Wastewater Treatment in Small and Medium Sized Municipalities in Turkey

BASELINE ASSESMENT

October 2009

Colophon	
Title:	***Wastewater Treatment in Small and Medium Sized Municipalities in Turkey***
	BASELINE ASSESSMENT
Reference:	G2G08/TR/7/2 Project WATTUR
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Counterpart:	Iller Bank
Beneficiaries:	Iller Bank and Ministry of Environment and Forestry (MoEF)
Date:	October 2009
Summary:	The following baseline report contains the findings from activities 1.1-1.3 (i.e. Legal and Institutional Baseline Study, Technical Baseline Study and Process / Organisation and Financial Baseline Study). The report also contains lessons learned and conclusions.

Contents

1 Introduction

1.1 Background

The EVD contracted Ameco, Dutch partner Tauw and Turkish partner IBS Research & Consultancy, IBS to assist the following Turkish parties in implementing Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment (UWWTD):

- Iller Bank (counterpart and beneficiary);
- The Ministry of Environment and Forestry, MoEF (beneficiary);
- State Planning Organisation, SPO (stakeholder); and
- Various municipalities (to be identified from the pilot pool from Iller Bank and MoEF, together with representatives from the Turkish Municipalities Union, TMU (stakeholder).

The project is being executed within the framework of the G2G/V Programme for 2008, which is being implemented by the EVD on behalf of The Netherlands Ministry of Economic Affairs, Ministry of Foreign Affairs and Ministry of Housing, Spatial Planning and the Environment.

An important element of the G2G Programme is the transfer of knowledge and expertise between governmental institutions. For the purposes of this project, this will take place between the Turkish counterpart, beneficiaries and stakeholders and the Dutch nominated partners Wereld Waternet and InfoMil (civil institutions/organisations active in the field of wastewater management). The consortium will facilitate this process while at the same time providing expert input.

The purpose of the project is to: *"Contribute to the implementation of Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment (UWWTD) by supporting Iller Bank, MoEF, SPO and municipalities in development of efficient and sustainable options and alternatives for municipal infrastructure investments."*

The expected results of the project include:

1. Analysis of options and alternatives for the development of a planning and implementation methodology for UWWT investments in Turkey;
2. Preparation of feasibility studies and final designs for four pilot projects; and
3. Strengthening of technical capacities of beneficiaries and relevant stakeholders on UWWT.

To ensure that the project team has a good understanding of the current situation of UWWT in Turkey, a Baseline Assessment has been carried out. The aim of the assessment is to clarify and confirm the point of departure for the project. It will also serve as a reference point for the evaluation of the project results following the completion of the project.

Bottlenecks experienced in UWWT in small and medium-sized municipalities can generally be attributed to a combination of factors associated with constraints and limitations in terms of financial and technical, organisational and to a lesser extent, legal and institutional, processes. For this reason, the entire UWWT 'chain', from planning to exploitation, was assessed.

1.2 Sources of information

Information for this Baseline Assessment was obtained during various site visits, interviews with relevant experts at Iller Bank, SPO, TMU, MoEF, municipalities and desk-top studies (e.g. EU Integrated Environmental Approximation Strategy 2007 - 2023 for the Republic of Turkey that was developed by the MoEF in 2006). Insight into practices 'on-the-ground' was gathered during the assessment of the pilot projects in Kepez and Aycavik. For more details on the assessment of these two pilots, see Annex 1. In addition, information concerning related projects and initiatives was also reviewed.

Contributions to this Baseline Assessment report were made by consortium partners Ameco, TAUW and IBS Research & Consultancy and nominated partners Wereld Waternet and InfoMil.

(From top clockwise: site visit to Kizilcahamam, location of planned UWWTP in Kizilcahamam, Technical team meeting in Kizilcahamam, assessment of Pilot 1& 2, meeting with MoEF)

2 Legal and Institutional Assessment

2.1 Introduction

The legal and institutional context of UWWT in small and medium-sized municipalities in Turkey was evaluated. Compliance with local, regional, national and EU regulations and legislation, as well as non-binding agreements, were assessed. Given that EU legislation on UWWT is currently being harmonized, only current institutions and their responsibilities were considered.

2.2 Legal Framework

The following Turkish legislative documents have been harmonised with European directives (source: Country Report presentation by Fatih Topbaş, 3 March 2008): Water Framework Directive; UWWTD; Drinking Water Directive; Quality of Surface Water Intended for the Abstraction of Drinking Water Directive; Directive on Dangerous Substances Discharged into Water; Nitrate Directive; and Bathing Water Directive.

The two Turkish regulations that regulate UWW discharges, based on the UWWTD Council Directive 91/271/EEC of 21 May 1991 (UWWTD), are the By-law on UWWT, in which the collection, treatment and discharge of urban wastewater on UWWP's is arranged, and the By-law on Control of Water Pollution, whose aim is to regulate the water pollution of all discharges of households and industries on surface water.

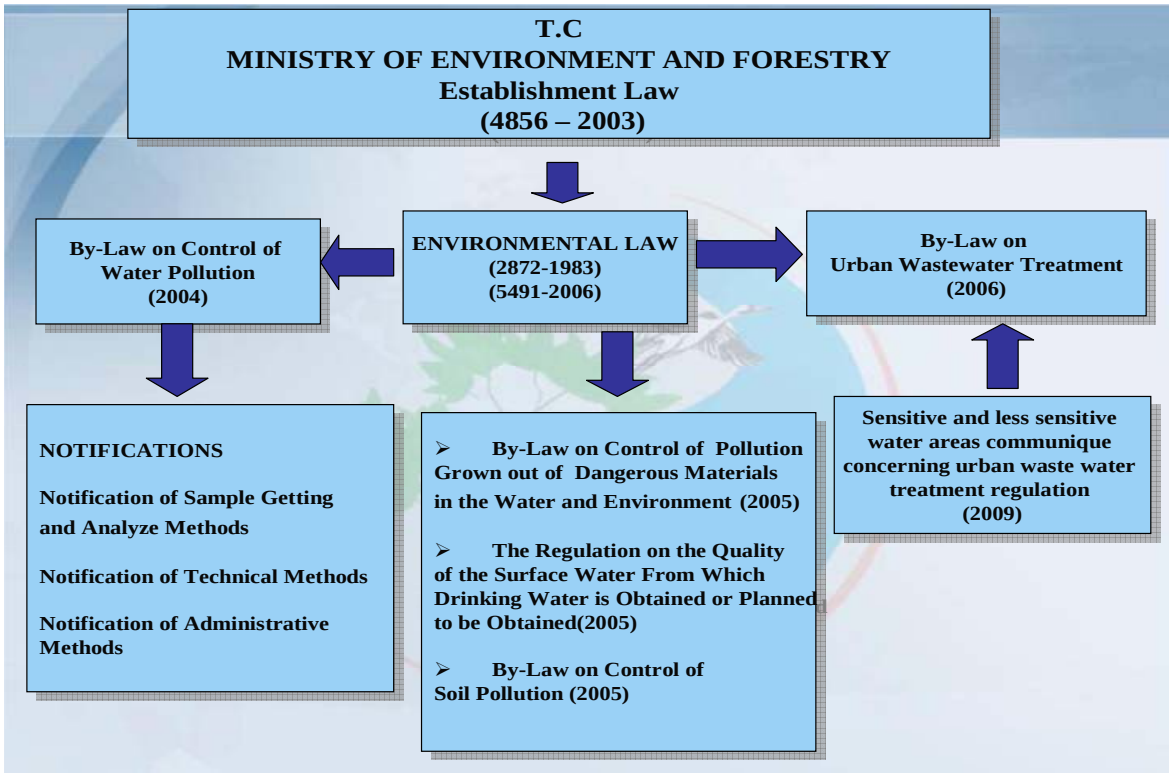

Figure 1: overview of relevant wastewater legislation
(Source: Country Report presentation by Fatih Topbaş, 3 March 2008)

2.2.1 Progress to date

The UWWTD has been transposed to the Turkish legislation by the By-law on UWWT, which was published in the Official Gazette No. 26047 on 8 January 2006. In accordance with the Provisional Article 2 of the By-law on UWWT, sensitive areas were determined by "Sensitive and less sensitive water areas concerning urban waste water treatment regulation" in June 2009. A new technical study is also currently being conducted for reviewing of the sensitive areas and the agglomerations. According to the official data of Turkish Statistical Institute (2004), the number of settlement areas according to population groups in Turkey, number of UWWTPs and ratio of sewage system and connection to UWWTPs by population groups can be classified as follows:

Table 1: Overview of wastewater statistics in Turkey

Population Groups	Number of Settlement	Sewage Connection Ratio	Number of UWWTPs (secondary + advanced)	The Ratio of Population Served with UWWTP
<2,000	35,106	59	1	5
2,000-9,999	2,572	55	33	5
10,000-49,999	458	81	43	19
50,000-100,000	83	90	15	20
>100,000	114	96	46	69

Technical studies are currently being carried out to complete a list of agglomerations based on population equivalent (p.e.). Technical studies are also being carried out to determine the size and load of the agglomerations, as well as the monitoring of the amount of treatment sludge.

The performance of the UWWTPs is monitored individually by the municipalities to which they are connected. The compliance of discharge water from the UWWTP according to receiving environment discharge standards for relevant sectors as defined in the By-law on Control of Water Pollution (Official Gazette: 31 December 2004, No. 25687) has been monitored.

2.2.2 Turkish By-laws on UWWT

By-law on UWWT and By-law on Control of Water Pollution

In addition to the By-law on UWWT, the Turkish By-law on the Control of Water Pollution regulates all waste water discharges including UWW. This By-law aims to protect surface water and groundwater from water pollution from household and industrial discharges.

For the purposes of this baseline study, the collection areas of urban waste water between 2.000 – 10.000 population equivalent (p.e.) were considered. Municipalities are responsible for treatment of this size of collection areas. Per region, the provincial offices of the MoEF are responsible for the permitting and control of discharges of UWWTPs on surface water.

The main articles for permitting and control of urban waste water on UWWTP's in both By-laws are explained in the following section.

Figure 2 shows a schematic diagram of the legislation of discharges on public UWWTP's and surface water. In each step the applicable articles of both By-laws are provided.

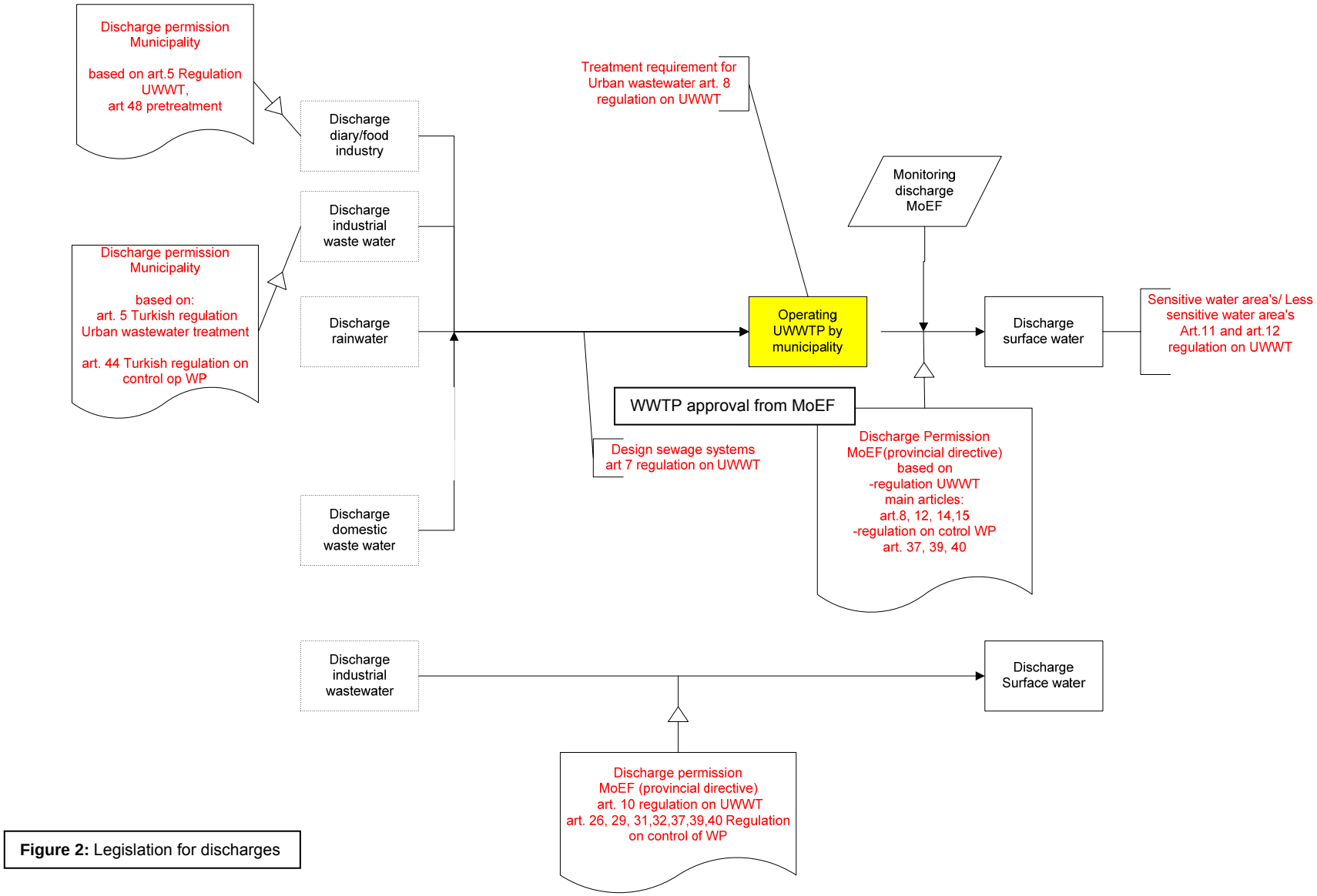

Figure 2: Legislation for discharges

Discharge into sewerage systems

By-law on UWWT

According to Article 9, the principles of discharging the industrial waste water to the sewerage system, municipalities ensure that industrial waste water discharge to the sewerage system are subject to permission for connection on sewerage system (government cares for all kind of waste water).

By-law on Control of Water Pollution

According to Article 25, basic principles for discharge on sewerage system, when there is a sewerage system, preference is given to discharging waste water to the sewerage systems instead of treatment and direct discharge on surface water.

In Article 44, permission for companies to discharge on the sewerage system is described:

- Permission is given by the municipality.
- It's a written document for household water and industrial waste water.

Article 45 refers to limitations of discharging to sewerage systems:

- In case of separate systems, rain or drainage water is not connected to the sewerage system.
- Companies must build balance pools before connection to a sewerage system.

Article 47 concerns maximum values parameters. Standards for discharges on sewerage systems are provided in Table 25 in the By-law.

In Article 48, maximum values for pre-treatment for food/diary industries are provided in Table 5 and 25 of the By-law. With more than 10% of total flow and pollutant rate of the sewerage system, the company must establish special ~~pre-treatment~~ purification facilities.

Treatment public UWWTP and discharge into surface water

By-law on UWWT

Article 7 and 8 are concerned with the treatment requirements for UWW:

- Discharge standards/ values/ criteria Table 1 Annex IV (in By-Law)
- In sensitive areas standards/ values/ criteria Table 2 Annex IV (in By-Law)
- Principles sensitive area's in Annex I (in By-Law)
- Evaluation of monitoring results in Annex II (monitoring method, number of annually samples, in By-Law)

Article 10 deals with permission for discharging wastewater with biologically degradable compounds directly into surface water:

- Municipalities will be ensured that the biologically degradable waste water originating from the facilities belonging to the industrial sectors that are mentioned under Annex-III (in By-law) and that cannot enter the UWWT facilities due to technical and economic reasons and discharged industrially to e.p. of 4000 or more, is in conformity with the discharge standards stated under Tables 5 and 6 of the By-law on The Control of Water Pollution.
- The permission for discharging to the receiving environment is subject to the Article 37 of the By-law on Control of Water Pollution.

Article 12 is less stringent then secondary treatment for collection areas 2.000-10.000 p.e. in less sensitive area's in the following cases:

- Such discharges are shown to be in conformity with the control procedures laid down in Annex II (In By-Law)

- Comprehensive studies indicate that such discharges will not adversely effect the environment. The municipality must send the outcome of the studies mentioned above to the MoEF at least once a year.
- The MoEF shall ensure that the identification of less sensitive areas is reviewed at intervals of no more than four years.

Article 14 addresses monitoring and control:

- Provincial office of MoEF monitors the compliance of the discharges.
- The municipality monitors waste water discharges made by industries of Annex III (allowed direct discharges with biological degradable compounds, in By-Law).
- The provincial directive of the MoEF sends the information of control every two year to the MoEF, or on request.

Article 15 refers to evaluation:

- Provincial office of MoEF makes a status report of all the public UWWTP discharges in their region every two year and sends it to MoEF Ankara.
- The provincial directive MoEF prepares an implementation program to implement the By-law together with the municipalities.
- The MoEF evaluates the result of regions every two year.

By-law on Control of Water Pollution

Article 26 is concerned with responsibility for measurement and control:

- Municipality as owner of the public UWWTP is responsible for the amount and quality control of waste water, decrease of pollution, appropriate to given waste water discharge values. Data are kept by the municipality during three years.
- Provincial offices of the MoEF control whether these activities are realized and control this with own measurements; the municipality pays for these measurements.

Article 32 contains standards and values for household discharge referring to Table 21. The discharge standards were defined in four categories depending on BOD_5 loads or equivalent population. It is getting more stringent with the increase of load/population. However, it refers only discharge parameters of BOD5, COD, SS and pH. Table 21 differs from the values for discharges in Table 1 and Table 2 of the By-law on UWWT due to the fact that the By-law on UWWT is the most recently published By-law. New UWWTP's should comply with Table 1 or 2 of the By-law on UWWT and the existing UWWTP's should comply with Table 21 of the By-law on Control of Water Pollution.

According to Article 37 on the basis discharge permission:

- All kinds of household or industrial wastewater discharges have to have permission for discharging from the Provincial office of the MoEF.
- Permission given by the Provincial office of the MoEF is valid for five years.
- Basis of permission are the standards/values/criteria in Table 5 – 21.
- Realizing limits: twelve months after notification of the limitations.

In Article 39, limitations and cancellation of permissions is presented. When discharge permission is exceeded, a penalty is given two times with a period to make the necessary amendments. If the company does not provide the required discharge conditions, the discharge permission is cancelled.

Article 40 concerns process permitting:

- The administration has to give permission at least within 2 months after the permission application.

- Permission certificates are renewed periodically. In the phase of this renewing, the probable changes of mentioned features, amount of waste water and pollution, realization of required technological; precautions, necessity of new precautions, measurement programs are controlled.
- When there are changes mentioned above, the applicant must begin to permission procedures again and take a permission certificate again.

Details of the harmonisation of the UWWTD in the Turkish context are included in Annex 2.

2.3 Institutional context

2.3.1 General duties and responsibilities include:

- The MoEF is responsible for wastewater discharge principles, sectoral discharge standards, legal permissions related discharging to the receiving environment (discharge permission to sewage given by sewage system owner), controlling and monitoring, financing and approval of WWT projects.
- The General Directorate of State Hydraulic Works can build a WWTP if necessary in special situations
- The Ministry Of Agriculture And Rural Affairs is responsible for nitrate pollution controlling and monitoring in fishing areas and groundwater
- The General Directorate Of Provinces Bank (Iller Bank) is responsible for WWTP project-design, tendering and construction, if any municipality asks for loan or credit from the Iller Bank.
- The Metropolitan Municipality and other municipalities are responsible for establishment of sewage system and UWWTPs, maintenance, improvement and operation.

2.3.2 Duties and responsibilities related to industrial discharges on public UWWTP include:

- Municipalities provide data of analysis of measurements of industrial discharges on sewerage systems.
- Municipalities check whether the wastewater conforms with Article 44 and Table 25 of the By-law on Control of Water Pollution.
- Permission is given by the municipality to the company;
- In case of food/dairy industries, municipality measure discharges and check whether pre-treatment is necessary.
- Control regular intervals.
- Change permits when necessary (conditions Table 25 of the By-law on Control of Water Pollution).

2.3.3 Duties and responsibilities for discharges of public UWWTP on surface water include:

- A permit application is sent to the provincial office of the MoEF.
- The provincial office of the MoEF checks whether the application conforms to the Notification about Administrational Methods of the By-law on Control of Water Pollution.
- The provincial office of the MoEF checks whether the wastewater conforms to Article 37 (Table 5 - 21) of the By-law on Control of Water Pollution.
- Within 2 months a permission certificate is extended to the municipality by MoEF.

- The municipality takes samples. Data are kept for three years.
- The provincial office of the MoEF checks the discharge permission values with own measurements.
- The provincial office of the MoEF makes a status report of all the public UWWTP discharges in their region every two years and sends it to the MoEF in Ankara.
- The MoEF in Ankara evaluate the result of regions every two years.
- The Provincial office of the MoEF, together with the municipalities, prepares an implementation program to implement the By-law.

2.4 General findings

- In the Turkish regulation all treatment requirements of wastewater are described. The duties and responsibilities on UWWT of organisations and institutions are addressed clearly. It can be concluded that the EU-Directive on UWWT is fully transposed in the Turkish By-laws.
- An integrated approach to the wastewater and environmental Directives is could be more developed. The By-law on UWWT and the By-law on Control of Water Pollution could be more harmonized. Furthermore, both By-laws should be increasingly integrated with the regulations of the whole water sector.
- The MoEF website contains all acts and By-laws with no further explanations. There are regional trainings carried out by the MoEF in Ankara every year and for new legislation if it includes significant changes. If needed (when provincial directorate see necessary) questions about legislation are directed to the MoEF in Ankara by the Provincial Directorates.
- Limited training on legislation is given to the municipalities by the Provincial Directorates of the MoEF.
- The requirements of the UWWTD have been incorporated in Turkish laws and regulations; however it remains unclear as to what extent regulations are being executed because of insufficient data. The general picture is that there is not enough staff (at all levels) to adequately implement these regulations.
- There is a lack of personnel that is properly educated in UWWT technology in small and medium sized municipalities.
- In small and medium sized municipalities permits for industrial discharges into the sewerage system can be extended but the quality of these discharges are not always checked (i.e. insufficient controlling and monitoring).
- The measurement and analysis of UWWTP discharges is done by Provincial Directorates of the MoEF. Although the MoEF would prefer municipalities to also carry out these tasks, they lack the man-power and capacity to do so.
- Enforcement of regulation by MoEF could be improved. The Provincial Directorate of the MoEF is responsible for monitoring the operational performance of the UWWTP. Discharges are analysed by the laboratory written in “Notification of sample getting analyze methods” (because sampling interval changes according to plants capacity). When the UWWTP is unable to meet the discharge criteria, they are first given a written warning but giving time does not prevent them receiving a penalty. Should the problem persist, the Provincial Directorate has the right to penalise them excessively. However, the Directorates very seldom penalise UWWTPs. They appear to have adopted a stance that municipalities that have established UWWTPs should rather be supported and not demotivated by the issuing of penalties.
- The challenge to enhance both wastewater collection and UWWT is significant (refer to Table 1).

3 Technical Assessment

3.1 Introduction

The objective of the Technical Baseline Assessment was to evaluate the present status of UWWT in small and medium-sized municipalities in Turkey.

The general findings given in 3.2 are given based on various sources. As presented in the introduction, many experts were consulted during site visits to Turkey. In addition desk research was executed and designs of UWWTPs reviewed. UWWT in practice has been assessment by the project team during the execution of two pilots in Kepez and Aycavik. The conclusions of the two pilots are not representative for all UWWTPs in Turkey, however have been considered when drafting the general findings section. The detailed findings for the pilots can be reviewed in Annex 1.

3.2 General findings

- Designs of UWWTP's: in general the designs of UWWTP's are well drafted. However, the construction of the UWWTP's does not always comply with the initial design. Increased supervision by Iller Bank, relevant institutional and company experts during the construction of the UWWTPs could address this problem which municipalities have insufficient technical personal.
- Costs of design: some UWWTPs are built taken into account possible future expansion. At the time of designing and constructing the UWWTP this might seem cost efficient, however in practice costs are not used efficiently. Building costs will be higher than necessary. In addition, the installed components will be subject to depreciation (due to weather influences, pollution by wastewater etc.) and will most probably need to be renewed at the time of expanding the UWWTP. In addition, the technique for UWWTP's can change considerable in time. The result could be an out-of-date UWWTP.
- Analysis of influent and effluent: the actual efficiency of the UWWTPs is often not known and the characteristics of the influent and effluent are not adequately analysed. It is very important to know the efficiency of a UWWTP.
- Online flow measurement: limited online flow measurement is being undertaken. The daily hydraulic load is therefore not known.
- Online measurement equipment: limited online measurement equipment has been installed. This makes it difficult to operate a UWWTP. For example, online oxygen measurement in the activated sludge tank is important. The surface aerators should be controlled by this online oxygen measurement in order to ensure that the amount of oxygen input is related to the current load of the UWWTP. For example, in a UWWTP this would mean that if the load drops then one surface aerator would be automatically switched off and when the load increases the second surface aerator would be switched on again. No oxygen (and therefore energy) is wasted in this way. In general more online measurements also translate into less time required from operators. A good balance in online measurements should be considered.
- Chlorination is sometimes used in the final stages of treatment. The step is expensive and dangerous to install.
- The sludge treatment equipment is used rarely, a few hours once a week. It could be more efficient to transport the sludge from a WWT plant to another UWWT plant in the neighbourhood and make use of one thickener.

- Training of operators by the constructor: the constructor of the UWWTP has to train the operators of the UWWTP within a limited time span following completion of the construction of the UWWTP. After this Iller Bank checks whether the UWWTP is operating properly. If this is the case, Iller Bank hands over the responsibility of the UWWTP to the municipality. It appears that the training conducted by the contractor only has a technical (i.e. how to switch things on and off) focus. It is not technological. Therefore the UWWTP's often are not operated properly. Operators should also be trained on technological aspects.
- It is not registered what Iller Bank experts check before handing over responsibility of the UWWTP to the municipality. A protocol could be useful, in which the aspects that should be checked are recorded. In this way defects (e.g. wrong-turning aerator) can be identified and corrected in time.
- Safety/security: the safety/security of the operators of the UWWTP's can be improved by the implementation and enforcement of existing standards (such as TSI, IEC and Directives of machinery). Some examples: installing safety work switches in order to ensure that the electrical power is off when someone is doing maintenance on an electrical device like a pump; installing appropriate railings near basements to minimise the risk of a possible fall; applying pull safety cords in the activated sludge tanks which will, once pulled, switch of the propulsors and the aeration devices when someone accidentally falls into the activated sludge tanks; and securing gas bottles to the walls to prevent possible drops.
- Automation: The components of the UWWTPs are served on and off manually. The operation and control of the machinery can be made easier and more efficient by using simple controllers and timers. There is no need for using complicated hardware or software. With smart process control- equipment and adjustments the high workload of the operators will be reduced (they are available 24 hours a day). The automatic operation of the systems will also reduce the energy use in the UWWTP:
    - Using better quality measuring equipment and applying extra level switches will prevent flooding or running the pumps dry.
    - The use of more measuring sensors (Level, Oxygen, flow) and using more feedback for targeted control of the machinery and more linearity of the process ensure a stable process operation of the system.
    - Many process fluctuations, switching the machinery on and off too frequently without feedback, disrupt the desired process results.
    - Execution of an energy assessment of the plant components with energy efficient alternatives of machines is expected to increase improvements, which will reduce the energy demand and therefore lower the yearly operating costs.
- The functioning of existing WWTP's can be improved by some relatively small adjustments like online measurement equipment and automated process control equipment.

4 Management, Operations and Financing

4.1 Introduction

Apart from the institutional and legal WWT setting and technical aspects of UWWTP's, considerations related to organisation, management and finances, especially when it comes to operation and maintenance of UWWTPs in small and medium sized municipalities, have been assessed. The latter is seen as a considerable problem in the total process of WWT.

4.2 General findings

4.2.1 Organisation & management

- Municipalities are held responsible for the realisation, operation and maintenance of UWWTPs and financing waste water services.
- UWWT processes in small and medium-sized municipalities seem rather in-efficient, due to limited co-operation between municipalities. When municipalities combine UWWT efforts, combined UWWTPs can be constructed. This can result in more efficient processes due to advantages in scale and the increased involvement of capable personnel and reduce the operation costs. There are some practices of co-operation between municipalities. In general co-operation fails or inefficient due to the fact that one of the partnering municipalities does not fulfil there financial obligations. Forms of co-operation should be found addressing the problems mentioned.
- MoEF prioritize all river basins with respect to UWWT (6 are very important). MoEF develops Action Plans for WWT per river basin. The Action Plan includes priorities for the development of UWWTPs. Municipalities are widely consulted and involved in the process of setting priorities. For three of the basins Action Plans have been drafted (published on their website). Plans for the other four basins will follow. The Action Plans of MoEF for the priority basins does incorporate the development of unions (management systems) for combined UWWT by municipalities. Management systems still need to be elaborated. According to current legislation, unions can already be formed.
- The Iller Bank develops designs for UWWTPs on request of municipalities. Iller Bank provides the municipalities various options for UWWTPs; however municipalities are not capable of making a proper selection. Municipalities should be more closely involved in the process of designing and building the WWTPs and in considerations related to the operation and maintenance after the construction of the plants.
- Feasibility studies for the construction of smaller UWWTP's do not include financial considerations for operation and maintenance (i.e. studies prepared by Iller Bank). Multiple costs such as for energy, operation, maintenance and staffing should be taken into consideration for at least 30 years when designing the UWWTPs. Including financial considerations in the stage of the feasibility studies could considerably impact the decision on appropriate small-scale UWWT techniques.

- There is a lack of qualified personnel for operating UWWTPs at municipal levels. Therefore unification of the UWWT processes, especially of neighbouring municipalities is favourable. When plants are similar, personnel can easily be exchanged between the different UWWTPs. Both MoEF as the Iller Bank use a Guideline with standard designs for UWWTPs. The guidelines are not similar, resulting in different solutions for the same kind of waste water circumstances in some cases (e.g. estimation of population, flow, loading, etc.)
- There is a gentlemen's agreement between MoEF and Iller Bank that states that project concepts and designs will be accepted by MoEF. However, there are no set procedures for acceptance of their products. Results could be improved by offering more alternatives and information about the evaluation of alternatives and by setting clear guidelines. This could improve the quality of the products and the co-operation between the organisations.
- The constructed UWWTP's are not always in line with the initial design. Increased supervision by Iller Bank, relevant institutional and company experts during the construction of the UWWTPs could address this problem.
- The Mayor of municipalities is elected and serves the municipalities for five years. Each five years there is a chance that the public officers are (partly) replaced, due to political circumstances. This should be taken into account when developing training programmes on water management for public officers working for municipalities.
- In general, the public is not actively and adequately involved in the decision-making of municipalities on water regulation/management.
- The objective of the Turkish government to have 2,500 municipalities supplied with an UWWTP before 2015 is considered a challenge. Identifying management options for optimising the number of UWWTP's and municipalities should be investigated, given the above-mentioned constraints.
- UWWT processes are relatively inefficient due to limited cooperation between municipalities. Involvement of municipalities in the phase of design and building of a WWTP is relatively low, whereas in this phase important decisions are made concerning the operation phase.

4.2.2 Financing resources

- The first investment costs of UWWTPs can often be recovered. However, the biggest challenge is recovering costs during operation and maintenance. These should be considered prior to construction of UWWTPs (e.g. pre-feasibility stage).
- Many small and medium-sized municipalities in Turkey do not base their water tariff on actual cost calculations. They are also usually not sufficient to cover the full costs. The operation of UWWTPs is costly and if water tariffs are not adjusted by taking treatment cost into consideration, the plants become a financial burden for the municipalities. Before starting to operate an UWWTP, the municipalities should either increase water tariffs or introduce a wastewater tariff. This supports the user and polluter pays principle and increases the sustainability of the plant.
- Regulations on water tariffs are currently being developed and adopted.
- The WWTP energy incentive regulation published on 01.10.2010, which includes the financing of energy costs of urban and industrial, properly operated WWTPs.
- Political issues can effect the decision making of municipalities when it comes to the introduction of higher prices for water and UWWT should be considered.
- Taxes collected from greater municipalities could recover the first investment costs and operational costs of smaller municipalities when there is a union from municipalities (see the metropol of Ankara, four WWTP and one tariff for the whole region on water, including costs for UWWT).

- MoEF is currently developing a subsidy programme. Municipalities who operate well (discharge water is within limits set), can get covered 50% of the energy costs (by central budget). Different types of subsidies are planned depending on the size of UWWTPs. The goal of the programme is a change in culture. Sustainable follow up measures should be considered. An alternative for a subsidy on energy costs could be a subsidy on investment costs and enhance the enforcement on effluent discharge.
- Choices related to the construction of new WWTP's are based on investment costs rather than the total cost of ownership.
- The polluter pays principle is not fully implemented as tariffs in many cases do not cover the total costs of UWWT.

In order to finance public sector investments, national and international grants must be used for urban infrastructure projects which are selected according to prioritization criterion. If a municipality has insufficient technical capacity to implement the selected project, Iller Bank should implement the project.

Figure 3 below illustrates the possible sources of financing for environmental investments, such as UWWTPs in small and medium-sized municipalities.

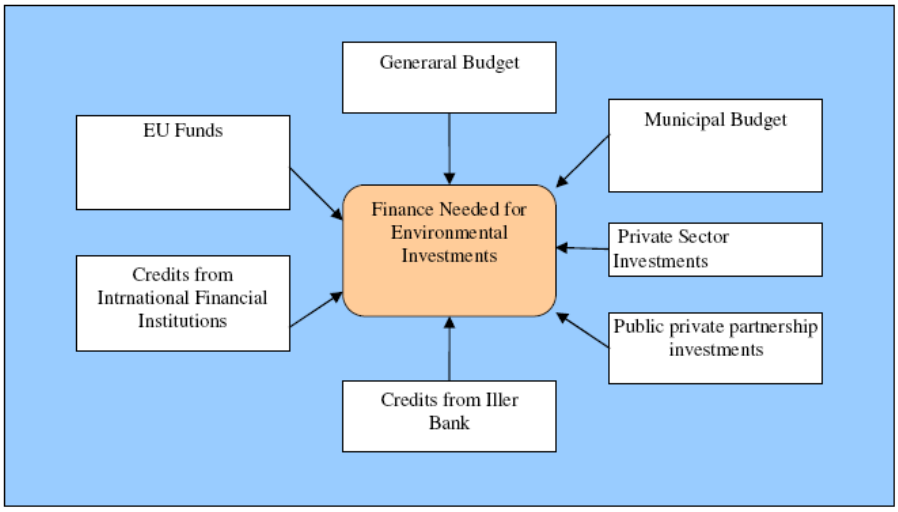

Figure 3: possible sources of financing for environmental investments
(Source: EU Integrated Environmental Approximation Strategy 2007 - 2023)

5 Way Forward

The following priorities for improving UWWT in small and medium-sized municipalities in Turkey are set by the project team:

- Increase the capacity at central ministerial level (MoEF) and within the TMU for the development of management structures for combined UWWT by small and medium-sized municipalities.
- Increase the capacity of central authorities (MoEF and Iller Bank) on management, organisation and financing to operate and maintain UWWTPs.
- Increase the capacity of central authorities (MoEF and Iller Bank) on the preparation of feasibility studies (include financial considerations in feasibility studies)
- Develop structures for capacity building of operators of UWWTPs.
- Develop structures for capacity building of public officers at regional and local level on water management, operation and maintenances and financing.
- Develop structures for capacity building of public officers on regional and local level for enforcement of water regulation.
- Develop mechanisms for increasing information dissemination between central, regional and local authorities on UWWT and regulation.
- Encourage public consultation and participation in decision-making at the local level.
- Publishing new regulations to implement collecting wastewater cost from subscribers.

(Site visit to Kizilcahamam with Consortium members, nominated partners, representatives from Iller Bank and MoEF and the municipality)

6 Annexes

- Report: Pilot 1 and 2 Annex 1
- Harmonisation of the UWWTD in the Turkish context Annex 2
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Wastewater Treatment in Small and Medium Sized Municipalities in Turkey

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Annex 1: Harmonisation of the UWWTD in the Turkish context

Annex 1

Harmonisation of the UWWTD in the Turkish context

Establishing technical and financial programme for implementation of the directive (Art.17 of the directive)

Technical studies for the preparation of an Environmental Approximation Strategy of Turkey are about to come into being. The outputs of the "Technical Assistance for the Preparation of the Integrated Environment Approximation Strategy for Turkey" Project financed under EU MEDA Program (2003-2004), and the "Technical Assistance for Environmental Heavy Cost Investment Planning" Project within the framework of the "Capacity Building in the Field of Environment for Turkey" Project financed under the 2002 EU Pre-Accession Financial Assistance (2003-2005), are taken into consideration in the preparation of the Strategy.

The Document, which sets out Turkey's action plan for environmental management, also puts forward the purposes of the Urban Waste Water Treatment Directive (91/271/EEC of 21 May 1991), targets, strategies and financial programme for the short, medium and long-term for the implementation of the By-law on UWWT.

Requiring specific regulation and/or authorisation (permit procedure) and ensuring that treatment plants are designed, constructed, operated and maintained to meet specified performance requirements (Art. 10, 4, 5 of the directive)

Article 6 (a) of the By-law on UWWT sets out the procedures and principles to be followed in the design, construction and maintenance of the urban wastewater treatment plants that shall take into account seasonal changes in organic and hydraulic loads and can operate with adequate performance under normal local climate conditions.

The Law on the Establishment and Duties of the MoEF No.4856 (Official Gazette: 8 May 2003, No. 25102) assigns the MoEF with the duties of granting discharge permits to facilities, monitoring and controlling the treatment plants and approving the projects for the treatment systems to be established for the facilities. In this context, Ministerial Circular on Waste Water Treatment Facility Project Approval (No: 2005/5, dated 29 April 2005) has been published.

Provincial Directorates of the MoEF monitor whether facilities comply with receiving environment discharge criteria. Accordingly, discharge permit is granted to wastewater treatment plants, which comply with the discharge limits. There exist legal arrangements with respect to preparation of projects for and construction, maintenance and operation of wastewater treatment plants in the Law on Municipality No.5359 (Official Gazette: 13 July 2005, No.25874), the Law on Metropolitan Municipalities No.5216 (Official Gazette: 23 July 2004, No.25531), the Law on the Establishment and Duties of General Directorate of Istanbul Water and Sewage Administration No.2560 (Official Gazette: 23 November 1981, No.17523).

Requiring specific regulation and/or authorisation (permit procedure) and pre-treatment for industrial discharges into urban/municipal sewage collecting systems (Art.11, Annex IC of the directive)

Article 9 of the By-law on UWWT sets out the procedures concerning the principles of discharge of wastewater to sewage. The By-law on Control of Water Pollution, the Law on Municipality No.5359, the Law on Metropolitan Municipality No.5216, the Law on the Establishment and Duties of the General Directorate of Istanbul Water and Sewage Administration No.2560 set out the permit procedures and special arrangements for pre-treated industrial discharges to sewage.

Identifying food-processing industries (Annex III) and requiring prior regulation and/or specific authorisation (permit procedure) and adequate treatment for discharges from these industries (Art.13 of the directive)

Article 10 of the By-law on UWWT sets out the rules and procedures for the determination of the food industries, special permit procedures for wastewater discharges of food industries to receiving environment as well as the rules and procedures for wastewater discharge of these industries.

Providing collecting systems for agglomerations greater than 15 000 p.e. (Art. 3 of the directive)

In accordance with the By-law on UWWT, 10,000 p.e. is taken as the basis for providing collection systems.

According to the official data of Turkish Statistical Institute (2004), there are 655 settlement areas with a population more than 10,000 in Turkey. The connection ratio of settlement areas to sewage is 92 %. There are 469 settlement areas with a population of more than 15,000. The ratio of the population of the settlement areas served by the sewage to the total population of the municipality is 93 %.

Provisional Article 1 of the By-law on UWWT sets out the timeframes for the construction of main collectors and wastewater treatment plants.

Providing collecting systems for agglomerations 2 000 – 15 000 p.e. (Art. 3 of the directive)

According to the official data of Turkish Statistical Institute (2004), there are 2,572 settlement areas with a population of 2,000 – 10,000 in Turkey. The ratio of the population of the settlement areas served by the sewage to the total population of the municipality is 55 %.

There are 2,758 settlements areas with a population of 2,000 – 15,000 in Turkey. The ratio of the population of the settlement areas served by the sewage to the total population of the municipality is 59 %

Ensuring requirements for adequate capacity, special design, construction and maintenance of collecting systems and ensuring measures to deal with limitation of pollution from storm water overflows and prevention of leaks (Art.3 and Annex I.A and footnote of the directive)

Article 7 of the By-law on UWWT sets out the rules and procedures for the design, construction and maintenance of the sewage.

Requiring UWW entering collecting systems to be subject to secondary or equivalent treatment for agglomerations more than 15 000 p.e. (Art. 4 of the directive)

Article 6 (d) and Provisional Article 1 of the By-law on UWWT specifies the rules and procedures regarding discharges of the agglomerations more than 10,000 p.e.

According to the official data of Turkish Statistical Institute (2004), there are 104 secondary treatment plants in settlement areas with a population more than 10,000. The ratio served by treatment plants is 53 %.

There are 91 secondary treatment plants of which 4 are advanced treatment plants in settlement areas with a population more than 15,000 and the ratio of the population served by the treatment plants is 55 %.

The treatment requirements will be determined following the determination of agglomerations, sensitive and less sensitive areas. Technical studies are in progress.

Requiring UWW entering collecting systems to be subject to secondary or equivalent treatment for agglomerations 10 000 – 15 000 p.e. (Art. 4 of the directive)

Article 6 (d) and Provisional Article 1 of the By-law on UWWT specifies the rules and procedures regarding the discharges of the agglomerations more than 10,000 p.e.

According to the official data of Turkish Statistical Institute (2004), there are 15 secondary treatment plants in settlement areas with a population of 10,000 – 15,000 and the ratio of the population served by the treatment plants is 13 %.

The treatment requirements will be determined following the determination of agglomerations, sensitive and less sensitive areas. Technical studies are in progress.

Requiring UWW entering collecting systems to be subject to secondary or equivalent treatment for discharges to fresh water and estuaries for agglomerations 2 000 – 10 000 p.e. (Art. 4 of the directive)

Article 6 (d) and Provisional Article 1 of the By-law on UWWT specifies the rules and procedures regarding the discharges of the agglomerations with a population of 2,000-10,000 p.e.

According to the official data of Turkish Statistical Institute (2004), there are 33 secondary treatment plants in settlement areas with a population of 2,000 – 10,000 and the ratio of the population served by the treatment plants is 5 %.

The treatment requirements will be determined following the determination of agglomerations, sensitive and less sensitive areas. Technical studies are in progress.

Requiring UWW entering collecting systems for discharge to sensitive areas to be subject to more stringent treatment for agglomerations greater than 10 000 p.e. (Art. 5 of the directive)

Article 11 and Provisional Article 1 of the By-law on UWWT set out the rules and procedures regarding discharges of agglomerations with a population of more than 10,000 p.e.

The treatment requirements will be determined following the determination of agglomerations, sensitive and less sensitive areas. Technical studies are in progress.

Requiring UWW entering collecting systems for discharges to fresh waters, estuaries and coastal waters to be subject to appropriate treatment (Art. 7 of the directive)

Article 6 (c) and (d) of the By-law on UWWT set out the rules and procedures for the treatment requirements for discharges to the fresh water, estuaries and coastal waters.

Technical studies for the classification of coastal waters are in progress.

Requiring prior regulation/ specific authorizations and specific requirements for disposal/re-use of treated waste water from UWWT plants (Art. 12 of the directive)

The arrangements with respect to the re-use of wastewater in the Article 5 (e) of the By-law on UWWT is given in the irrigation water criteria provision of the Communiqué on Technical Procedures (Official Gazette: 7 January 1991, No. 20748) published in accordance with the with the By-law on Control of Water Pollution.

Regulating management of sewage sludge: ensuring its treatment and environmentally sound disposal and/or re-use (Art. 14 of the directive)

Article 5 (f) and (g) of the By-law on UWWT set out the rules and procedures for treatment sludge.

The treatment sludge is used in soil in line with the standards and procedures set out in the By-law on Soil Pollution Control (Official Gazette: 31 May 2005, No.25831).

Sludge that is not used for agricultural purposes is disposed in line with the By-law on Solid Waste Control (Official Gazette: 14 March 2005, No.25755) and By-law on Hazardous Waste Control (Official Gazette: 14 March 2005, No. 25755).

According to the By-law on Soil Pollution Control, permits regarding the use of treatment sludge are given by Governorships.

Establishing an effective monitoring and enforcement system and considering accreditation schemes for laboratories, ensuring the use of standard laboratory methods and regular QA/QC (Art. 15, Annex ID of the directive)

Article 14 (a) of the By-law on UWWT sets out the rules and procedures for monitoring the discharge of urban wastewater, and Article 5 (h) specifies the rules and procedures to be taken into account in the monitoring of wastewater and receiving environments.

As a requirement of the By-law on Control of Water Pollution, the samples taken from the discharge waters of the treatment systems are analyzed periodically by the administrations of the wastewater infrastructure authorities.

The inspection of the treatment plants, which discharge to receiving environments, is conducted by the MoEF, and the inspection of the treatment plants, which discharge to the sewerage systems, is conducted by the municipalities.

Enforcement is applied in accordance with the Law on Environment No.2872 (Official Gazette: 11 August 1983, No. 18132) to those who do not comply with the By-law on Control of Water Pollution, Law on Municipality No.5359, the Law on Metropolitan Municipality No.5216, the Law on the Establishment and Duties of General Directorate of Istanbul Water and Sewage Administration No.2560 and the By-law on Discharge to Sewerage Systems in Metropolitan Municipalities.

In accordance with the Law on the Establishment and Duties of the MoEF No.4856, Competency on Environmental Analysis Certificate is granted to the organizations, institutions and facilities, which conduct measurements and analysis, following the assessment of the analysis methods used in laboratory, adequacy of the personnel making

analysis, and other issues. This certificate is made on the basis of “TS EN ISO/IEC 17025” General Standards for the Competency of Experiment and Calibration Laboratories”.

Turkish Accreditation Agency, which is established by the Law on the Establishment and Duties of the Turkish Accreditation Agency No.4457 (Official Gazette: 4 November 1999, No.23866), has started issuing accreditations since 2001. The Agency has become a full member of the European Cooperation for Accreditation (EA) on 28 October 2002. The Agency conducts accreditation procedures in accordance with the TS EN ISO/IEC 17025:2000 standard for the institutions providing laboratory services.

Establishing a mechanism to provide information to the public considering publication of regular situation reports (Art. 16 of the directive)

Article 5 (i) of the By-law on UWWT sets out the rules and procedures for the dissemination of information regarding disposal of wastewater and treatment sludge publicly, via periodic reports.

Data with respect to discharge from sewage, quantity of the collected wastewater, level of treatment and receiving environments to which wastewater is discharged is collected through the “Municipal Wastewater Statistics Survey” conducted by the Turkish Statistical Institute. The statistical results are announced through web site and news bulletins.

Establishing a mechanism to report to the Commission in means of:

- *Management system to report information at national level.*
- *Technical tools for information upload, storage and assessment.*

Not applicable before membership.

Establishing protocols for notifying neighbouring Member States (Art. 9 of the directive)

Not applicable before membership.

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Annex 2: Investment for compliance with the EU environmental acquis

Annex 2

Investment for compliance with the EU environmental acquis

The preliminary estimate of investment cost of compliance for the EU environmental acquis including industrial, agricultural and urban infrastructure is about EUR 59 million. However, as this is only an estimation; it is considered necessary to carry out a detailed analysis in sector base. Approximately 80% of the environmental expenditure should be financed by the public sector and remaining 20% by the private sector.

In the table below, the sectoral distribution of environmental investments between the years of 2007-2023 is shown. The investment cost for water is forecasted at EUR 34 million, which is approximately 57% of the total forecasted environmental investment cost until 2023:

Table 1: Sectoral distribution of environmental investments in Turkey

(€ 000)	2007-10	2011-15	2016-20	2021-23	Total
1. Water sector	5,900	9,063	11,725	7,300	33,969
2. General total	7,500	18,010	19,641	12,752	58,585
½ %	78%	50%	59%	57%	57%

(Source: UCES)

The assumptions for the cost estimations are as follows:

- The cost estimations of harmonization for each sector and relating to this annual investment needs are derived from the results of 'Feasible Model' which is prepared within the Environmental Heavy Cost Investment Planning Project.
- The finance needed for the compliance of EU Environmental acquis, will be secured by central governmental and local administrations resources, private-public co-operation, bilateral co-operation credits, EU grants and other grant resources.
- The harmonization cost of directives related to private sector will be financed by the private sector.
- 112 numbered 'Cleaning and Environmental Prevention', 116 numbered 'Agriculture' and 119 numbered 'Water-Sewerage' revenues of functional budget are taken into account while determining the support from central governmental budget. And also the interest rate of this amount is accepted same as GNDP interest rate.
- Credits allocated by Iller Bank will increase with rate of GNDP.
- External credits will be used in cost effective, feasible and refunding projects of municipalities.
- Annual interest rate of private-public co-operation financial sources will be 9%.
- About 40% of resources in third component of EU financial co-operation funds will be for environmental investments over the period 2007-2010. Thus, 67-96 million Euros will be allocated to environment annually. The amount of financial assistance is expected to increase after 2010. As a result in 2011, 500 million Euros is estimated and also assumed that the amount will increase 10% annually.
- According to the EU Integrated Environmental Approximation Strategy 2007 – 2023, local administrations are responsible for financing wastewater services. Central government will only support the projects in special protection areas. 40% of EU Environmental Funds will be allocated to wastewater projects and this will expected to increase to 50% after 2011.

- Local administrations are responsible for co-financing EU funded projects. In this regard, credits from Iller Bank and other external institutions may be used for co-financing. In total, 50-60% of credits derived from Iller Bank and 50% of external credits will be used in wastewater projects. Local administrations (particularly greater ones) will allocate 40% percent of their own resources to wastewater investments. Table 2 below shows the annual distribution of environmental investments due to finance resources:

Table 2: Annual distribution of environmental investments in Turkey

(€ 000)	2007-10	2011-15	2016-20	2021-23	Total
1. Central Administration	1,290	2,010	2,568	1,870	7,738
2. Local Administration	5,287	6,364	7,073	3,088	21,814
2.1. Municipal Resources	*3,509*	*4,053*	*4,327*	*1,133*	*13,023*
2.2. Iller Bank	*1,244*	*1,832*	*2,270*	*1,635*	*6,980*
2.3. External Credits	*453*	*274*	*171*	*97*	*994*
2.4. PPP	*83*	*207*	*305*	*223*	*817*
3. Private Sector	1,514	3,653	5,660	4,311	15,138
4. Public Economic Enterprises	150	326	411	300	1,187
5. Funds (EU, Other)	328	3,094	4,963	4,325	12,708
General Total	8,569	15,448	20,675	13,893	58,585

(Source: UCES)

Table 3 shows the annual distribution of environmental investments based on finance resources. According to the table, central government is expected to finance 13% of the total environmental investment cost until 2023. The biggest portion of finance is the local administrations which are forecasted to finance 37% out of which 22% is municipal sources and 12% from the Iller Bank. Other funds (mainly EU funds and grants) are expected to finance 22% of the investment. The share of private sector investments will be one of the highest sources of financing (26%) despite the share of PPP (Public private partnerships), which is very low (1%).

Table 3: Annual distribution of environmental investments based on finance resources in Turkey

	TOTAL ('000 TL)	TOTAL (€ 000)	RATE (%)
1. Central Administration	14,378	7,738	13
2. Local Administration	40,530	21,814	37
2.1. Municipal Resources	*24,196*	*13,023*	*22*
2.2. Iller Bank	*12,970*	*6,980*	*12*
2.3. External Credits	*1,846*	*994*	*2*
2.4. PPP	*1,518*	*817*	*1*
3. Private Sector	28,126	15,138	26
4. Public Economic Enterprises	2,205	1,187	2
5. Funds (EU, Other)	23,611	12,708	22
General Total	**108,851**	**58,585**	**100**

(Source: UCES)