchange capacity (KAK_{eff}) represents the quantity of cations bound to soil colloids, taking into consideration the strongly pH-value-dependent charge of the organic substances. The interchangeable cations are bound to clay minerals and humus colloids. In neutral to weakly acidic soils, calcium (Ca), magnesium (mg), potassium (K) and sodium (Na) dominate the sorption complex; in acidic soils, e.g. pine and heath locations, aluminum (Al), hydrogen (H) and iron (Fe) predominate. The binding capacity of organic substances is considerably higher than that of the clay minerals. The strength of the bond with the organic substance is pH-dependent, while the bond with clay minerals is independent of the pH value. Thus, the binding capacity of the humus drops with the pH value. Clay and humus-rich soils with neutral soil reaction can therefore bind considerably more nutrients and pollutants, and prevent a washout of these substances into the groundwater, than can sandy, humus-poor locations. Effective cation exchange capacity is therefore useful for describing the nutrient and pollutant binding potentials of soils.

Methodology

The KAK_{eff} of the soil associations is derived from the main soil type of the topsoils and subsoils, as in (Table. 1). Topsoil is assumed to have a depth of 0 - 1 dm; the subsoil 3 - 15 dm. The exchange capacity of the humus (Table 3), corrected by a pH-dependent factor (Table 2), is added to the averaged cation exchange capacity of the main and subsidiary soil types. Since both the humus contents and the thickness of the humus layer may differ, depending on soil genesis and use, and since these are also incorporated into the calculation of the KAK, different use-specific values are ascertained for each soil association.

Type of Soil	KAK_{eff} [cmol/kg]	Type of Soil	KAK_{eff} [cmol/kg]	Type of Soil	KAK_{eff} [cmol/kg]
fS	2	Sl3	6	Ts4	15
G	2	Sl4	9	Tt	39
gS	2	Slu	9	Tu2	29
Ls2	13	St2	6	Tu3	21
Ls3	12	St3	11	Tu4	18
Ls4	12	Su2	2	Uls	9
Lt2	17	Su3	4	Us	5
Lt3	22	Su4	4	Ut2	9
Lts	19	Tl	29	Ut3	11
Lu	15	Ts2	28	Ut4	14
mS	2	Ts3	20	Uu	6
Sl2	4				

Table 1: Average KAK Values of the Soil Types (Soil-Scientific Mapping Directive, 1994)

pH value ($CaCl_2$)	pH factor
< 3.5	0.15
3.5 - < 4.5	0.25
4.5 - < 5.5	0.4
5.5 - < 6.5	0.6
6.5 - < 7.5	0.8
>= 7,5	1

Table 2: pH factors for the Determination of the Effective KAK of the Humus Fraction (Soil-Scientific Mapping Directive 1994)

Humus content [Mass %]	KAK_{pot} [$cmol_c$ / kg]
0 - < 1	0
1 - < 2	3
2 - < 4	7
4 - < 8	15
8 - < 15	25
15 - < 30	50
30 - 100	110

Table 3: Relationship between Humus Content and Potential KAK (Soil-Scientific Mapping Directive 1994), supplemented by Z3 peat

The values ascertained have been assigned to the stages 1 -5, from very slight - very great, according to the Soil-Scientific Mapping Directive (1994) (Table 4).

KAK_{eff} [cmolc / kg]	Level	Designation
0 < 4	1	very low
4- < 8	2	low
8-< 12	3	medium
12-< 20	4	high
< = 20	5	very high

Table 4: Effective Cation Capacity Levels (Soil-Scientific Mapping Directive 1994),

01.06.10 Water Permeability (kf)

Description

Water permeability (saturated water conductivity, kf value) indicates the permeability of soils. It depends on the soil type and storage density of the soil. Loose soils with high sand contents therefore have a considerably higher permeability than do clay-rich soils consisting of till. Water permeability is important for the evaluation of storage wetness, filtration qualities, erosion vulnerability and drainage effectiveness of soils. The speed of water permeability is given in m/s or in cm/d. The data on speed of water movement apply only to completely water-saturated soil, in which all pore spaces are filled with water. As a rule, terrestrial soils display non-saturated water conditions, with only a portion of the pores filled with water; at such non-saturated conditions, water movement is considerably slower. In addition, a large portion of the available water is taken up by the plants and is not available for flow. Since measurement of non-saturated water conductivity (ku) is very expensive and complicated, so that no accessible data are available in the Soil-Scientific Mapping Directive (1994), the attested values for saturated water conductivity are used in scientific practice as a rough measure.

The influence of the coarse soil was not taken into account.

Methodology

The kf value for the main soil types of the topsoil and the subsoil according to Table 1 was taken. The kf value for the topsoil and subsoil is the average of the topsoil kf and the subsoil kf. The kf values listed in the Table depending on soil type are based on an effective storage density of Ld3, which corresponds to the average for Berlin soils.

Type of soil	kf value [cm/d]	Type of soil	kf value [cm/d]
fHn	30	Slu	11
fS	106	Ss	229
fSms	169	St2	79
gSfs	130	St3	17
Hn	30	Su2	88
Hu	30	Su3	32
Ls2	20	Su4	24

Ls3	7	Tl	3
Ls4	14	Tt	2
Lt2	9	Tu2	5
Lt3	10	Tu3	28
Lts	6	Tu4	28
Lu	18	Uls	14
mS	427	Us	10
mSfs	221	Ut2	7
mSgs	281	Ut3	8
Sl2	49	Ut4	9
Sl3	33	Uu	7
Sl4	21		

Table 1: Water Permeability in Water-Saturated Soil (kf value) by Soil Type at the Mean Effective Retention Density of Ld3, Supplemented by Medium-Decomposed Peat (Z 3) at Medium Substance Volume (SV 3); from the Soil-Scientific Mapping Directive (1994).

For representation on the map, the results of water permeability have been categorized in six stages, from very low to extremely high (1 -6), as shown in Table 2.

kf value [cm/d]	Stage	Designation
0 - < 1	1	very low
1 - < 10	2	low
10 - < 40	3	medium
40 - < 100	4	high
100 - < 300	5	very high
>= 300	6	extremely high

Table 2: Classification of Water Permeability in Water-Saturated Soil (Soil-Scientific Mapping Directive 1994)

Literature

[1] **Aey, Dr. Wolfgang 1993:**
Zuordnung von Bodenkenngrößen zu Bodengesellschaften und Nutzungen. Im Auftrag der Senatsverwaltung für Stadtentwicklung und Umweltschutz.

[2] **Bodenkundliche Kartieranleitung 1994:**
4. Auflage; Hannover 1994.

[3] **Fahrenhorst, C, Haubrok, A. & Sydow, M. 1990:**
Übernahme der Bodengesellschaftskarte Berlin in das Umweltinformationssystem Berlin und Zuordnung von Bodeninformationen. Im Auftrag der Senatsverwaltung für Stadtentwicklung und Umweltschutz.

[4] **Gerstenberg, J.H., Faensen-Thiebes, A., 2005:**
Stufung der Nährstoffversorgung für die Bodenbewertung, Berlin, not published.

[5] **Gerstenberg, J.H. & Smettan, U., 2009:**
Erstellung von Karten zur Bewertung der Bodenfunktionen, im Auftrag der Senatsverwaltung für Stadtentwicklung, Berlin 2009.
(Download pdf; 1,9 MB)

[6] **Grenzius, R. 1987:**
Die Böden Berlins (West). Diss. TU Berlin.

[7] **Plath-Dreetz, R., Wessolek, G. & Renger, M. 1988:**
Analyse von Bodengesellschaften, Versiegelung, Vegetation und Grundwasserflurabstand zur Bestimmung der Grundwasserneubildung in Berlin. Teil 2, Gutachten im Auftrag der Senatsverwaltung für Stadtentwicklung.

[8] **Schlichting, E., Blume, H.-P., Stahr, K. 1995:**
Bodenkundliches Praktikum.

[9] **Schwermetalluntersuchungsprogramm 1986, 1987:**
Schwermetallgehalte im Oberboden. Im Auftrag der Senatsverwaltung für Stadtentwicklung und Umweltschutz, Berlin, not published.