

THE LEGAL BACKGROUND PERTAINING TO THE INSTALLATION AND OPERATION OF CONSTRUCTED WETLANDS IN HUNGARY

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Abstract: It has been proven that constructed wetlands can efficiently treat the sewage water of smaller agglomerations or of facilities which do not have waste water collecting systems. The use of extensive waste water treatment systems could be especially significant in Hungary, since three-fourths of the Hungarian settlements are too small for the building of a separate waste water collecting and treatment system in a cost effective manner, and long distances between the settlements do not allow the collection and conduction of the waste water from multiple settlements to a central system. The other problem with the long distances is that the waste water may rot in the pipes. In these cases constructed wetlands provide a good alternative, treating the waste water in an adequate manner, matching the emission limit values as specified in the laws. Extensive waste water treatment is an environmentally friendly and available way to treat the domestic waste water in smaller settlements.

Keywords: Constructed wetland, extensive waste water treatment, domestic waste water, threshold, limit values, Water Framework Directive.

INTRODUCTION

The strict environmental requirements of the European Union mean a great burden for the Member States, the municipalities and other addresses. There are some techniques which are able to meet these requirements in a cost effective manner. The aim of this article is to show that there are techniques based on natural processes which can meet the legal requirements while providing a means by which the 21st century man can live in harmony with the natural environment.

A constructed wetland (CW) is a wetland which is installed in a non-wetland area for the sake of treating domestic waste water and rainwater (Brix, 1994). It is a system, where both the abiotic and biotic environmental factors take part in the natural treating process as well as other functions (Lakatos and Czudar, 2008).

The EU issued a guide with regard to extensive waste water treatment (European Commission Guide, 2001), so that small and medium sized agglomerations can base their investment choices on information regarding the best technological and financial possibilities, while also keeping in mind ecological integration and a sustainable development. The guide points out, that alternative techniques can meet the requirements of the Commission Directive n°91/271 of 21 May 1991 concerning urban waste water treatment, and therefore municipalities can take into account extensive waste water treatments as a possible way for treating their domestic waste water.

There are many advantages in using CW. In the

construction of extensive waste water treatment plants, renewable energy sources are built into the system, providing the necessary energy for the operation of the plants and therefore greatly reducing the amount of external energy which needs to be used (Kocsis, 2001). The cost of the installation, operation, and maintenance is low (Lakatos and Czudar, 2008). CW ensure a new habitat for aquatic animals and plants. Secondary sludge does not arise. The operational safety is high and can meet the legal requirements of the EU. Special knowledge is not needed for the maintenance of CW, and also their repairation is cheap (European Commission Guide, 2001).

The Hungarian Ministry of Environment and Water declared the following: "Regarding the question, we believe that further regulating the rules regarding the application of extensive waste water treatment is not necessary. It is our belief that the existing laws provide a proper framework for their application. We do find it necessary though to provide help in the application of the existing laws, mainly in their interpretation".

Following the introduction of the water policy and the laws of the European Union, the Hungarian legal requirements are analyzed in this article.

POLICY AND LAW OF THE EUROPEAN UNION

It is absolutely necessary to have a clear knowledge of the laws of the European Union before introducing the Hungarian rules, being that since the accession of Hungary to the European Union, all the Hungarian environmental laws have been mainly derived from the

requirements of the Union.

The water quality rules make up the most evolved part of the environmental law of the Community (Horváth et al., 2004). The Community water policy and law is about 30 years old. It was fixed in the beginning on two objectives; on the one hand it set quality requirements for specific water uses; on the other hand it tried to limit the discharges of pollutants into water (Krämer, 2004).

Water framework directive

For the sake of a more coherent water policy the Community adopted a directive in 2000, named the European Union and Council Directive n°2000/60 establishing a framework for Community action in the field of water policy (Water Framework Directive). The Water Framework Directive gives a general frame, based on which the Community, the national, and the local authorities can follow an integral, coherent water policy. The Water Framework Directive aims at attaining a good ecological water quality by, at the very latest, 2015, and at halting further deterioration.

The Water Framework Directive rules apply to the surface and ground water jointly and uniformly, setting water quality requirements. The Water Framework Directive summarizes the physical, chemical, and biological indicators and uses them jointly with the help of the bottleneck principle. This means, that the state of the water will be characterized on the basis of the worst parameters. The planning, establishing programs and some economical requirements are also set in the directive, along with some requirements concerning agriculture, food safety and public sanitation (EMLA, 2003). One of the main achievements of the directive is that it requests the Member States to organize their waters according to individual river basins. In these territories an administration shall be established, which ensures the application of the Directive's rules in the river basin.

Over the next years the Water Framework Directive will strongly influence water management within the enlarged EC and — in particular via the river basin concept — beyond. It is much too early to decide whether it will reach its objectives. Much depends on the political will and the attitude of the relevant administration (Krämer, 2004).

Urban waste water directive

In 1991, the Community adopted the Commission Directive n°91/271 of 21 May 1991 concerning urban waste water treatment for protection from the negative effects of waste water. This directive is the most decisive law in the Community regarding extensive waste water treatments, even though its requirements only apply for agglomerations having a population

equivalent (p.e.) of more than 2000 (extensive waste water treatments can be efficiently used in smaller agglomerations, under 2000 p.e.). Indeed, agglomerations with less than 2000 p.e., which have a collection network, must also apply appropriate treatment (Article 7 of the "Urban Waste water" directive).

The objective of the Directive is to protect the environment from the adverse effects of the waste water discharges, in particular to reduce the pollution of the surface waters caused by nutrients originating in the waste water, and thus reducing the risk of eutrophication.

The main requirements of the Directive:

- all the agglomerations shall have domestic waste water collecting systems by the end of 2005;
- biological treatment;
- designation of sensitive areas, where stricter requirements are to apply;
- planning;
- monitoring.

Member States could submit a special request to the Commission for an extension of the deadlines. The Directive had to be transported into the Hungarian national law by the 1st of January, 2003, but Hungary requested a 10 year deferment from the execution of the other tasks of the directive, thus Hungary as a new Member State has to fulfill all the requirements of the Directive between 2008-2015. This is one of the longest postponement which was given to Hungary in the accession treaty (Európai füzetek az uniós csatlakozásról, 2004).

The deadlines and the settlements which need sewerage systems are listed in the government regulations 25/2000. (II. 27.) ('A' Programme) and 26/2002. (II. 27.). In the period till 2015, the 'A' Programme affects 651 agglomerations (1753 settlements) and another 800 settlements which are important with respect to the water base and environmental protection (KvVM, 2004). According to the plan of the 'A' Programme, 85 % of the domestic waste water will be discharged into collecting systems, utilizing a 100% secondary (biological) treatment. According to the report sent to the European Commission in July 2005 Hungary could fulfill the requirements of the program on time (KvVM, 2004). According to the data of the Hungarian Central Statistical Office, there has been a significant improvement in the field of waste water collection and treatment. However, of the treated waste water discharged into the receivers in 2008, 26 % had only been mechanically treated and 4,7 % had not been treated at all (Statistikai tükör, 2009).

The deadline regarding extensive waste water treatment is 31st of December, 2005 since by this time discharges from smaller agglomerations, where

collection system exist must be subject to an appropriate treatment according to art. 7 of the Directive.

Furthermore, Member States had to designate sensitive areas for which more stringent treatment requirements were to apply. Hungary fulfilled this requirement, and set the list of the sensitive areas in a government regulation 240/2000. (XII. 23.). Sensitive areas in Hungary are Lake Balaton, Lake Velence, and Lake Fertő and their drainage basins. This is important, since extensive waste water treatments will not be installed or only restrictedly installed in sensitive areas.

THE HUNGARIAN LEGISLATION

Use of CW is allowed in both the European Union and Hungary, although it is rarely mentioned in the law (Guide of the Ministry of Environment and Water, 2006). The extensive waste water treatments are under the scope of the law regarding artificial waste water treatment. Specific rules concerning the installation and operation of CW are set in the decree of the Ministry of Environment and Water 28/2004. (XII. 25.), giving the limit values for the discharge of water pollutants (hereinafter referred to as 28/2004. (XII. 25.) decree).

Legal conditions of the installation of constructed wetlands

First of all, it is necessary to examine the legal barriers regarding the installation of CW, and the rules which promote its use.

Extensive waste water treatment systems can only be installed in areas which do not lie within the 1. water quality protection area (e.g.: within the boundaries of Lake Balaton) according to the 28/2004. (XII. 25.) decree. The installation is also prohibited in the protection area of the ground water according to the government decree 123/1997. (VII. 18.) regarding the protection of the water base. Installation of CW is limited in the 2. water quality protection area (e.g.: within the boundaries of Lake Velence) and in areas which are sensitive to nitrates. Here CW can only be installed if the authority uniquely allows it, and the water base does not suffer damages. According to the government decree 123/1997. (VII. 18.), regarding the boundary of the 'A' zone of the ground water protection area, the installation or operation of a new or existing waste water treatment plant can be consented only after an environmental impact assessment (EIA) or unique assessment with the same content as EIA. The authority sets the requirements and the boundaries for the permits case by case, depending on the results of the assessments.

The government decree 219/2004 (VII. 21.), concerning the protection of ground water, prohibits,

among others, the discharge of substances which promote eutrophication, such as nitrates and phosphorous in areas which are sensitive from the point of view of the state of the ground water. This requirement indirectly sets a prohibition for the installation of waste water treatment plants in order to preserve the water quality.

The 28/2004. (XII. 25.) decree set another boundary regarding the use of the extensive waste water treatment plants. Above 600 p.e., it must be proven economically that the use of an extensive waste water treatment plant is more cost effective than an artificial one (taking into account the installation and 15 years of operation).

According to the 28/2004. (XII. 25.) decree, different limit values have been set in favor of the CW. An exception, regarding the winter period limit values in agglomerations with less than 2000 p.e. was also set, which also makes possible and more popular the use of the extensive waste water treatment plants.

Authorization

According to art. 28. (1) Act. 1995/57 concerning water management, the installation of extensive waste water treatment plants, thus the installation of CW is an activity which can only be pursued with a water permit. Furthermore, EIA shall be made in accordance with the decision of the competent authority, if the CW which is to be installed will be located in the water base protection area, or in the protection areas or sites of Natura 2000.

Issuing permits, and ordering EIA is in the competence of the inspectorate for environment, nature and water. Plan documentations need to be attached to the applications for the water permit procedure, in which, among others, the more important circumstances and data regarding water management need to be stated (Márk, 2006).

The water permit for installations is issued for a specified term. According to the present legal practice it is effective for 2 years (http://edktvf.zoldhatosag.hu/tartalom/nyomtatvany/zoldpont/ny_10.pdf). The permit authorizes the practice of the rights and fulfillment of obligations as they are set in the permit, the installation of the specified water establishment and the execution of the specified water work. In the permit the authority confirms the submitted plans, sets the main technical parameters and summarizes the requirements which shall be complied with during the installation.

The water permit for installation however does not release one from the obligation of obtaining a water permit for utilization and operation, as well as other obligatory permits (art. 3. (6) 72/1996. (V. 22.) government decree).

Legal conditions of operation and maintenance

A water permit for operation is needed to operate a CW (art. 28. (1) Act. 1995/57). The plant needs to be able to clean the collected waste water in a required manner, complying with the configuration parameters, while also meeting the safety, environmental and nature protection requirements (art. 10. (3) 21/2002. (IV. 25.) decree of the Ministry of Environment and Water).

The operator shall establish an operational bylaw, which contains, among others, the environmental and nature protection requirements (art. 8. (1) 21/2002. (IV. 25.) decree of the Ministry of Environment and Water). The inspectorate for environment, nature and water and the regional institute of the public health and medical services gives its consent to the issuance of the operational bylaw (art. 3. (2) and 8. (1) 21/2002. (IV. 25.) decree of the Ministry of Environment and Water).

According to the 28/2004. (XII. 25.) decree, waste water needs to be conducted to extensive waste water treatment plants through separate sewer systems (separated from the rainwater runoff) which do not operate with vacuum technology. Moreover, domestic waste water is subject to mechanical pre-treatment before its disposal to CW, and the approval of the authority is required for the disposal of pre-treated industrial waste water to CW (1. annex part I. B) (2) a) – b) 28/2004. (XII. 25.) decree).

The possibility for periodic sterilization must be ensured. However, establishing a fixed device for the sterilization or the constant sterilization of the waste

water is not obligatory (1. annex part I. B) (2) d) 28/2004. (XII. 25.) decree (2)).

If reed is used in CW, the reed bed filters must be monitored, and if necessary (usually every 6-8 years) must be changed. The older material must be disposed of, as set in the permission of the authority. During the change of the reed bed, the isolation of the bed must be verified, and if it is faulty, it must be repaired, if it is required by the authority, (1. annex part I. B) (2) d) 28/2004. (XII. 25.) decree (2) e)).

Another requirement for the waste water is that the microbiological quality of the discharged treated waste water can not effect the fulfillment of the microbiological requirements of the receiving water, as pertaining to its use for drinking, and bathing.

The following important requirements concern the emission limit values, which must be taken into account when operating a CW. The 28/2004. (XII. 25.) decree distinguishes technological and territorial emission limit values. The type of the limit values to be applied depends on the competent authority. For extensive waste water treatment, usually the technological emission limit values are set in the water permit, according to the present practice of law.

Presently in Hungary, moderate emission limit values are set, depending on the size of the agglomeration, similarly to the practice of Western Europe. For smaller settlements proportional limit values are set, as compared to the larger ones, taking into account the efficiency problem of the used techniques in the small agglomerations (KvVM, 2006) (see: Table 1.).

1. Table Technological emission limit values given in concentration(1) in minimum percentage of reduction(1) according to the 1 annex of 28/2004. (XII. 25.) decree

p.e.	COD ⁽³⁾		BOD ⁽²⁾⁽³⁾	total suspended solids ⁽³⁾			total phosphorus		total nitrogen	
	mg/l	%		%	mg/l	%	mg/l	%	from 1 May - 15 November	from 16 November to 30 April
<600	300	70	80	75	100	—	— ⁽⁴⁾	— ⁽⁴⁾	— ⁽⁴⁾	— ⁽⁴⁾
601–2000	200	75	50	80	70	—	— ⁽⁴⁾	— ⁽⁴⁾	— ⁽⁴⁾	— ⁽⁴⁾
2001–10 000	125	75	25	70–90	35	90	— ⁽⁴⁾	— ⁽⁴⁾	— ⁽⁴⁾	— ⁽⁴⁾
10 001–100 000	125	75	25	70–90	35	90	2 ⁽⁵⁾	80	15 ⁽⁵⁾	25 ⁽⁵⁾
>100 000	125	75	25	70–90	35	90	1 ⁽⁵⁾	80	10 ⁽⁵⁾	20 ⁽⁵⁾

2. Table Effectiveness of different constructed wetland approaches according to parameters (European Commission Guide, 2001, [tp://www.constructedwetlands.net/slides150904.pdf](http://www.constructedwetlands.net/slides150904.pdf), Dittrich, 2006)

Type of constructed wetland	Biochemical oxygen demand	Chemical oxygen demand (COD)	Total suspended solids	Total nitrogen	Total phosphorus
vertical flow reed bed filters	≤ 25mg/l Yes	≤ 90mg/l Yes	≤ 30 mg/l Yes	< 5 % efficiency, (very good nitrification)	reduction is normally low, depend on the age of the plant and the adsorption capacity 48%; with added iron 89%
horizontal flow reed bed filters	70-90% efficiency	n.d. *	< 90% efficiency	10-90 % efficiency nitrification capacity is low, very good denitrification	removal efficiency depends on the type of the soil, 30%; with added iron > 90% efficiency
multistage system	97% efficiency	n.d.*	61,5% efficiency	80,4 % efficiency	53 % efficiency

*n.d.: no data

Environmental load charges

According to act. 89 of 2003 on environmental load charges, the operation of a CW is an activity which is subject to a water permit, which is why it shall be liable for the water pollution duty payable as charged. Water load duty is charged for the emission of the water polluting substance such as COD, total phosphorus and total inorganic nitrogen into surface waters. In case of waste water treatment plants under 2000 p.e., water load duty shall be paid only after the discharge of COD in summer time, since, according to 28/2004. (XII. 25.) decree, the technological emission limit values regarding total phosphorus and total inorganic nitrogen are not applied for agglomerations with less than 2000 p.e., and in case of extensive waste water treatment the technological limit values shall be applied only in summer time.

The amount of the water load duty is calculated by the capacity, location of the plant, and the means of sludge disposal. For example, in case of a plant with 600 p.e., an annual discharge of 300 mg/l COD, located in a generally protected area where the sludge is disposed of within the plant (for example it is disposed under trees), about HUF 400 000/year shall be paid as water load duty. In the case of extensive waste water treatment, soil load duty is not obligatory, since biological soil cleaning is not an activity after which soil load duty must be paid (Márk, 2006).

Monitoring, supervision

The operator of the CW is obliged to self-audit, if according to its permit, and the data of the previous

year, the amount of discharged waste water into the receiver was more than 15 m³/operation day, or is deemed as endangering to the environment (art. 27. (2) government decree 220/2004. (VII. 21.)). The operator shall pursue the self-audit according to its self-audit plan, which is approved by the authority. Moreover, an operational log shall be kept, regarding the discharge of waste water and other technical processes (3. art. 27/2005. (XII. 6.) decree of Ministry of Environment and Water). The received results must be sent to the authority and, in certain cases, to the supplier. The authority supervises the conformance to the fulfillment of these requirements through onsite investigations, and by taking samplings. Furthermore, the operators who are obliged to self-audit shall supply data annually (art. 30 220/2004. (VII. 21.) government decree).

THE ROLE OF THE MUNICIPALITY IN THE USE OF THE CW

Waste water treatment and sewage disposal systems are outstandingly important in the life of a settlement. However the municipalities of the settlements with less than 2000 p.e., or which are not joined to any of the agglomerations of more than 2000 p.e., are not responsible for providing them, unless they decide otherwise. An exception is made for settlements with less than 2000 p.e. which are defined in the laws pertaining to the protection area of drinking water, and ground water, for whom the above mentioned tasks concerning waste water treatment are obligatory.

The treatment of domestic waste water must be solved even if it is not a responsibility of the municipality, since this is a precondition for the construction of buildings, since the construction of buildings is not allowed in areas where the collection and disposal of waste water is not solved (art. 33. (3) 253/1997. (XII. 20.) government decree).

The decisions concerning the manner in which the domestic waste water is to be treated is the task of the municipality, since the tasks and requirements concerning the domestic waste water must be set out in the municipal environmental program (art. 48/E. § (1) g) act. 53 of 1995).

In settlements with less than 2000 p.e., which do not belong to any agglomerations, the waste water treatment can be solved in many ways. If the municipality finds, that installing a collecting system is not cost effective, and the environmental protection aspects also do not warrant it, unique waste water treatments can be targeted in the municipal environmental program (KvVM, 2010). If building a waste water collecting system is cost effective, the municipality may take into account the use of extensive waste water treatments as a possible way to treat its domestic waste water, resulting from a concern for ecological integration and sustainable development for the sake of environmental protection (KvVM, 2010).

CONCLUSION

The use of CW is allowed in both the European Union and Hungary, although it is rarely mentioned in the law. In some instances its use is promoted, while in others it is hampered. Limit values are a good example for the promotion of the CW, since moderate limit values are set for CW as compared to the artificial waste water treatment plants. Examples for the obstruction of the installation and operation of CW are the following:

- The installation and operation of CW in sensitive areas is prohibited in order to protect the ground water.

- It has to be proven that the operation of such a waste water treatment plant is more cost effective than an artificial one.

- Although the use of CW is allowed in most instances, the operators often complain about the resistance of the authorities during the authorization procedure.

Similar legal requirements are set for extensive as well as artificial waste water treatment systems. A water permit is required for the installation and operation of each. Moreover it is obligatory to obtain a permit for outflowing the waste water, in order to protect the ground and the surface water.

Extensive waste water treatment plants must treat the waste water in the manner specified in the permits. Since the safety, environmental and nature protection criteria must be satisfied, these requirements must be set in an operational bylaw. Specific requirements are set in the decree of the Ministry of Environment and Water 28/2004. (XII. 25.).

The operation of a CW is an activity for which environmental loading duty must be paid, although paying soil loading duty is not obligatory.

In general, the municipalities of the settlements with less than 2000 p.e. are not responsible for providing waste water treatment in the settlement. However local governments have a great role in increasing the popularity of CW, since they are responsible for deciding on the manner in which the domestic waste water is to be treated in the settlement. It has been proven that CW can efficiently treat the waste water of smaller agglomerations or of facilities which do not have waste water collecting systems. The use of extensive waste water treatment systems could be especially significant in Hungary since three-fourths of the Hungarian towns are too small for the building of a separate waste water collecting and treatment system in a cost effective manner, and long distances between the settlements do not allow the joining of multiple settlements to a central system. The other problem with the long distances is that the waste water may rot in the pipes. In these cases, as it presented in this article CW provide a good environmentally friendly and available alternative, treating the domestic waste water of a small settlement in an adequate manner, matching the emission limit values as specified in the laws. The establishment of companies for the installation of CW and the foundation of a consortium in the western part of Hungary for the sake of the use of extensive waste water treatment shows the need for CW in Hungary.

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