PROLINE-CE

WORKPACKAGE T2, ACTIVITY T2.1

SET UP OF PILOT SCECIFIC MANAGEMENT PRACTICES

D.T2.1.4 DESCRIPTIVE DOCUMENTATION OF PILOT ACTIONS AND RELATED ISSUES

PILOT ACTION 3.2: *ALONG DANUBE BEND*

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Lead Institution	General Directorate of Water Management
Contributor/s	
Lead Author/s	Agnes Tahy
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Contributors, name and surname	Institution
Magdolna Ambrus	General Directorate of Water Management OVF
Orsolya Both	General Directorate of Water Management OVF
Ágnes Tahy	General Directorate of Water Management OVF
Róbert Hegyi	General Directorate of Water Management OVF
Tamás Belovai	General Directorate of Water Management OVF

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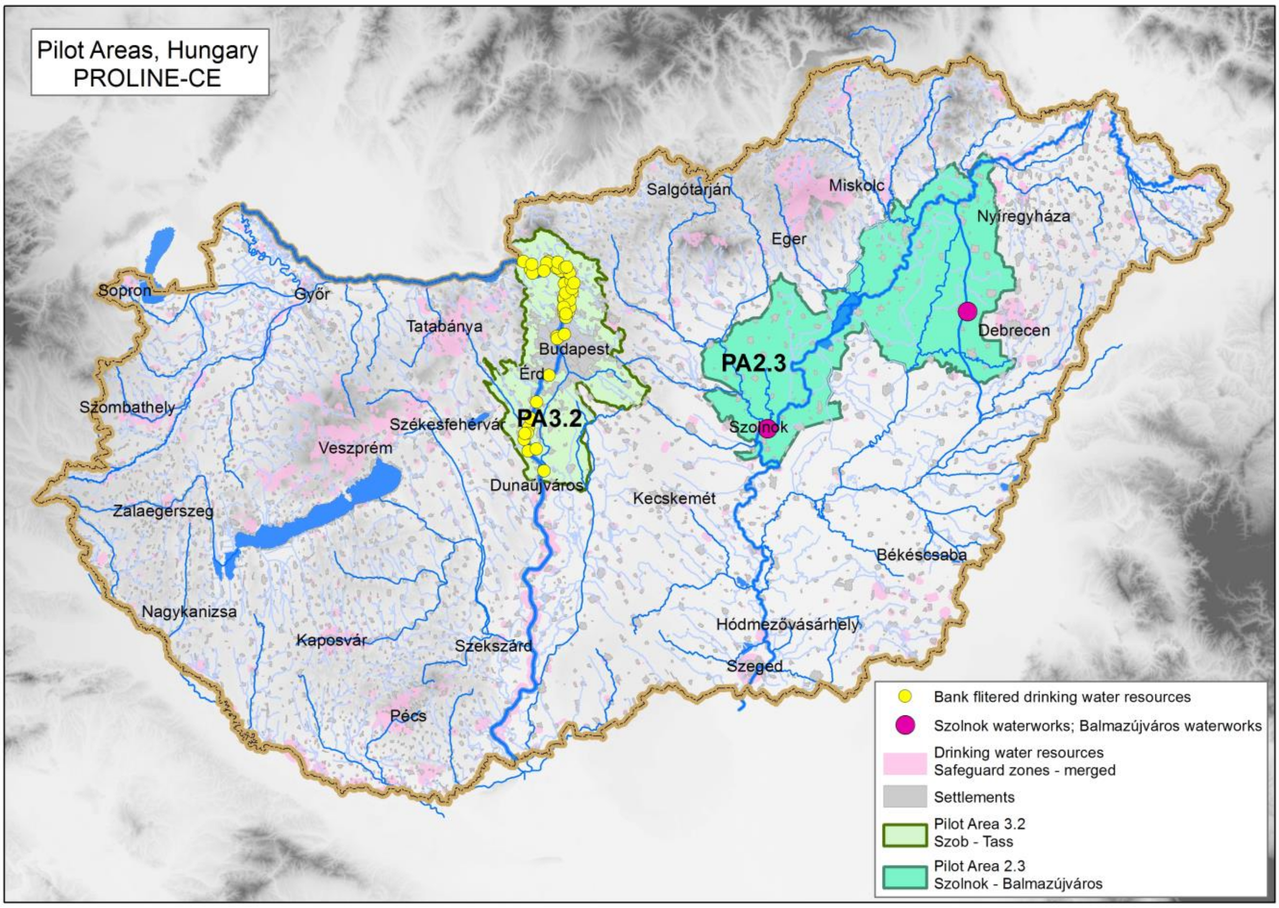
1. Introduction

The most important water supply area in the country is the bank-filtered water resources on the right and left bank of the Danube and on the Szentendrei and Csepel Islands. The bank-filtered water resources located in the pilot area supply with drinking water mainly Budapest and about 150 settlements in agglomeration, about 2.5 million inhabitants.

The land use of the pilot area is very complex, in the north is mountainous, in the middle there are densely urban areas and the capital, in the south and on the islands agricultural lands are found.



1. Figure Location of the PA3.2 Along Danube Bend.

2. Basic data about pilot action

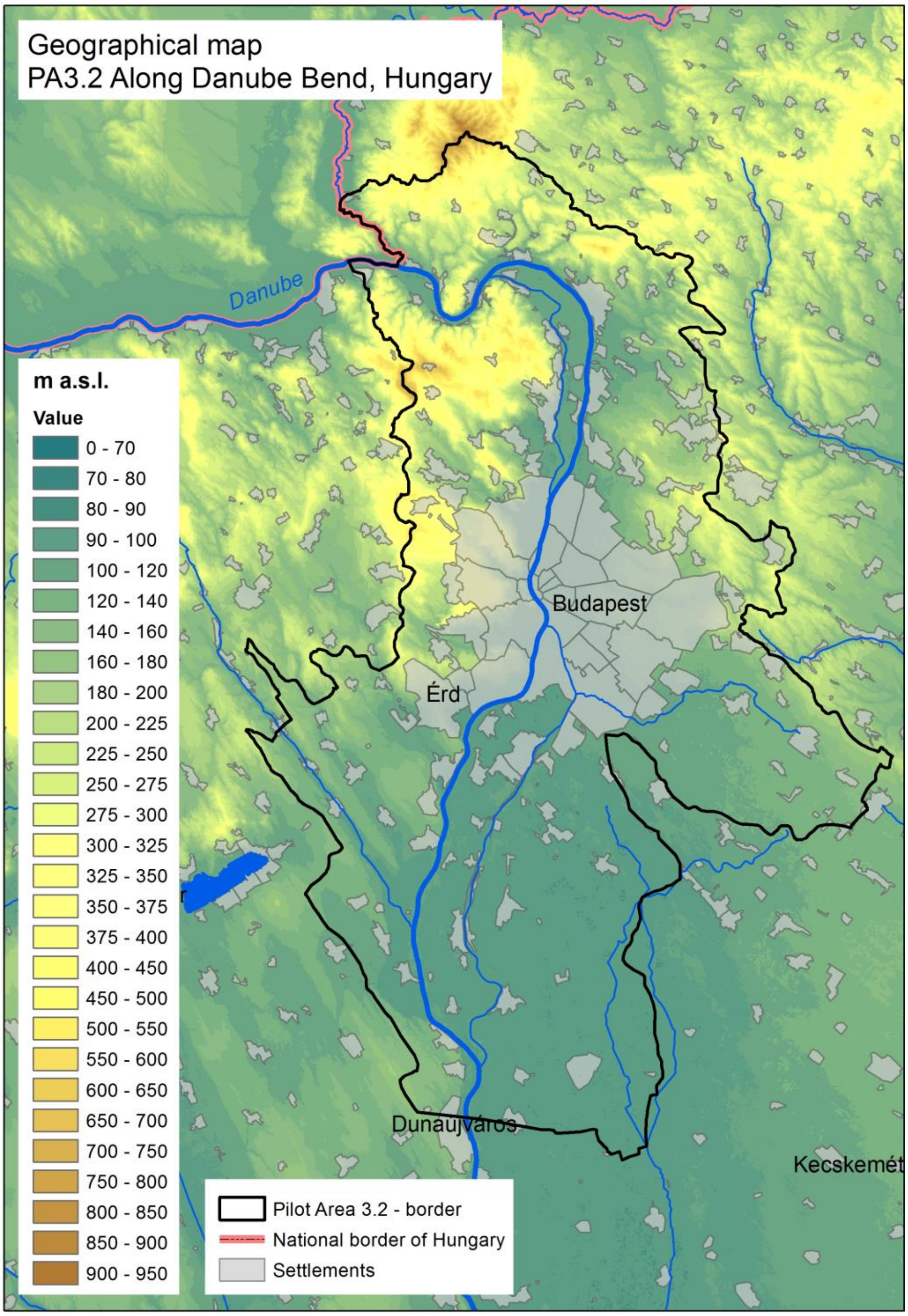
2.1. Geographical description

The Pilot Area is located in the northern part of Central Hungary, in section of Danube between Szob and Tass. The geographic structure of the area is very diversified: on the left bank includes the southern part of Börzsöny, the western edge of the Gödöllő hills and the Pesti plain with the alluvial cone- terraces. It belongs on the right bank, among the parts of the Dunántúli Mountains: the Visegrád Mountains, the Pilis, the Buda Hills and the northern part of the Mezőföld emerging from the southern.

The pilot area includes the municipality Budapest, the Szentendre Island, in north of it, and the Csepel Island, in south of the capital. On these islands are located the two most important bank-filtered drinking water resources of Hungary, that provide the drinking water supply of the capital.

The Szentendre Island is a very distinct geographic, hydrogeological, habitat and settlement geographic unit. The island is surrounded by the Danube and Szentendre-Danube branch. It is 30,85 km long, with an average width is 2,3 km, its maximum width is 3,5 km and its area is 55,73 km^2. The island, which once consisted of six small islands, is formed by aggradation of the Danube. Its altitude varies from 100 to 123,5 m a.s.l.

The Csepel Island is located on the River Danube south of Budapest. The island is situated between the great Danube branch and the Ráckeve-Soroksári branch, its length is about 54 km, its largest width is from 4 to 6 km and its area is 256 km^2. Morphologically is very monotonous, flat, with an average height above sea level land, rarely occur blown sand hills.



2. Figure Geographical map of PA3.2 Along Danube Bend

2.2. Geological description

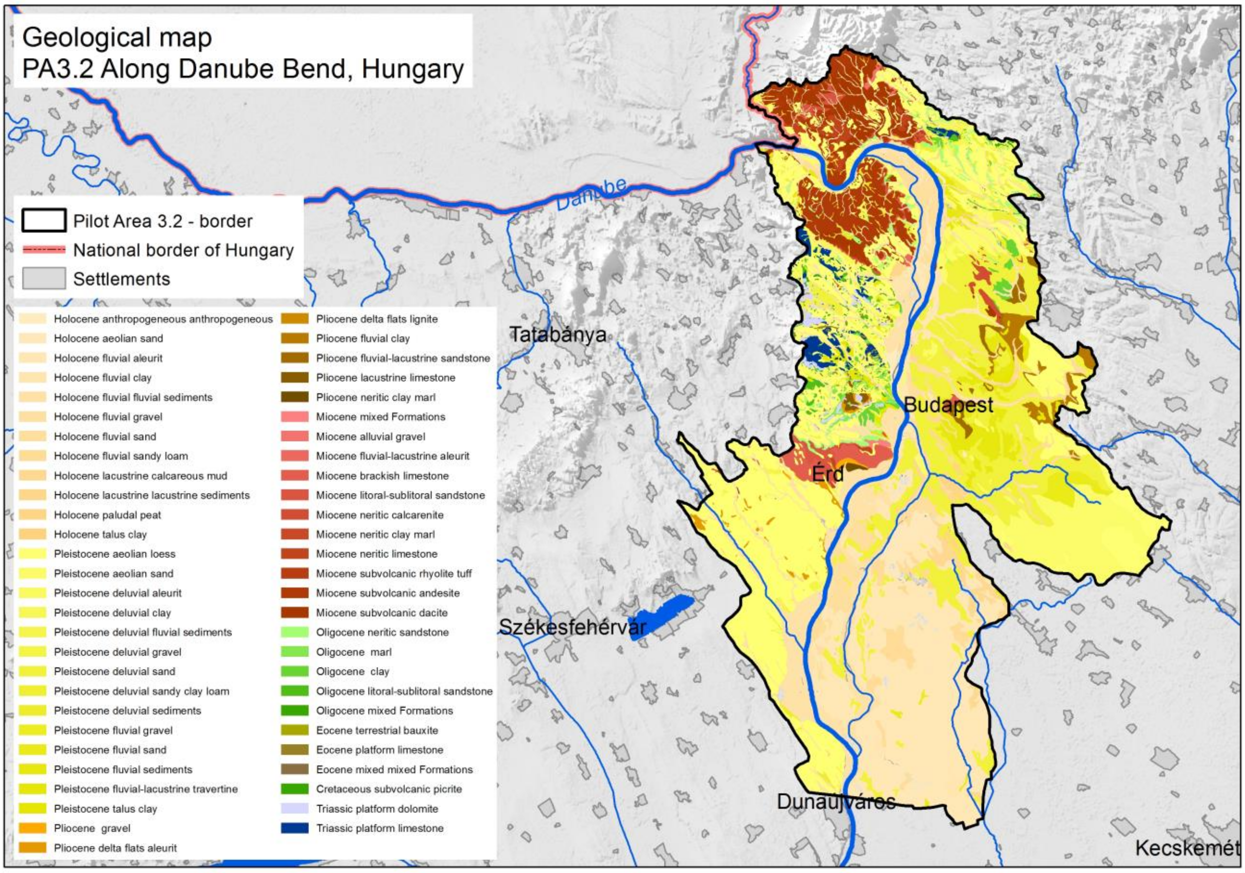
In the northern part of the pilot area is situated the Börzsöny, which in majority is covered by volcanic materials (mainly Miocene andesite-tuff and agglomerate). The north-western and southern part of the mountain is unevenly covered with loess or Pleistocene clay. The Visegrád Mountains today's image was formed by volcanic activity in the Middle Miocene. The volcanic activity was the nature dacit and andesitic. The ascended mountain was without sedimentation until the Pleistocene, thereafter is characteristic the loess formation.

In the central of the pilot area is situated the Dunamenti Plain, where the basement is predominant formed from the Triassic carbonate formations. On the Oligocene-Miocene formations started the formation of the large alluvial cone of the Danube at the beginning of the Pleistocene, or at the end of Pliocene. At present the surface is covered with several meters of alluvial mud, but the river gravel succession situated under these was accumulated during the quaternary dislocation of the river bed. At the end of the Pleistocene there was a formation of blown sand on the Szentendre Island situated on high floodplain.

The Buda Hills are situated between the Duna Valley, North Mezőföld, Zsámbéki Basin and the Pilisvörösvár-Solymár depression. It has imbricated structure, is fractured, with horsts, fragmented with basins. Its average height is 250-500 m. The area is poor in springs and surface waterways, but it is rich in karst water mixed with thermal springs.

The Mezőföld is a transitional area between the Dunántúli Hills and the Great Hungarian Plain. It can be divided into three parts. The absolute height of the area is 200-300 m a.s.l. In the area, the Pliocene and Lower Pleistocene alluvial sediments are becoming thicker southward, and the ridges are covered with loess southward also thickening. The Pest plain is the northernmost tiniest part of the Danubian Great Plain, fragmented with the alluvial terraces. Its surface, in exception of low-flood areas, is mainly covered with gravelly, sandy formations. The higher flood-free terraces are covered with blown sand and loess sand. The gravel layers are everywhere near the surface. The low-flood areas are covered with young alluvial formations.

In the Csepeli Plane, on the southern part of the pilot area, the the basement is formed by different formations, fragmented along Paleozoic-Mesozoic structural lines. On the Pannonian sediments there are coarse-grained fluvial deposits. The generally 10-20 m thick gravel layer is close to the surface, with good water retention capacity and contains significant exploitable gravel reserves. Most of the surface is covered by Holocene formations. In the eastern parts and on Csepel Island, there are also smaller Pleistocene highland terrains covered by blown sand (MTA Geography Science Research Institute, 2010).



3. **Figure Geological map of PA3.2 Along Danube Bend**

2.3. Pedology

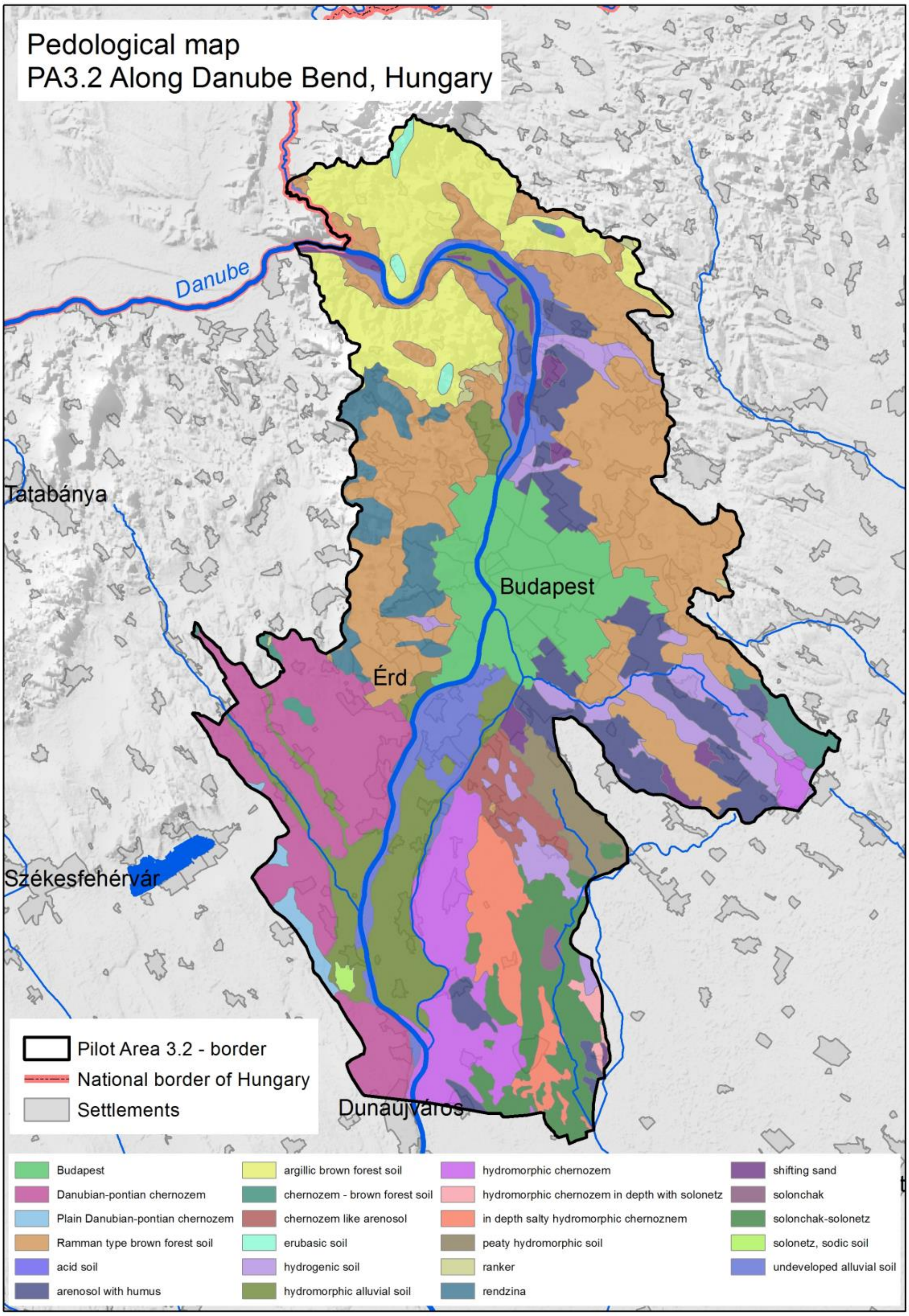
The pilot area is mostly covered by forests, dominant soil type is the forest soil. Forest soil is located in the Visegrádi-mountain, chernozem is on the parts of the Great Hungarian Plaine (Alföld).

The soil erosion is heavy on the cultivated slopes.The natural factors and the alluvium of the Danube had important influence in the development of soil types.

Chernozem soil and hydromorphic alluvial soil formed on loessy sediments in the Danube-valley have good productivity. These soil types have good permeability and good water retention capacity.

Soils with poor water retention capacity are located on the sand of the ridge: chernozem like arenosol, arenosol with humus, sporadically shifting sand.

Solonchak-solonetz is formed in the lowly areas (MTA Geography Science Research Institute, 2010).



4. Figure Pedological map of PA3.2 Along Danube Bend

2.4. Climate characteristics

The mountainous region has mild cool and mild humid climate. In the central of the pilot area (Budapest and surroundings) is transitional area. Warm and dry climate is characteristic in Budapest. The southern part of the pilot area has continental climate, mild warm and dry.

The annual average temperature in the highlands is 8-10°C, in Budapest 10-11,2 °C, in southern areas of the pilot area 11 °C.

The annual precipitation is 580-750 mm in the northern area. Towards the southern areas (Budapest surroundings) precipitation is 550-600 mm, until in the southern part of the Csepel Island is only 510-560 mm.

The annual average potential evaporation is about 700 mm. Over the last two decades evaporation values have increased. The annual average evapotranspiration is 480-540 mm.

The frequent direction of the wind is northwest, but because of the diverse relief it can be westward (MTA Geography Science Research Institute, 2010).

2.5. Hydrology

2.5.1. Surface waters

The main channel of the Danube and the Szentendrei- and Soroksári (Ráckevei-) Danube branches dominate the pilot area.

The Danube slows down after breaking through the Visegrádi-mountain, from its alluvium the Szentendrei- and Csepel – Island was formed, along with several smaller islands. A lot of streams flow into the Danube from the surrounding highlands.

Flood in early summer, low water in autumn and winter are characteristic for Danube. At the gauge of Nagymaros (minimum water level: -53 cm, maximum flood water level: 751 cm) located in the northern part of the pilot area the average water level was 91 cm in year 2015. At the gauge of Budapest the minimum water level was 51 cm, maximum flood water level: 891 cm. The average water level was 204 cm in year 2015.

Danube influences the groundwater level significantly.

The balance of the Danube channel section at Vác and Göd were controlled by groynes, T-groynes and bank protection.

The hydromorfological characteristic of the Danube at Budapest significantly differs from the upper sections. The capital has influenced the extension of the flood control structures. Nowadays the capital influences the physical-chemical and ecological state of the river through its presence.

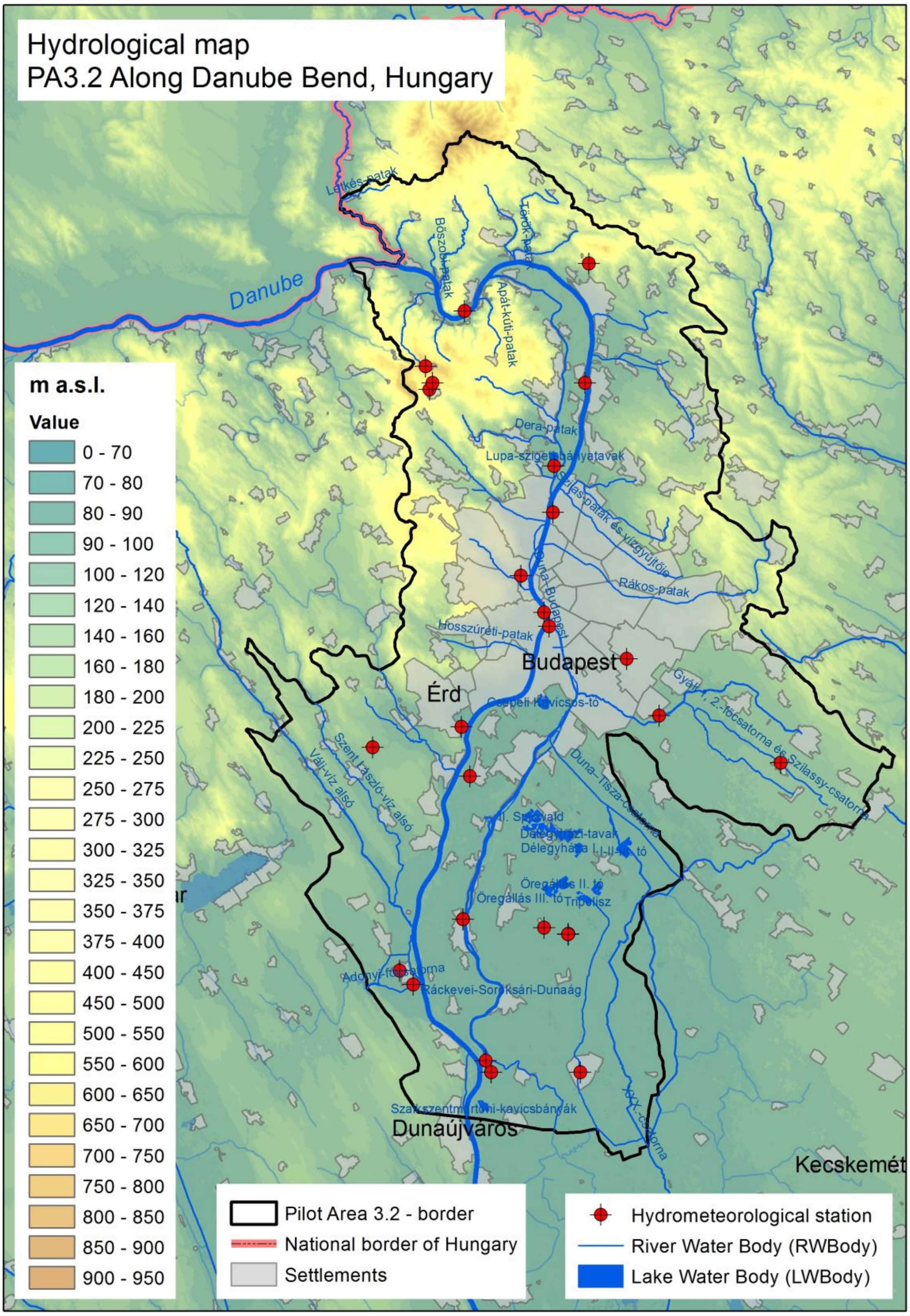
The hydrological cycle of the Ráckevei (Soroksári-) - Danube (RSD) is controlled artificially. The RSD ensures the drainage and the water supplementation of the channels on lower plains by Danube.

Between Szob and Budapest the Danube is a natural flow of water, its state with respect to biological elements and its ecological state is moderate, its state with respect to physical-chemical and hydromorphological elements is good, as swimming water its state is excellent, its chemical state is good, its state with respect to pollution according to Water Framework Directive Appendix VIII is excellent. The water body's state is moderate.

At Budapest and below the capital the Danube waterbody is heavily modified, its state with respect to biological elements and its ecological state is moderate, its state with respect to physical-chemical elements is good and hydromorphological elements is excellent, as swimming water its state is excellent, its chemical state is good, its state with respect to pollution according to WFD Appendix VIII is excellent at Budapest, below Budapest is good. The water body's state is moderate.

Ráckevei (Soroksári-)-Danube waterbody is heavily modified, its state with respect to biological elements and its ecological state is poor, its state with respect to physical-chemical elements is moderate, hydromorphological elements is excellent, as swimming water its state is excellent, its chemical state is good, its state with respect to pollution according to WFD Appendix VIII is excellent. The water body's state is poor.

In the Southwest part of the pilot area artificial mining lakes are located.



5. Figure Hydrological map of PA3.2 Along Danube Bend

2.5.2. Flood issues

Description of flood issues and past flood events on Duna Riverbasin

Through many centuries records of the occurrences of floods have been kept along the Danube Valley. The most famous among these is the 1501 flood of the upper Danube, thought to be the largest summer flood of the last millennium, causing extensive devastation down to Vienna, and presumably, its impact was extreme downstream as far as the Danube Bend at Visegrád. Among the ice jam-induced floods, that of 1838 has historical significance; it devastated several settlements from Esztergom to Vukovar, including the towns Pest, Óbuda and the lower parts of Buda on the territory of today's Hungarian capital. During the last century characteristic years when maximum flood levels occurred: 1902, 1924, 1926, 1940, 1941, 1942, 1944, 1954, 1965, 1970, 1974, 1991, and 2002.

Flood in 2002:

Several municipalities were affected by the flooding of the Danube near Visegrad. About 2,000 people had to be evacuated, and 4,370 homes were damaged. More serious damage was successfully avoided by flood prevention structures and emergency interventions, however. The overall cost of the emergency operation was €33 million, and the rehabilitation of flood defence structures is expected to cost some €10.2 million.

Flood in 2006:

The Danube spring flood of 2006 proved to be a major flood - upstream of Komárom and downstream of the southern tip of Csepel Island, Alert Level III was registered. Along the intermediate section – from Esztergom to Tass – flood crests exceeded the highest ever-recorded highest high water (HHW) values. Flood discharges (9,000 m^3/s recorded at Nagymaros; 8,800 m^3/s at Budapest) indicate that this flood had a recurrence interval of 80-100 years. The flood discharge of the Danube increased to over 8,500 m^3/s at the confluence with the Váh River. Flood crests exceeded the previously recorded maximum downstream of Esztergom to the southern edge of the Csepel Island (Tass gauging station).

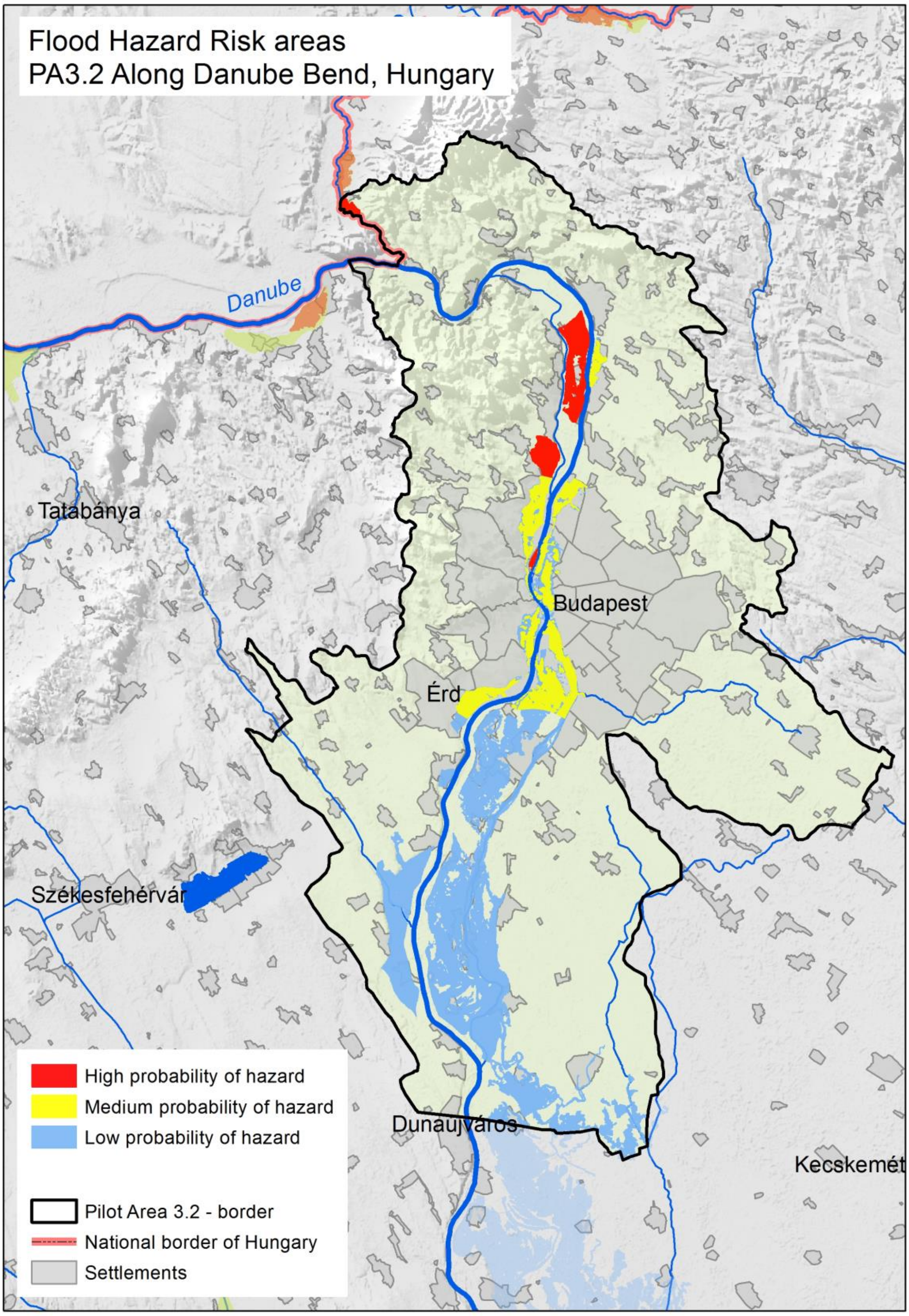
The Danube flooding necessitated evacuation of inhabitants from low-lying, unprotected areas along the Danube River. 268 people in Pest County and another 67 in the capital were obliged to leave their homes.

Flood in 2013:

The flood event in June 2013 was the highest ever recorded flood level all along the Hungarian Danube section, except only one gauge at the most downstream part of the country (Mohács). Heroic fight of professionals and civilians were needed to keep the water between the dikes and protect the lives of thousands, since a small mistake could have caused a regional catastrophe. The massive flood volume had a surface peak which was the maximum of the water level that can be handled. Still tens of kilometres of temporary dikes had to be built up to prevent large areas from inundation. The flood propagation can be compared to the event in August 2002. The main difference is in the lower gross amount of water and the aerial distribution of the precipitation. It can be however assumed that even higher runoff (+300-500 m^3/s peak discharge) is possible if the same catchment conditions would coincide with the 2002 meteorological events. Based on ADCP measurements the incoming peak flow was 10.640 m^3/s at Vámosszabadi, and 8.300 m^3/s left the country towards Croatia. The calculated return period based on the existing statistics is around 125-135 years in the upstream part, but if the 2013 event is taken into the sampling it could go down to 80 years. Until 2013 the highest ever recorded flood levels were registered in 2002 in the Hungarian upper Danube section (Rajka, Nagymaros), in 2006 in the Hungarian middle Danube section (Nagymaros-Budapest) and in 1965 in the Hungarian lower Danube section (Dunaújváros-Mohács). Except of Mohács all these values were exceeded in 2013 with 13-44 cm overtop. During the defence work the alerted dike length went over 800 km. The Hungarian Government announced emergency situation on 3rd of June and 540 km long dike turned into an extreme alert level. The effective defence work was carried out in between 31 May – 19 June, but because of certain damages and legislative rules the emergency situation lasted until 19 July.

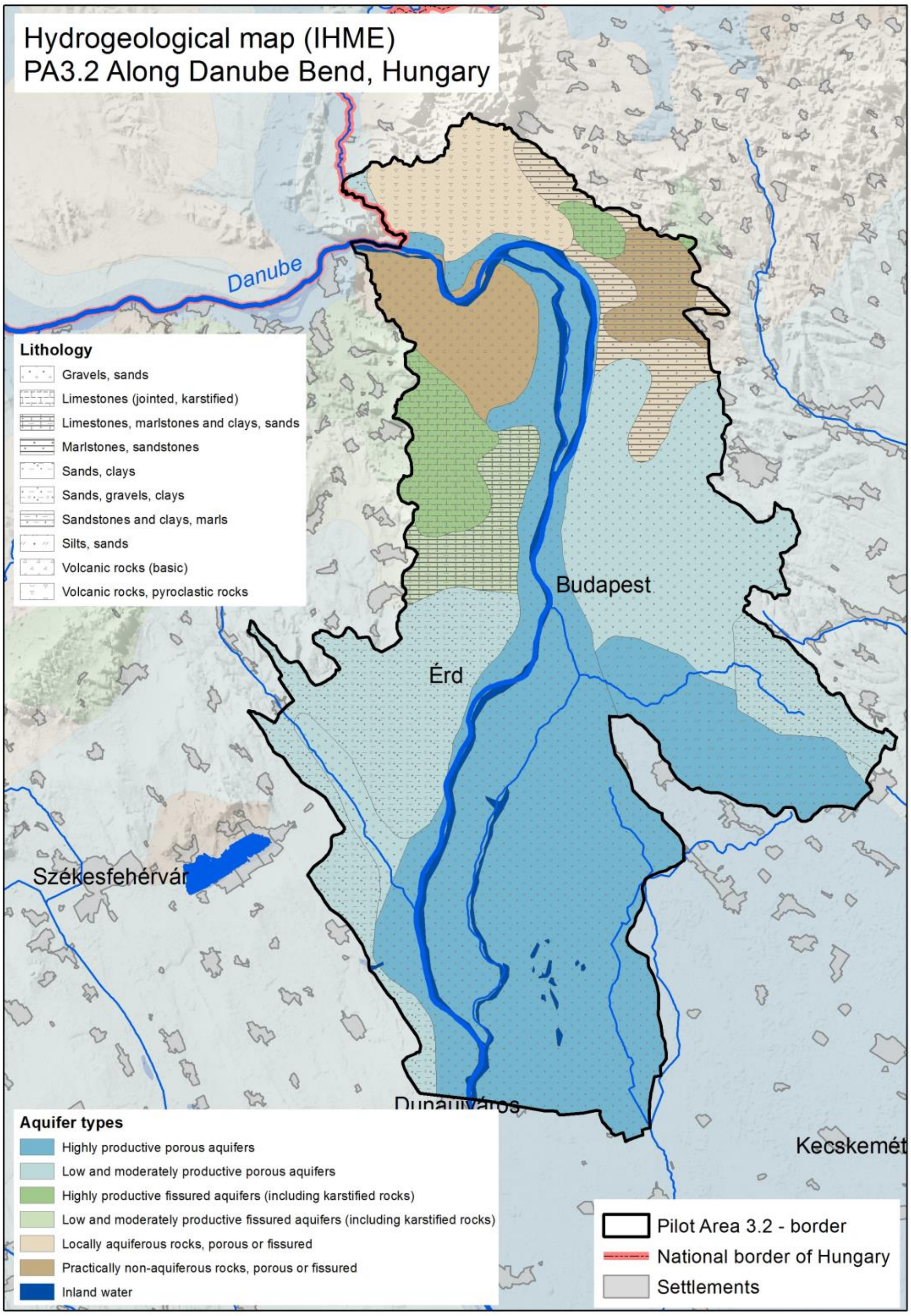
The load on the defence structures was very high and several sections, which were under construction, needed a special attention. Settlements on "high banks" had to build up defence lines in locations where it was never needed before, so huge resources were directed to those areas, too.

The main task was to complement the height deficits on the dike crests and discover low terrestrial formations or ridges to build temporal earth dike lines. Usual routine was to cover the wet side of the dikes with plastic foil and stabilize the embankments with extra load on the dry side to avoid dike breaches or slides. Due to the high water pressure several boils appeared which had to be supported with counterpressure pools. In some places mobile elements were placed that worked well. Seepage generally appeared everywhere and slowed down the material transport.



6. Figure Flood hazard risk areas along Danube Bend

2.6. Hydrogeology



7. Figure Hydrogeological map of PA3.2 Along Danube Bend

In the area of Dunamenti-plain there have been created 5-25 meters thick highly productive gravel aquifers and sandy gravel lens strata with medium thick coarse-grained sand and thin floodplain clay interbeddings by the Danube alluvial sediment-activity at the end of Pleistocene. The gravel and sand stratums in the depth of 20-80 meters are capable producing 500-800 l/min capacity water abstractions by each well. Disadvantage is that they are vulnerable against contaminations from surface because of the nearness to surface and the thin overlaying strata. The extracted waters have high Fe and NH_4 values which originate from strata; these concentrations often exceed the drinking water limits (200 µg/l Fe, 0.50 mg/l NH_4).

On the Szentendrei Island the water table follows the changing of the water level of the Danube not depending on changing of relief. Therefore on the high points of the island the water table can reach 8-10 meters depth under the surface. Away from the river the correlation decreases.

The direction of groundwater flow is the same as the river flow in natural state, but near the banks that can be perpendicular or two-way. The water regime of the island is based on the river Danube. Above 2 meters Danube water level at Budapest station the island recharges and under this level it discharges.

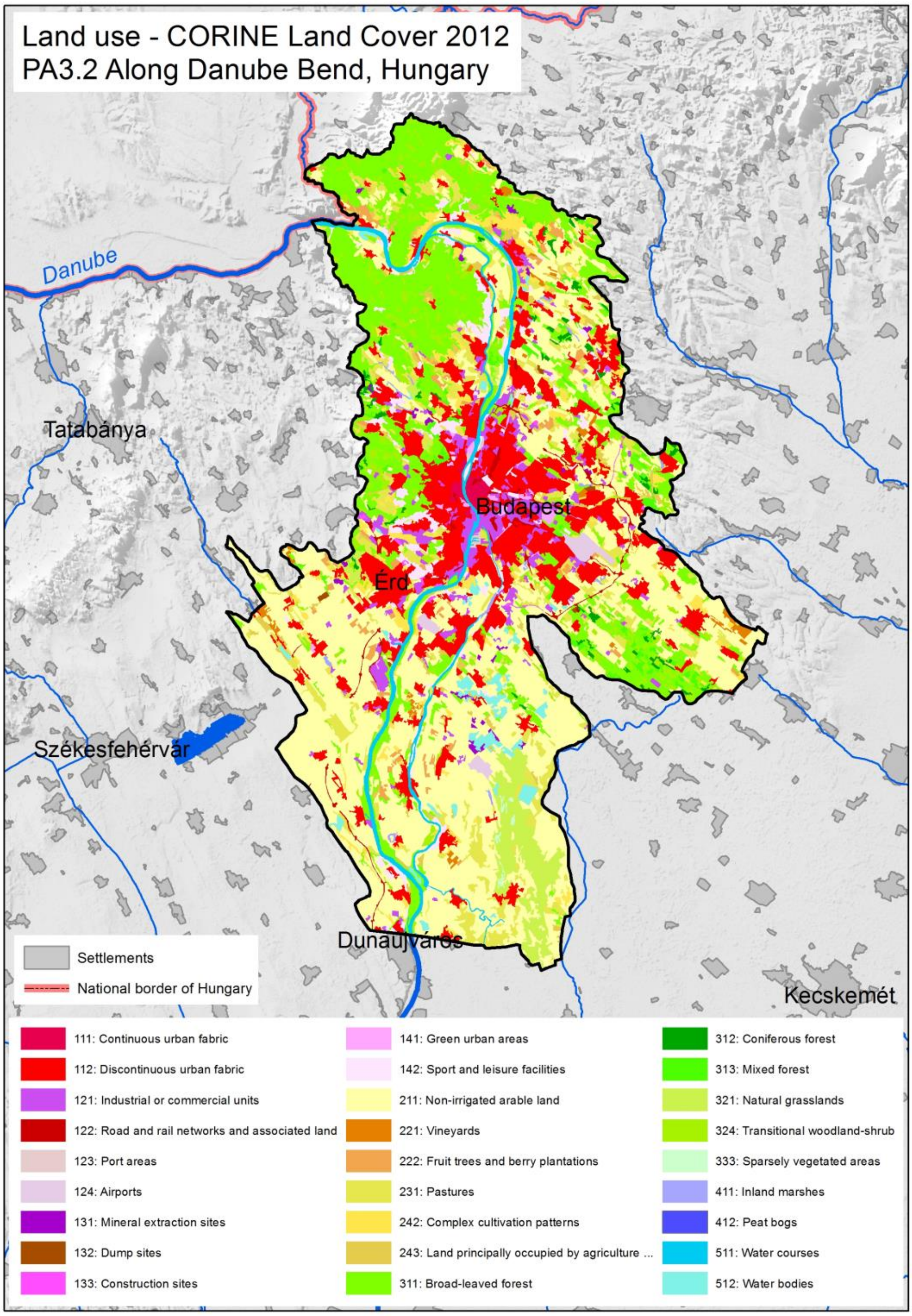
In the Csepeli-plain due to the groundwater abstractions the Pannonian and Quarter layers are significant. The tens of meters thick highly productive later Pannonian aquifers consist of the alternation of medium-sized sand, aleurite and clay. These are situated on the north and south border of the area, and on the west they can go down until 100-300 meters depth.

On the Csepel Island two aquifers had been formed above each other in the 10-15 meters thick Quarter sediment layer. The lower aquifer is connected to the large extension gravel layer as coherent water mass, it gets the water recharge from the Soroksári Danube.

The upper aquifer is articulated to stripes which consist of free water level sand-gravel layers, which mainly gets the recharge from precipitation. The water table is getting lower from north and east.

To north from Ráckeve the water table is in the depth of 3-4 meters, it can be found deeper only in the region of Tököl-Szigetcsép and Szigetújfalu. This is caused by the bank-filtered drinking water abstractions (along the Danube) which create depression. The shallow groundwater is situated mainly in the gravel (Diagnostic studies of drinking water resources with vulnerable geological environment 1997-2017).

2.7. Land use



8. Figure Land use within PA3.2 Along Danube Bend

1. Table Shares of particular CORINE land cover categories along Danube Bend

CLC code	Land use	Surface area (%)	Surface area (km^2)
111	Continuous urban fabric	0,34	13,71
112	Discontinuous urban fabric	14,06	559,85
121	Industrial or commercial units	3,27	130,39
122	Road and rail networks and associated land	0,75	29,84
123	Port areas	0,07	2,86
124	Airports	0,55	21,92
131	Mineral extraction sites	0,32	12,64
132	Dump sites	0,08	3,33
133	Construction sites	0,14	5,47
141	Green urban areas	0,38	15,19
142	Sport and leisure facilities	2,51	99,99
211	Non-irrigated arable land	35,42	1 410,24
213	Rice fields	0	0
221	Vineyards	0,58	23,06
222	Fruit trees and berry plantations	1,04	41,55
231	Pastures	6,44	256,57
242	Complex cultivation	3,03	120,48
243	Land principally occupied by agriculture, with significant areas of natural vegetation	1,71	68,04
311	Broad-leaved forest	17,36	691,31
312	Coniferous forest	0,71	28,25
313	Mixed forest	1,08	42,99
321	Natural grassland	2,81	111,98
324	Transitional woodland shrub	3,39	135,16
331	Beaches, dunes, and sand plains	0	0
333	Sparsely vegetated areas	0,1	3,81
411	Inland marshes	0,25	10,02
412	Peat bogs	0	0,18
511	Water courses	2,43	96,57
512	Water bodies	1,17	46,54

2. Table Land use only on the bank-filtered drinking water protective zones (DWPZ)

clc2012	LABEL_3	CLC12 area on bank-filtered DWPZ km^2	Proportion from DWPZ-s area (%)
111	Continuous urban fabric	0,75	0,19
112	Discontinuous urban fabric	44,35	11,39
121	Industrial or commercial units	12,11	3,11
122	Road and rail networks and associated land	1,78	0,46
123	Port areas	0,22	0,06
124	Airports	4,23	1,09
132	Dump sites	0,14	0,03
133	Construction sites	0,83	0,21
141	Green urban areas	0,51	0,13
142	Sport and leisure facilities	14,61	3,75
211	Non-irrigated arable land	150,03	38,54
221	Vineyards	2,19	0,56
222	Fruit trees and berry plantations	3,44	0,88
231	Pastures	25,35	6,51
242	Complex cultivation	12,70	3,26
243	Land principally occupied by agriculture, with si*	9,36	2,40
311	Broad-leaved forest	42,63	10,95
312	Coniferous forest	0,40	0,10
313	Mixed forest	1,83	0,47
321	Natural grassland	3,02	0,78
324	Transitional woodland shrub	6,42	1,65
411	Inland marshes	1,08	0,28
511	Water courses	36,57	9,39
512	Water bodies	3,19	0,82

The bank-filtered drinking water protection zones area on the Pilot Area is 389 km^2. The highest rate is represented by the non-irrigated arable land (38,5%), the discontinuous urban fabric (11,4%,), broad-leaved forest (11%) and the pasture (6,5%).

2.8. Protected areas

According to the Water Framework Directive (2000/60/EC), ANNEX IV: The register of protected areas required under Article 6 shall include the following types of protected areas:

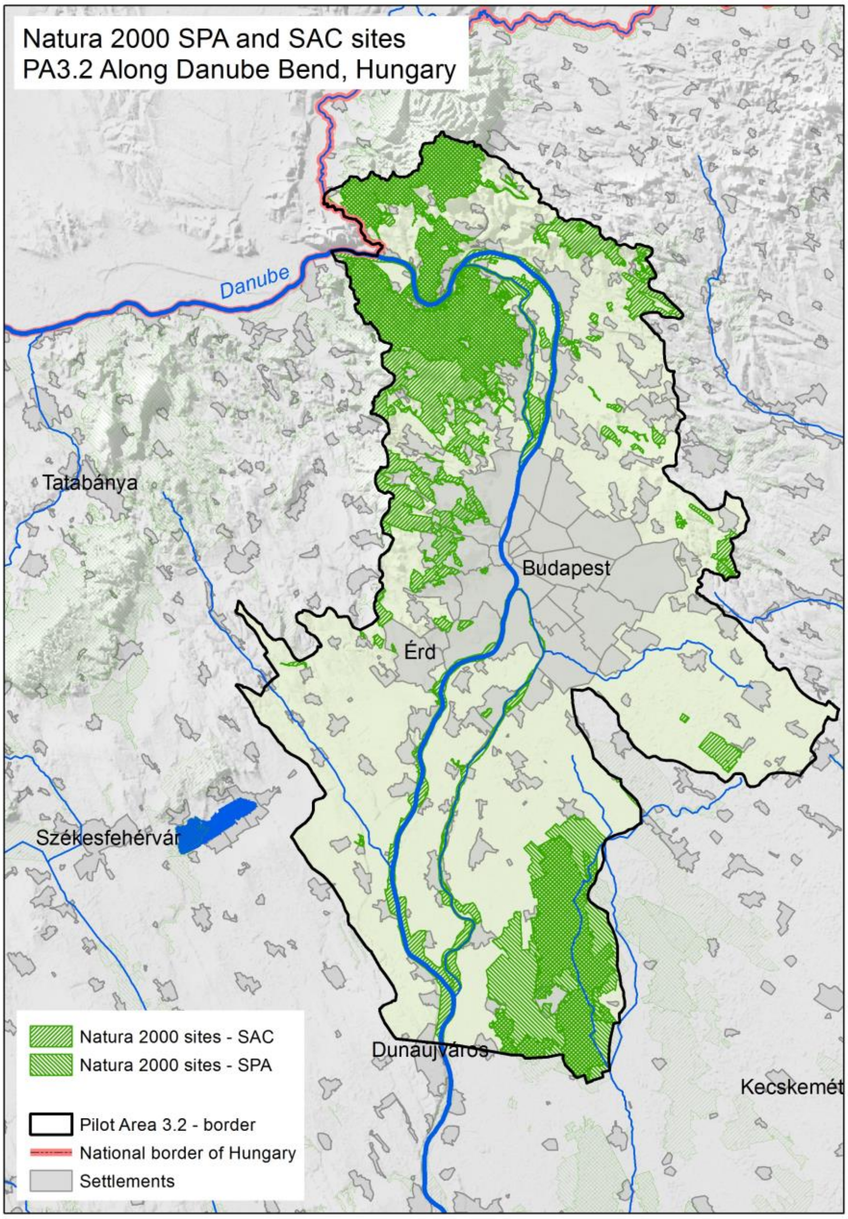
- areas designated for the abstraction of water intended for human consumption under Article 7;
- areas designated for the protection of economically significant aquatic species;
- bodies of water designated as recreational waters, including areas designated as bathing waters under Bathing Water Directive (76/160/EEC);
- nutrient-sensitive areas, including areas designated as vulnerable zones under Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under Urban waste water treatment Directive (91/271/EEC); and
- areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, including relevant Natura 2000 sites designated under Habitats Directive (92/43/EEC(1)) and Birds Directive (79/409/EEC(2)).

3. Table Natura 2000 SPA and SAC sites along Danube Bend from Szob to Tass

OBJECTID	Name	Identification	Type
1	Felső-kiskunsági szikes puszta	HUKN20001	SAC
2	Tass-szalkszentmártoni szikes puszta	HUKN20005	SAC
3	Budai-hegység	HUDI20009	SCI, SAC
4	Budaörsi kopárok	HUDI20010	SAC
5	Csévharaszti homokvidék	HUDI20012	SCI, SAC
6	Debegió-hegy	HUDI20014	SAC
7	Gödöllői-dombság peremhegyei	HUDI20040	SAC
8	Szigeti homokok	HUDI20047	SAC
9	Érd-Százhalombattai táblarög	HUDI20052	SAC
10	Veresegyházi-medence	HUDI20055	SAC
11	Nyugat-Cserhát és Naszály	HUDI20038	SAC
12	Besnyői löszvölgy	HUDI20007	SAC
13	Börzsöny	HUDI20008	SAC
14	Ipoly-völgy	HUDI20026	SAC
15	Szentgyörgypuszta	HUDI20049	SAC
16	Ráckevei Duna-ág	HUDI20042	SAC
17	Duna és ártere	HUDI20034	SAC
18	Szigethalmi homokbuckák	HUDI20045	SAC
19	Érd-tétényi plató	HUDI20017	SAC
20	Turjánvidék	HUDI20051	SCI, SAC
21	Pilis és Visegrádi-hegység	HUDI20039	SAC
22	Gödöllői-dombság	HUDI20023	SAC
23	Felső-Kiskunsági szikes puszták és turjánvidék	HUKN10001	SPA
24	Börzsöny és Visegrádi-hegység	HUDI10002	SPA

There are large areas of Natura 2000 on the northern and south-eastern parts of the Pilot Area. The SAC types cover 837 km2, the SPA types covers 587 km2, between them there are overlaps.

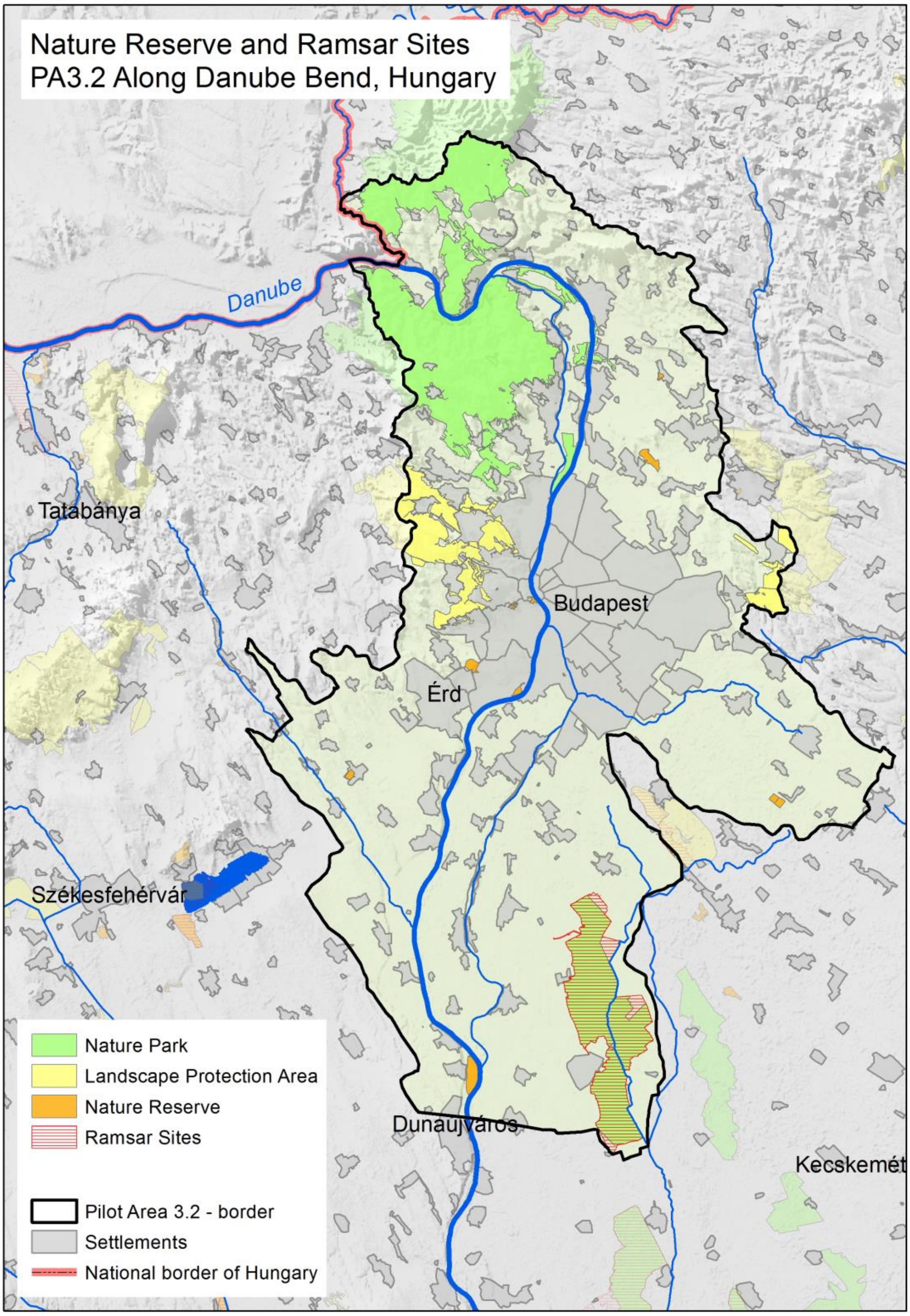
The national protected areas (National Parks, Landscape Protection Areas and Nature Conservation Areas) cover altogether 586 km2, and there are 129 km2 Ramsar areas on the Pilot Area. Natural bathing waters are also protected, of which 29 are located on the Pilot Area. A significant part (84%) of the Pilot Area is nitrate-sensitive, an area of 3362 km2, of which 1030 km2 (26%) is nutrient-sensitive area also.



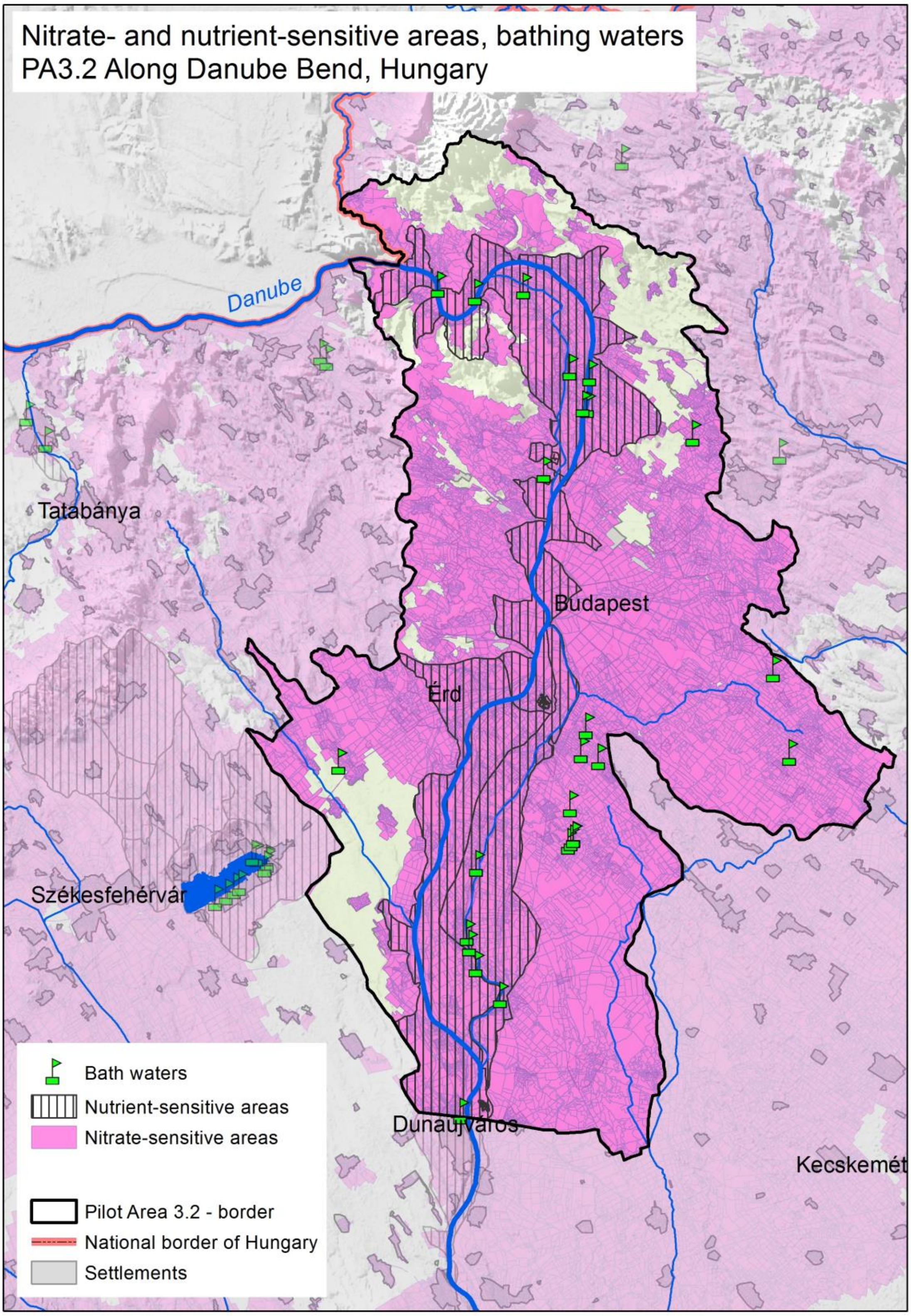
9. Figure NATURA 2000 SPA and SAC sites along Danube Bend.

4. Table Nature Reserve and Ramsar Sites along Danube Bend from Szob to Tass

OBJECTID	Name	MOSAIC	Nature_Park	Code	Type
1	Rácalmási-szigetek Természetvédelmi Terület	Rácalmási-szigetek TT	Duna-Ipoly NPI	270/TT/96	NP
2	Adonyi természetvédelmi terület	Adonyi TT	Duna-Ipoly NPI	192/TT/87	NR
3	Gödöllői Dombvidék Tájvédelmi Körzet		Duna-Ipoly NPI	231/TK/90	LPA
4	Fóti-Somlyó természetvédelmi terület	Fóti-Somlyó TT	Duna-Ipoly NPI	46/TT/53	NR
5	Ócsai Tájvédelmi Körzet		Duna-Ipoly NPI	112/TK/75	LPA
6	Csévharaszti-borókás természetvédelmi terület		Duna-Ipoly NPI	2/TT/40	NR
7	Csévharaszti-borókás természetvédelmi terület		Duna-Ipoly NPI	2/TT/40	NR
8	Peregi Parkerdő Természetvédelmi Terület		Duna-Ipoly NPI	269/TT/96	NR
9	Duna-Ipoly Nemzeti Park		Duna-Ipoly NPI	283/NP/97	NP
10	Szemlőhegyi-barlang felszíni védőterülete természetvédelmi terület		Duna-Ipoly NPI	61/TT/57	NR
11	Pálvölgyi-barlang felszíni védőterülete természetvédelmi terület		Duna-Ipoly NPI	14/TT/44	NR
12	Budai Sas-hegy természetvédelmi terület	Budai Sas-hegy TT	Duna-Ipoly NPI	64/TT/57	NR
13	Tétényi-fennsík Természetvédelmi Terület		Duna-Ipoly NPI	321/TT/11	NR
14	Budakalászi Kemotaxonómiai Botanikus Kert Természetvédelmi Terület	Budakalászi Kemotaxonómiai Botanikus Kert TT	Duna-Ipoly NPI	297/TT/03	NR
15	Kiskunsági Nemzeti Park	Felső-kiskunsági puszta	Kiskunsági NPI	109/NP/74	NP
16	Budai Tájvédelmi Körzet		Duna-Ipoly NPI	163/TK/78	LPA
17	Budapesti botanikus kert természetvédelmi terület	Budapesti botanikus kert TT	Duna-Ipoly NPI	75/TT/60	NR
18	Jókai-kert természetvédelmi terület		Duna-Ipoly NPI	115/TT/75	NR
19	Gellérthegy Természetvédelmi Terület	Gellérthegy TT	Duna-Ipoly NPI	275/TT/97	NR
20	Vácrátóti arborétum természetvédelmi terület		Duna-Ipoly NPI	27/TT/51	NR
21	Szentendrei rózsa termőhelye természetvédelmi terület		Duna-Ipoly NPI	5/TT/42	NR
22	Martonvásári-park természetvédelmi terület		Duna-Ipoly NPI	47/TT/53	NR
23	Érdi Kakukk-hegy természetvédelmi terület	Érdi Kakukk-hegy TT	Duna-Ipoly NPI	307/TT/07	NR
24	Háros-szigeti Ártéri-erdő Természetvédelmi Terület	Hunyadi-sziget	Duna-Ipoly NPI	265/TT/93	NR
25	Háros-szigeti Ártéri-erdő Természetvédelmi Terület	Háros-szigeti Ártéri-erdő	Duna-Ipoly NPI	265/TT/93	NR
26	Tamariska-domb természetvédelmi terület		Duna-Ipoly NPI	329/TT/12	NR



10. Figure Nature reserves and RAMSAR sites along Danube Bend



11. Figure Nitrates and nutrient sensitive areas and bathing waters along Danube Bend

3. Water supply in the pilot action

3.1. Drinking water sources

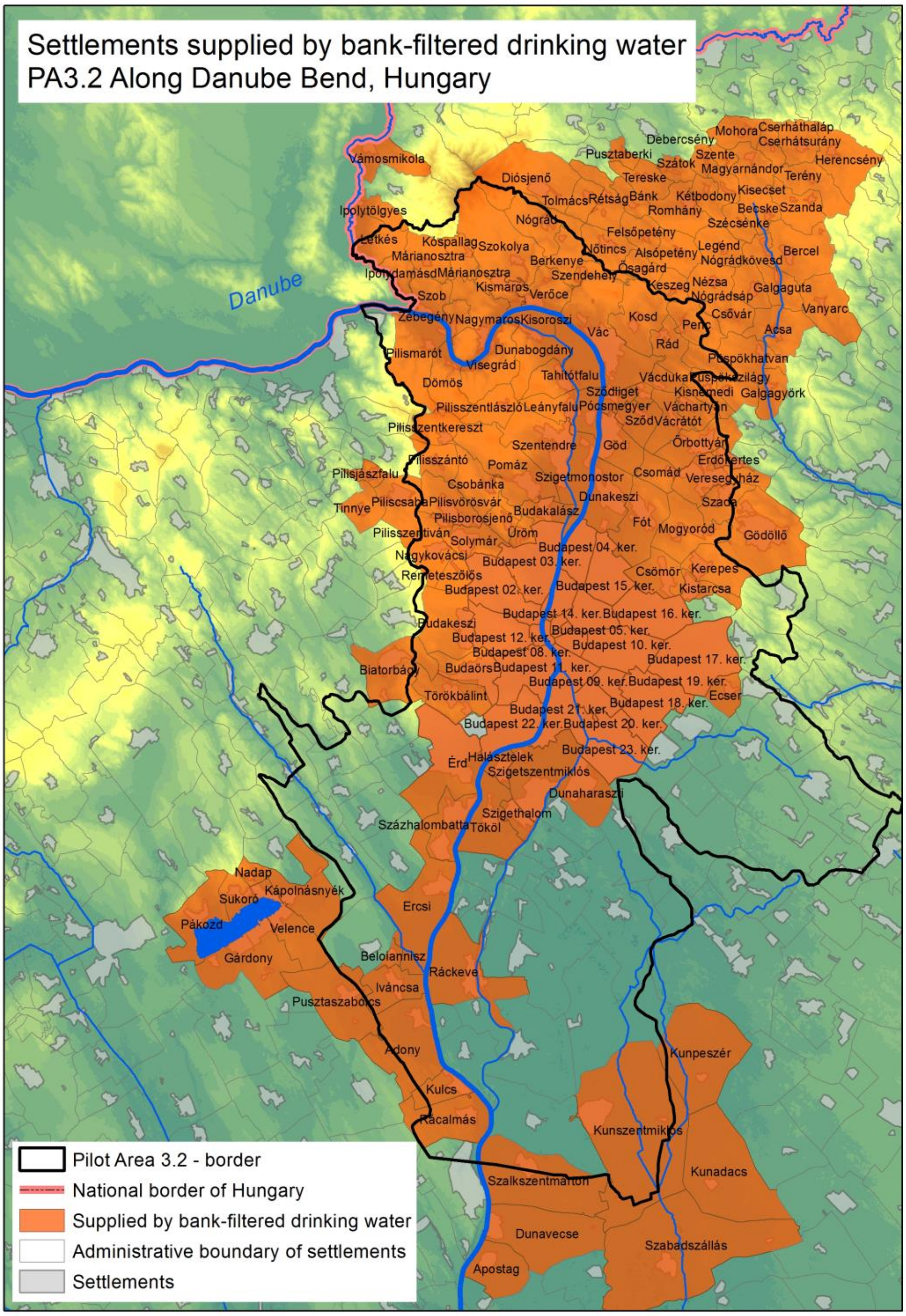
On the pilot area the bank-filtered water production is made with horizontal wells and tube wells. The table 5 shows the number of wells in each water resource and the extracted water quantity in 2015 (OVF (2016)).

5. Table Number of wells in each water resource and the extracted water quantity in 2015.

DWPA code	Settlement	Drinking water resources name	Status	Number of wells (piece)	Extracted water in 2015 thousand m³/year
AID262	Budakalász	Budakalász, Lupa-szigeti Vízmű	reserve	11	0
AID263	Budapest 03. ker.	Budapest III., Budaújlaki vmt.	working	6	1 548
AID264	Budapest 04. ker.	Budapest IV., Balpart I. Vmt.	working	8	760
AID265	Budapest 13. ker.	Budapest XIII., Margitszigeti vmt.	working	11	3 409
AID283	Halásztelek	Halásztelek, Csepel-Halásztelek vm.	working	36	3 736
AID306	Dömös	Dömös vízbázis	working	13	256
AID319	Dunabogdány	Dunabogdány Községi Vízmű vízbázisa	working	4	406
AID322	Dunakeszi	Dunakeszi, Balparti II. Vmt.	working	23	5 298
AID323	Dunakeszi	Dunakeszi, DBRVR Dunakeszi vízbázis	working	2	826
AID340	Ercsi	Ercsi partiszűrésű vízbázisok	working	4	2 431
AID382	Göd	Göd, DBRVR Gödi vízbázis	working	19	303
AID474	Kisoroszi	Kisoroszi, Tahi vízbázis	working	29	18 033
AID475	Kisoroszi	Kisoroszi vmt.	working	12	20 992
AID498	Leányfalu	Leányfalu, DJRVR Leányfalui vízbázis	working	2	1 564
AID574	Nagymaros	Nagymaros, DBRVR Nagymarosi vízbázis	working	7	742
AID636	Pócsmegyer	Pócsmegyer, Surányi vmt.	working	20	14 890
AID649	Ráckeve	Ráckeve I. Vmt.	working	21	17 116
AID650	Ráckeve	Ráckeve II. Vmt.	working	9	6 224
AID713	Szentendre	Szentendre, DJRVR Szentendre Északi vízbázis	working	6	1 092
AID714	Szentendre	Szentendre, DJRVR Szentendre Pap-szigeti vízbázis	working	1	1 142
AID716	Szentendre	Szentendre, DJRVR Szentendre Regionális Déli Vízbázis	working	17	1 391
AID721	Szigetmonostor	Szigetmonostor, Horányi vmt.	working	108	6 971
AID722	Szigetmonostor	Szigetmonostor, Monostori vmt.	working	245	19 594
AID723	Szigetmonostor	Szigetmonostor, Pócsmegyeri vmt.	working	96	13 651
AID724	Szigetmonostor	Szigetmonostor, Sziget I-II. vmt.	working	31	24 636
AID730	Szob	Szob, IpRVR Szob Hidegréti vízbázis	working	2	445
AID742	Tahitótfalu	Tahitótfalu, Pokol-szigeti vízműkút	working	1	0
AID743	Tahitótfalu	Tahitótfalu, Tótfalui vízműtelep	working	8	2 980
AID749	Tass	Tass (Gudmon-fok)	working	11	871
AID778	Szigetújfalu	Szigetújfalu, Tököl-Szigetújfalui vm.	working	98	5 027
AID785	Vác	Vác, DBRVR Vác Buki-szigeti vízbázis	working	7	1 464
AID808	Verőce	Verőcemaros, DBRVR Verőcei vízbázis	working	39	5 694
AID817	Visegrád	Visegrád, DJRVR Visegrádi Vízbázis	working	3	0
AID835	Zebegény	Zebegény Községi Vízmű vízbázisa	working	2	121
ALF869	Budapest 13. ker.	Budapest XIII., Radnóti úti galéria	reserve		0
ALG020	Göd	Göd, Felsőgödi vízbázis	reserve	3	0
ALG793	Vác	Vác, Déli Vízbázis	reserve		0

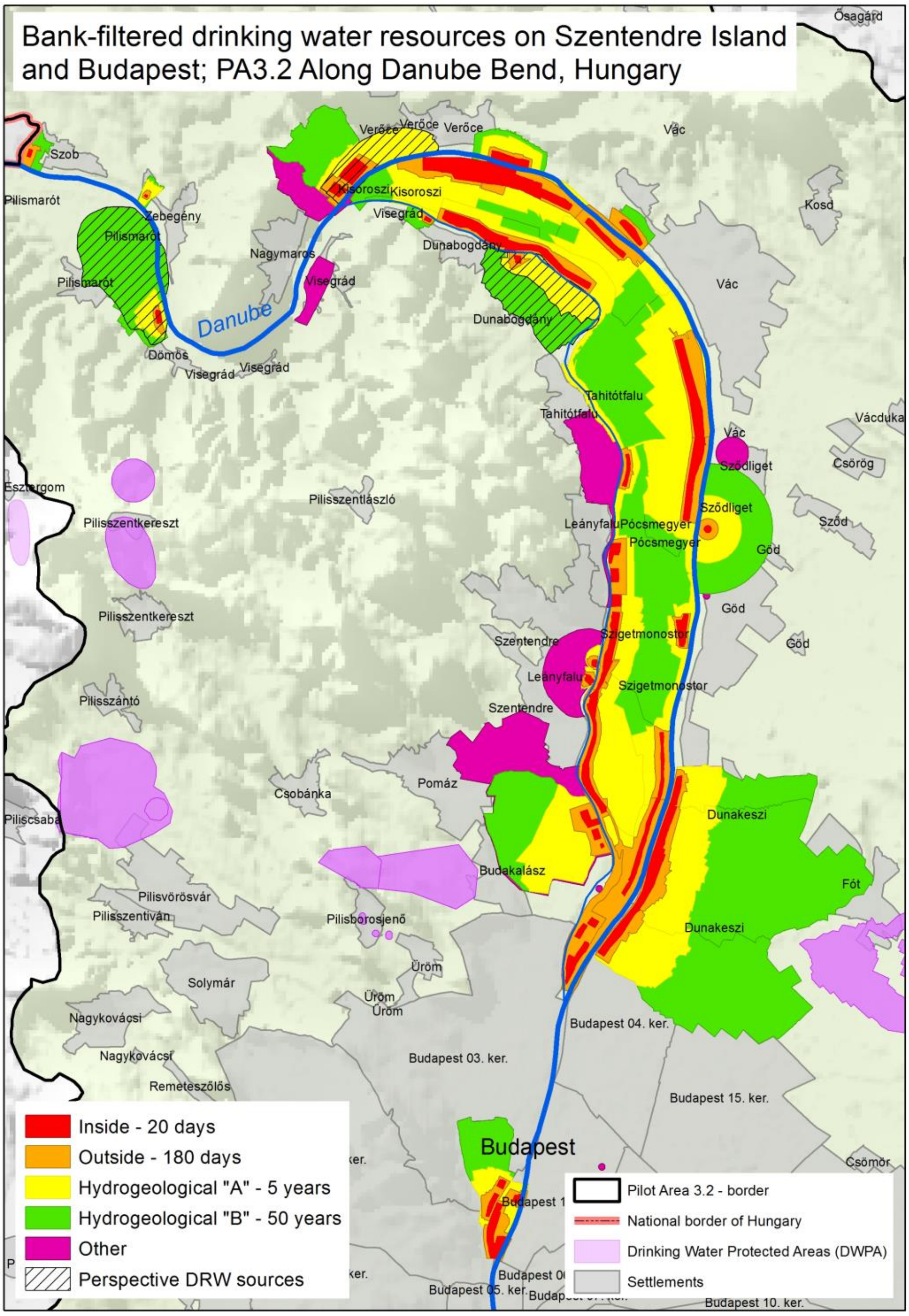
Total (2015)					**183 613**

The bank-filtered water resources located on the pilot area supplies with drinking water mainly Budapest and about 150 settlements in agglomeration, about 2,5 million inhabitants. On the pilot area there are 7 perspective drinking water resources, with 146 million m^3/day capacity.

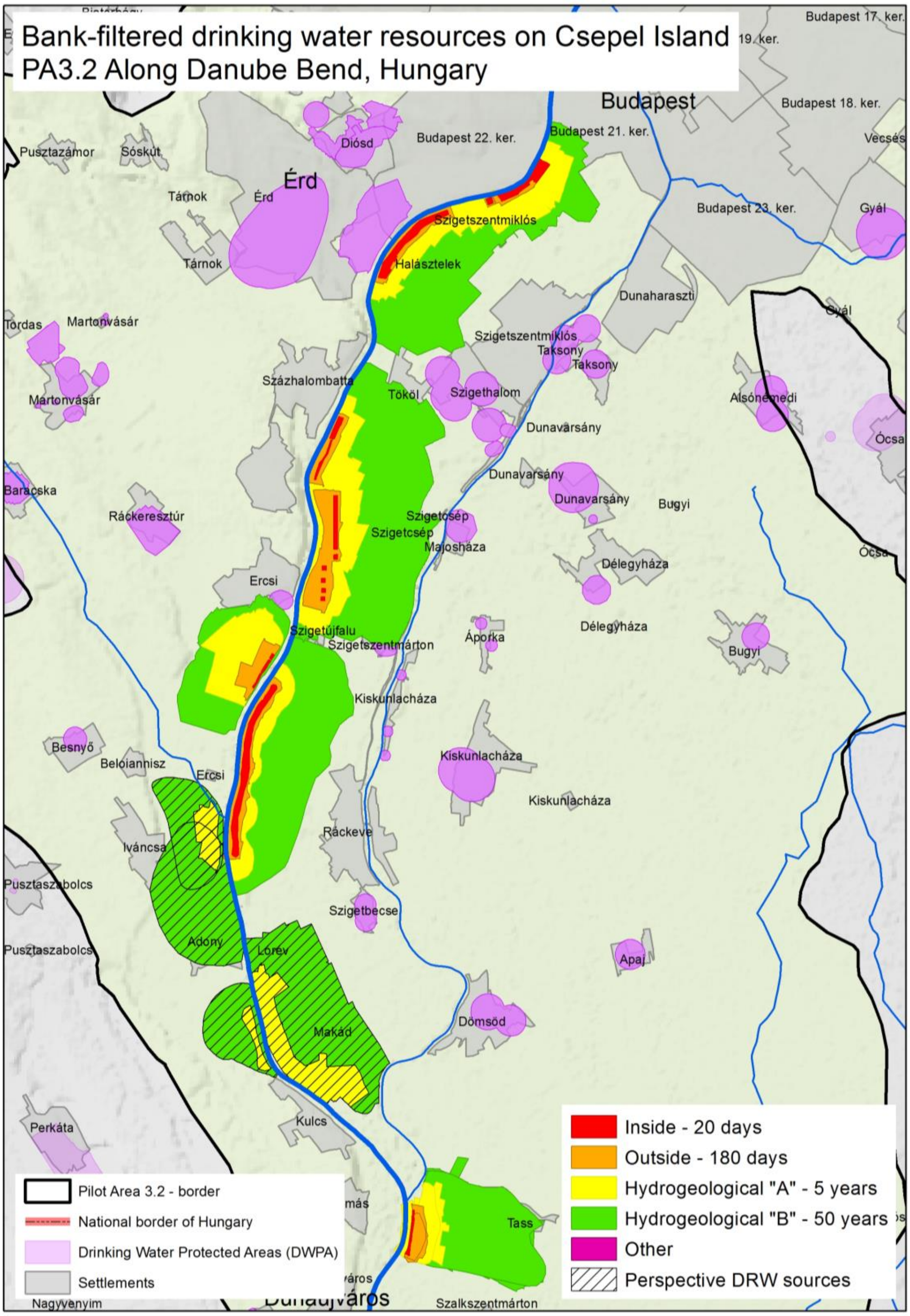


12. Figure Settlements supplied by bank-filtered drinking water along Danube Bend

3.2. Drinking water protection



13. Figure Bank-filtered drinking water resources on Szentendre Island and Budapest along Danube Bend



14. Figure Bank-filtered drinking water resources on Csepel Island along Danube Bend

Each protective blocks of bank-filtered water resource has cross section with surface, so all are vulnerable (based on River Basin Management Plan –status 2015).

6. Table Status of DWPZs of bank-filtered water resources along Danube Bend

DWPA code	Settlement	DWPA name	Status	Legaly protected with DWPZs	DWPZs are determinated, but isn't water authority decision	Pre-modeled DWPZs
AID198	Adony	Adony sziget felhagyott távlati vízbázis	perspective/ closed		yes	
AID199	Adony	Adony-Dél távlati vb.	perspective		yes	
AID262	Budakalász	Budakalász, Lupa-szigeti Vízmű	reserve			yes
AID263	Budapest 03. ker.	Budapest III., Budaújlaki vmt.	working	yes		
AID264	Budapest 04. ker.	Budapest IV., Balpart I. Vmt.	working		yes	
AID265	Budapest 13. ker.	Budapest XIII., Margitszigeti vmt.	working		yes	
AID283	Halásztelek	Halásztelek, Csepel-Halásztelek vm.	working	yes		
AID306	Dömös	Dömös vízbázis	working		yes	
AID319	Dunabogdány	Dunabogdány Községi Vízmű vízbázisa	working	yes		
AID320	Dunabogdány	Dunabogdányi öblözet Távlati Vízbázis	perspective		yes	
AID322	Dunakeszi	Dunakeszi, Balparti II. Vmt.	working		yes	
AID323	Dunakeszi	Dunakeszi, DBRVR Dunakeszi vízbázis	working		yes	
AID340	Ercsi	Ercsi partiszűrésű vízbázisok	working	yes		
AID345	Pilismarót	Esztergom-K-Pilismarót	perspective		yes	
AID382	Göd	Göd, DBRVR Gödi vízbázis	working			yes
AID473	Kismaros	Kismaros-Nagymaros Távlati Vízbázis	perspective		yes	
AID474	Kisoroszi	Kisoroszi, Tahi vízbázis	working		yes	
AID475	Kisoroszi	Kisoroszi vmt.	working	yes		
AID498	Leányfalu	Leányfalu, DJRVR Leányfalui vízbázis	working	yes		
AID509	Lórév	Lórév-Makád Távlati Vízbázis	perspective		yes	
AID574	Nagymaros	Nagymaros, DBRVR Nagymarosi vízbázis	working		yes	
AID636	Pócsmegyer	Pócsmegyer, Surányi vmt.	working		yes	
AID649	Ráckeve	Ráckeve I. Vmt.	working		ongoing	
AID650	Ráckeve	Ráckeve II. Vmt.	working		ongoing	
AID713	Szentendre	Szentendre, DJRVR Szentendre Északi vízbázis	working	yes		
AID714	Szentendre	Szentendre, DJRVR Szentendre Pap-szigeti vízbázis	working	yes		
AID716	Szentendre	Szentendre, DJRVR Szentendre Regionális Déli Vízbázis	working	yes		
AID721	Szigetmonostor	Szigetmonostor, Horányi vmt.	working		yes	
AID722	Szigetmonostor	Szigetmonostor, Monostori vmt.	working	yes		
AID723	Szigetmonostor	Szigetmonostor, Pócsmegyeri vmt.	working		yes	
AID724	Szigetmonostor	Szigetmonostor, Sziget I-II. vmt.	working		yes	
AID730	Szob	Szob, IpRVR Szob Hidegréti vízbázis	working		yes	
AID742	Tahitótfalu	Tahitótfalu, Pokol-szigeti vízműkút	working			yes
AID743	Tahitótfalu	Tahitótfalu, Tótfalui vízműtelep	working		yes	
AID749	Tass	Tass (Gudmon-fok)	working	yes		
AID778	Szigetújfalu	Szigetújfalu, Tököl-Szigetújfalui vm.	working	yes		
AID785	Vác	Vác, DBRVR Vác Buki-szigeti vízbázis	working		yes	
AID788	Iváncsa	Váli-víz torkolati távlati vízbázis	perspective	yes		
AID808	Verőce	Verőcemaros, DBRVR Verőcei vízbázis	working		yes	
AID817	Visegrád	Visegrád, DJRVR Visegrádi Vízbázis	working	yes		
AID835	Zebegény	Zebegény Községi Vízmű vízbázisa	working	yes		
ALF869	Budapest 13. ker.	Budapest XIII., Radnóti úti galéria	reserve			yes
ALG020	Göd	Göd, Felsőgödi vízbázis	reserve			yes
ALG793	Vác	Vác, Déli Vízbázis	reserve			yes

88% of the working water resources have delineated DPWZs, from these 48.5% don't have authority decision. Two water resources are currently ongoing the diagnostic research and two have a pre-defined protective area. We can say that each of the operating water resource has at least predetermined protective area (Diagnostic studies of drinking water resources with vulnerable geological environment 1997-2017, 2004-2013).

The most stringent restrictions are in the inner zone, for example: The inner zone shall be fenced or guarded in another effective manner. The owner of the inner zone shall be the same as that of the water facilities. Regular access shall be permitted to the personnel of the operator of the water facility, who perform work there and who possess a "health book" demonstrating the regular medical checks provided for in another act of legislation. Entry shall be authorised further to superiors of the personnel and representatives of the supervisory authority, further to persons authorised specifically (e.g. for the period of performing work) by the owner of the protective area. The person authorising entry shall be responsible for preventing those staying temporarily in the protective area from causing pollution.

In the protection zones depending on in which zone, several activities are prohibited, or prohibited for new facilities and activities, or may be allowed pending on the outcome of an environmental audit or environmental impact assessment. Other activities are allowed if they operates without pollution or new facilities and activities can let pending on the outcome of an EIA, or environmental audit, or an equivalent investigation. Some activities are not restricted at all or in the hydrological or hydrogeological zones.

7. Table Allowed and prohibited activities in the drinking water protection zones (http://www.njt.hu/)

	Surface and subsurface supplies		Subsurface supplies, hydrogeological	
	inner	outer	A	B
	protective zones			
Residential, recreation development				
Housing colony, real-estate development for recreation	-	-	-	o
Residential- or office building with sewerage	-	x	+	+
Residential buildings without sewerage	-	-	x	o
Sewer crossing the area	-	x	o	o
Sewage treatment plant	-	-	o	+
Domestic sewage seepage pit	-	-	o	o
Construction and operation of communal liquid wastes disposal facility	-	-	-	o
Communal solid (non-hazardous) wastes landfill	-	-	-	o
Building rubble deposit	-	-	o	x
Cemetery	-	-	x	+
Hobby gardens	-	-	o	o
Camping, bathing	-	x	+	+
Sports ground	-	x	+	+
Industry				
Production, processing of highly toxic or radioactive materials, storage, disposal thereof	-	-	-	-
Production, processing, storage of toxic materials	-	-	-	o
Plants using no toxic materials, with appropriate sewerage	-	x	o	+
Production, transport in pipelines, processing and storage of petroleum and such products	-	-	x	o
Hazardous wastes disposal facility	-	-	-	x

	Surface and subsurface supplies		Subsurface supplies, hydrogeological	
	inner	outer	A	B
	protective zones			
Hazardous wastes landfill	-	-	-	-
On-site collection of hazardous wastes	-	-	x	o
Seepage disposal and storage of food industry effluents	-	-	-	o
Seepage disposal of other industrial waste waters	-	-	-	-
Landfilling with slag and ash	-	-	o	o
Agriculture				
Forest planting and management without chemicals	-	+	+	+
Crop farming[1]	-	o	o	o
Composting facility	-	-	x	o
Animal farming beyond the home demand level	-	-	x	o
Grazing, keeping domestic animals	-	o	o	+
Manure application[1]	-	o	o	+
Fertiliser application[1]	-	o	o	o
Application of dissolved fertiliser and liquid manure	-	-	-	o
Release of liquid manure	-	-	-	-
Sewage irrigation[1]	-	-	-	o
Irrigation with sewage treatment plant effluent[1]	-	-	o	+
Pesticide application[1]	-	o	o	o
Pesticide application from aircraft[1]	-	-	-	o
Pesticide storage and residues disposal	-	-	-	x
Washing pesticide equipment, effluent disposal	-	-	-	o
Manure- and fertiliser storage	-	-	x	o
Sewage sludge storage	-	-	x	o
Farmland disposal of sewage sludge[1]	-	-	x	o
Burying carcasses, construction and operation of carcass wells	-	-	-	o
Fish farming, feeding	-	-	o	o
Transportation				
Motorway, highway, sealed storm drain	-	x	o	+
Other road with sealed storm drain	-	x	+	+
other road	-	-	x	+
Railway	-	-	o	+
Vehicle parking area	-	-	o	+
Fuel filling station	-	-	x	o
Washing, repair shop, de-icing salt storage	-	-	o	+
Other activities				
Mining	-	-	x	o
Drilling, sinking new well	-	o	o	o
Other activities affecting the cover, or the aquifer	-	-	o	o

[1] In particular investigations the provisions of the directive 91/676 EEC on pollution control against nitrate from agriculture should be applied

[1] In particular investigations the provisions of the directive 91/676 EEC on pollution control against nitrate from agriculture should be applied

4. Main identified problems / conflicts

The most important water supply area in the country is the bank-filtered water sources on the right and left bank of the Danube, on the Szentendre and Csepel Islands. The bank-filtered water sources located on the pilot area supply with drinking water mainly Budapest and about 150 settlements in the agglomeration, about 2.5 million inhabitants.

The land use of the pilot area is very complex, in the north is mountainous, in the middle there are densely urban areas and the capital, in the south plain area and on the islands agricultural lands are found.

Our goal is to apply good practices in order to prevent the quality and quantity deterioration of drinking water sources. In case of bank-filtration the particular challenge is the necessity of protection from both the river side and the background. In the same time the wells are shallow drilled, so the system is exceptional vulnerable. Due to the dual endangering there is conflict of interest with flood protection, so for solving this conflict it is necessary to secure strong expert background and multipoint consultations.

In Hungary there are a lot of best practices, included in national plans (River Basin Management Plan, Flood Risk Management Plan in regards of drinking water protection) and legislation (Government Regulation on the protection of the actual and potential sources, defines the criteria of water protection zones) in order to minimise the negative impact of agriculture and industry on the DWPZs. Despite of the legislation the implementation and authority inspection is insufficient. Further problem is the low willingness of cooperation among farmers, other stakeholders and some water suppliers to ensure water protection. Despite of this national level insufficiency, there is a very good cooperation practice on this PA. Budapest Waterworks Company created a good practice guideline for farmers to support the protection of drinking water in an agricultural area and at the same time to help farmers making their livelihood in the water protection zones. The greatest drinking water sources are situated on the Szentendre or Csepel Island, and their water protection are managed by Budapest Waterworks (BW). These islands are not covered by urban area, the main land use is agriculture and nature reservation is also significant.

The DWPAs are situated on high-value real estates; this facility makes more difficult the procedure of designation by authorities.

On the PA there are detected contaminated sites, on which remediation has been going on. On the DWPAs there are professionally built monitoring systems which are controlled regularly (water quality and water level), so in case of a contamination mind happened it is possible starting the intervention.

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