SOUTHWEST COAST ENVIRONMENTAL PROJECT
FEASIBILITY STUDY FOR ÇEŞME-ALACAŞI AND SURROUNDING AREA
ENVIRONMENTAL ASSESSMENT REPORT

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

This Report presents an Environmental Assessment (EA) of the Southwest Coast Environmental Project Feasibility Study for Çeşme-Alaçatı and Surrounding Area. The EA has comprised a Category B level analysis in accordance with The World Bank Operational Directive OD 4.01. In addition, a full EIA study for a sanitary landfill was prepared and approved by the Ministry of Environment. Following review of the Feasibility Study, as the scheme proceeds to detailed design and tender preparation, further EA studies may be required which meet the requirements of Turkish Regulations.

It should be noted that, for consistency, the Drawings, Figures and Photographs referred to in this Report have the same designation numbers as the Main Study Report.

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

There are a number of laws that have been established in Turkey to control industry and development and protect the environment. The Environment Law (1983) sets a general environmental protection framework but relies on a number of subsequent sets of regulations for implementation. These regulations include the Water Pollution Control Regulations (1988), the Solid Waste Control Regulation (1991), the Clinical Waste Control Regulation (1993), the Hazardous Waste Regulations (1995) and the EIA Regulations (1993). An EIA report was required under the latter for the solid waste component of the Project.

3.0 PROJECT DESCRIPTION

The key objective of the Project is to improve the delivery of the basic urban services of water supply, sewerage, wastewater treatment and solid waste collection and disposal in the Municipalities of Çeşme and Alaçatı by a scheme which is financially affordable, environmentally sustainable and has the required institutional framework. The Municipalities are located on the Karaburun Peninsula on the Aegean coast of Turkey, approximately 80km west of İzmir, (See Figure 1.1). The area is important for tourism and is linked to İzmir by a new 6 lane motorway. A new airport is under construction to the south-east of Alaçatı.

3.1 Wastewater Component

The present wastewater system for most of the area consists of septic tanks, effectively operating as holding tanks, which are emptied regularly by tanker and the sewage discharged at a number of locations resulting in severe localised impacts. Only the town of Alaçatı and the seasonal summer housing area of Şantiye (on the coast north of Alaçatı) have piped collection systems. These systems have physical problems and discharge untreated wastewater into streams.
In an attempt to alleviate the present problems, separate sewerage systems are under construction to serve Çeşme and Alacati. The İller Bank funded work has proceeded slowly since 1989 and, to date, main trunk sewers, two pumping stations (buildings only), and two 1300m long sea outfalls have been completed. The current programme will not see the systems operational until at least the end of 1999.

The Phase 1 scheme proposed under this Study, has been developed to gain maximum benefit from the investment already made by achieving an operating system as soon as possible and would use the maximum affordable Municipality funds to:-

- provide preliminary treatment (6mm screening and grit removal) initially at the new pumping stations, then later at the Alacatı treatment works, with possible uprating to primary or secondary treatment in Phase 2 if and when required;
- construct secondary sewers in a phased programme commencing with priority areas;
- install mechanical and electrical works into the new pumping stations;
- construct additional area pumping stations and main collectors; and
- as an immediate improvement, renovate the pumping stations in Şantıye and improve the present discharge point of the Şantıye system on İstanbul Hill.

The scheme, as proposed in this Study, would initially utilise the existing Alacatı outfall into the Aegean Sea, which has been designed in accordance with the Turkish Water Pollution Control Regulations.

The previously proposed site for the Çeşme wastewater treatment works is situated in the centre of a broad valley to the north-west of the village of Ovacık, in an area of good agricultural land. The site is readily accessed and, with the exception of a few isolated farms, far from residential areas. Alternative sites have been considered in this Study and one nearby, in a less valuable agricultural area has been suggested. The proposed future Alacatı wastewater treatment works is sited in an isolated rocky upland area at a distance from residential areas and presently covered with scrub vegetation.

3.2 Water Supply Component

Since 1992, water supply to the area has been supplied mainly from the İldır Springs to the north-east of İldır Bay, together with a number of small wells located around the Municipality. The İldır source is, however, becoming affected by saline intrusion caused by over-pumping. Protection of this aquifer is of key importance. Some of the other wells, which are not generally very deep, suffer contamination from the present method of sewage disposal in the area.

An additional water supply source should be available from 1999, with the completion of the Kutlu Aktaş Dam and treatment plant, which impounds a small catchment to the east of Alacatı. The dam started filling in February 1996, and the treatment works, pumping station and link into the network should start construction in early 1997. The distribution system is otherwise in place. Once the dam source is commissioned, the projected demand should be met from existing sources until at least 2020.
In addition to the provision of treatment facilities for the dam water, the proposed scheme will aim to provide protection to the İldir aquifer and to improve the yield from this major source. Initially it is proposed to sink exploratory boreholes and build up monitoring data on the extent of the aquifer and the groundwater quality. A measure which is known to be effective in reducing saline intrusion is to provide an impervious curtain wall between the sea and the freshwater aquifer. Trial grouting of concrete at chosen locations will provide the necessary parameters to design the permanent grout walling. Some of the existing wells at İldir will be relocated to improve their yield.

A number of relatively small but important local improvements to the supply network and leakage control measures will also be carried out in Phase 1.

3.3 Solid Waste Component

Solid waste in the area has historically been disposed of at two unlined landfill sites, one 2km south-east of Çeşme, the other 4km east of Ālaçatı. Waste disposal at the latter ceased in 1992, when construction of the nearby Ālaçatı Dam commenced, and therefore all waste from the area is currently disposed of at the Çeşme dump.

Following consideration of the various options available for solid waste management the following scheme has been proposed. A sanitary landfill would be developed at a new, flat and easily accessed site, 8 km south of Çeşme and 4 km south-west Alacatı, to the south of the new İzmir motorway. There are no residential areas within a 1 km radius of the site.

The site would be designed as a $800,000m^3$ capacity sanitary landfill to take waste arisings from the Municipalities until the year 2020. The landfill site will be a fully engineered facility with a range of environmental controls, including:

- low permeability liner;
- leachate drainage system and on-site treatment plant when necessary;
- surface water cut-off trenches;
- passive landfill gas ventilation and dispersion; and
- phased restoration to open space.

The proposed landfill site has been agreed by the two Municipalities. It was located in what was designated as a Natural Protection Zone. However, procedures are underway to redesignate this area for use as a landfill.

The Project would also include pilot waste separation, recycling and composting plants at the proposed sanitary landfill site and remedial works at the existing Çeşme landfill site.

Future developments which might be required in Phase 2 could include the construction of additional phases of the landfill and extensions of recycling and/or composting schemes.
3.4 Project Implementation

All land required for the Project is under public ownership except for parts of the previously proposed Çeşme wastewater treatment works site. No land acquisition problems are envisaged.

Planning and liaison will be carried out throughout the design process, co-ordinated by the two Municipalities through their local councils. In addition, public consultation, which has already started, should be continued by the Municipalities to inform the public of the benefits of the Project and keep them informed of construction activities.

In accordance with local requirements, construction activities in coastal and tourist areas will not be undertaken, where avoidable, during the summer tourist season. Construction of the preliminary wastewater treatment facilities is scheduled to commence in 1998 for a duration of 3 years. Providing funds are available, construction of the sanitary landfill is also proposed to commence in 1998 for a shorter period. Aquifer protection works at Ildır will commence after investigations and grouting trials, scheduled to commence in 1997.

4.0 DESCRIPTION OF THE BASELINE ENVIRONMENT

The Study Area for the Project is defined as that area of the Karaburun Peninsula within the combined Municipalities of Çeşme and Alaçatı and the villages of Reisdere and Germiyan.

The majority of the population and tourism developments are located along the northern coast from the small port town of Çeşme in the west to Şifne in the east. The southern coast is generally undeveloped. The old town of Alaçatı lies in the middle of the peninsula. The geology of the area is basically platform type continuous carbonate overlain by quaternary sediments. The proposed landfill is bordered by sedimentary rocks but situated entirely on volcanic Pliocene aged tuffs. An area of high quality agricultural land is located south of Çeşme and west of the village of Ovacık.

There are no major sources of surface water in the vicinity of any of the Project sites and the landfill will not be situated within any surface or groundwater protection zones.

Existing discharges to the marine environment include diffuse inputs from septic tank soakaways via groundwater and surface watercourses from small package treatment plants at summer holiday facilities, from boat and shipping discharges and from Municipal sources such as Istanbul Hill (via Şifne stream) and Alaçatı Bay. In general, microbiological water quality problems are localised and probably associated with relatively small untreated sewage discharges. Monitoring data indicate that eutrophication is not a significant factor in the region.

The landscape of the area is generally of moderate to high quality, characterised by a series of rocky headlands and sandy bays. Inland, the peninsula is gently undulating and predominantly rural in character. The more rocky upland areas are generally vegetated by scrub and rough grassland; in the lower valleys agriculture predominates. Tree cover is
limited.

The northern coast between Çeşme and Şifne is substantially developed and the character of this area must be considered as urban. The architectural and aesthetic quality of the tourist areas is variable. The towns of Çeşme and Alaçatı have more architectural interest, with a number of attractive old areas.

The vegetation of the Study Area generally comprises plants characteristic of arid land, such as olive trees, spring shrubs and wild grasses. None of the areas of land required for the Project are of significant nature conservation value. The marine ecology is typical of semi-enclosed seas at this latitude, with relatively low species diversity and abundance. Within the coastal zone there are no designated shell fisheries, although there are some small commercial and recreational fishery activities.

A large part of the Study Area has recently been designated as a Natural Protection Zone in an attempt to control further uncontrolled development. İldır village has been designated as a 1st Degree Archaeological Protection Zone. There are several other protected areas within the Study Area, but they will be avoided by the development.

The influx of Turkish holidaymakers and foreign tourists in the summer months increases the current resident population of around 20,000 more than five times. The total summer population is projected to increase by about 45% by 2005 and to double by 2020 to around 217,000.

The future development of the area will continue to depend extensively on the tourist and leisure industry. Tourism, agriculture and trade will therefore form the main economy of the region. The main industrial and commercial activities will relate almost exclusively to servicing the tourist industry.

5.0 POTENTIAL IMPACT OF THE PROPOSED PROJECT

5.1 Wastewater Component

The potential impacts of the construction and operation of the wastewater collection and treatment system will be as follows:

- increase in wastewater discharged to the Aegean Sea and localised adverse impact on marine ecology;
- improvement to water quality, ecology and aesthetics at İstanbul Hill and other locations where wastewater is presently discharged or overflows;
- protection against cross-contamination between the sewage pumping main and main water transmission pipeline on İstanbul Hill;
- significant beneficial impact on groundwater quality and public health;
- adverse visual impact of wastewater treatment works;
- localised impacts such as construction noise; dust emissions; disruption to vehicular and pedestrian traffic;
- temporary construction phase ecological disturbance at Alaçatı wastewater treatment
works site;

* possible occasional localised odour emissions from treatment works and pumping stations;
* generation of 20 to 30 jobs for local people during the construction period; and
* opportunity to enhance appearance of pumping stations and immediate surroundings by townscapc improvements.

5.2 Water Supply Component

The potential impacts of the proposed aquifer protection works and extensions to the water supply network will be as follows:-

* improvement in potable water quality as a result of reduced saline intrusion into the Ildir source and more effective disinfection;
* improved water quality and quantities as a result of commissioning of the new Alaçatı Dam water source with its treatment plant and relocated wells at Ildir;
* improvements in the management and conversation of groundwater resources;
* possible effects on groundwater flows and marine water quality through a change in salinity;
* temporary localised noise, dust, traffic and visual impacts associated with construction works; and
* limited but possible adverse impact on archaeology at Ildir.

5.3 Solid Waste

The potential impacts of the proposed sanitary waste landfill will be as follows:

* significant benefit of more efficient and environmentally controlled solid waste management system;
* loss of soils and need for importation of suitable topsoil for site restoration;
* alteration to topography of the immediate area, however the final landform will not be visible from any residential areas;
* potential for windblown litter;
* loss of ecological habitat and a small number of olive trees of local significance;
* slight noise impacts to site workers;
* small risk of vermin and insects;
* potential for dust generation;
* noise and other disturbance at the site during construction phase;
* impacts from traffic entering and exiting the site;
* generation of odours from putrescing wastes in open vehicles during hot weather; and
* impact of contaminated run-off entering groundwater or surface waters.

6.0 ANALYSIS OF ALTERNATIVES TO THE PROPOSED PROJECT

The do-nothing option for Çeşme and Alaçatı would mean that the present programme of Ileri Bank funded schemes would continue at a very slow rate. The slower implementation of a piped sewerage network would result in slower phasing out of the existing septic tank
system, and worsening of the existing problems. The water quality of the Ildir source would further deteriorate and in the medium term the area would probably experience supply problems. Solid waste collection and disposal would continue as at present with gradual worsening of the current environmental impacts, particularly in the summer.

The İller Bank scheme, which has been partly constructed, is planned to provide for primary and secondary treatment at both the Çeşme and Alaçatı treatment works. Following a review of projected loadings over the planning horizon to 2020 and modelling of the water quality that would be achieved at the outfalls already in place, it has been concluded that preliminary treatment only would meet the required water quality standards in the short term (Phase 1).

To eliminate the current discharges of septic tank waste from tankers at numerous sites around the peninsula, an option was considered to construct centres for the treatment and disposal of these wastes. It was rejected on grounds of economics and of unacceptable environmental impact.

The locations available for both the Çeşme and Alaçatı wastewater treatment works were limited by the fact that main sewers and outfalls had already been constructed. Three alternative sites were investigated in Çeşme and the preferred option was selected on the criteria of land availability and environmental factors. For the Çeşme site an area of less agricultural value was found.

Options for alternative water supplies are extremely limited since capital investment has already taken place at the Ildir Springs and the Alaçatı Dam. The only alternative to aquifer protection work at Ildir would be to decrease the volume of water abstracted, which is not viable if demand is to be met.

Those alternative solid waste treatment/disposal methods considered as part of the Study were recycling, composting, sanitary landfill and incineration. The latter was rejected for economic and environmental reasons and because of the low calorific value of waste in the area. The future feasibility of recycling and composting will be assessed by pilot projects.

Nine alternative locations for the sanitary landfill were investigated and the preferred site selected on criteria of capacity, access, location, and least environmental sensitivity.

The use of transfer stations for waste collection was considered but not pursued as no economic benefit could be demonstrated by their use at this time.

7.0 MITIGATION AND MONITORING ACTION PLAN

An Action Plan of mitigation measures will be drawn up. It will also be necessary for a formal Monitoring Plan to be prepared, so that the environmental effects of the Project are adequately controlled by the proposed mitigation measures, and to give a quantitative assessment of the level of environmental benefit resulting from Project implementation.

The mitigation measures to be adopted include the scheduling of construction work outside
the summer tourist season; use of noise attenuation screens and ear defenders; undertaking aesthetic improvements and landscaping at visible sites; liaison with local residents; taking measures to avoid fuel and chemical spillages; minimising tree felling and loss of agricultural land; implementing dust control measures; providing litter fencing and vermin control at the sanitary landfill; restriction of construction and waste transfer traffic to suitable routes and normal working hours; provision, operation and maintenance of effective leachate and landfill gas control systems; and carrying out extensive groundwater monitoring at Ildir.

Given the importance of tourism and associated bathing and water-based recreation in the area, a formalised rationale for routine water quality monitoring is needed. This will provide a useful database for evaluating the levels of water quality improvement associated with the overall Project, and form the basis of an EU sampling protocol in line with the European Bathing Waters Directive. This would allow an accurate assessment of possible future compliance should Turkey join the EU and adopt its legislation.

Detailed monitoring protocols should be formulated during the detailed design stage in consultation with the Ministries of Tourism, Environment, Agriculture and Forests; and the Çeşme and Alacati Municipalities. These should then be assimilated into an overall strategic Monitoring Plan for the Project which would be reviewed annually by all concerned.

8.0 ENVIRONMENTAL MANAGEMENT AND INSTITUTIONAL REQUIREMENTS

A review of the current environmental controls and monitoring responsibilities in Çeşme-Alacati has been carried out. Recommendations are made to ensure that the Municipality service delivery organisation is in a position to adequately monitor operational performance in supplying potable water and collecting, treating and disposing of wastewater and solid wastes generated. Such monitoring will also help ensure that the existing and new Project infrastructure will be maintained properly, thereby extending its effective lifespan.

Proposals are made to ensure the continued involvement in the regulatory role of the Sub-Provincial Health Departments and the Provincial Environmental Directorate of the Ministry of the Environment.

9.0 INTER-AGENCY CO-ORDINATION AND PUBLIC/NGO PARTICIPATION

Consultation and meetings have been held with all Government authorities and the relevant NGOs in the Çeşme-Alacati area and their views and concerns taken full account of during the Feasibility Study. A questionnaire survey of local people indicated a low opinion of potable water quality and a belief that the most serious environmental problems in the area were due to increasing urbanisation and the inadequacy of infrastructure services.

Public meetings were held in Çeşme Municipality in July and September 1996 and February 1997, to enable a debate on the relevant aspects of the water, wastewater and solid waste disposal proposals.
10.0 CONCLUSIONS AND RECOMMENDATIONS

The Southwest Coast Environmental Project will significantly improve the present arrangements for water supply, wastewater collection and disposal and solid waste management in the Municipalities of Çeşme and Alaçatı and bring a number of environmental benefits to the area. The negative impacts of the Project components will generally be of low significance, relating mainly to short-term construction phase impacts.

In conclusion, the Southwest Coast Environmental Project in Çeşme - Alaçatı and their Surrounding Area should proceed as a matter of urgency. With the adoption of the proposed mitigation and monitoring plans, the Project should not have any significant adverse impacts.

It should be noted that the final analysis of Municipality affordability of the proposed infrastructure for solid waste and wastewater components of the Project will dictate the exact content and programme of implementation of the works discussed in this EA Report.
1.0 INTRODUCTION

1.1 Terms of Reference

The Terms of Reference for the Environmental Assessment (EA) of the Southwest Coast Environmental Project are contained in Section F of the Consultant's Brief. They require the preparation of an Environmental Assessment Report (EAR) which meets The World Bank's requirements for a Category B investment project, as well as any relevant requirements of the Turkish Government. A Category B project is defined as one where more limited environmental analysis is appropriate, as the project may have specific environmental impacts. The information required by Section F of the Consultant's Brief is provided in the following Sections.

In carrying out this EA, reference has also been made to the requirements of The World Bank Operational Directive OD4.01, of October 1991, entitled "Environmental Assessment", and the Environmental Assessment Sourcebook published by the World Bank Environment Department (Technical Papers 139 and 140) in 1991.

The Project is currently at the stage of a Feasibility Study. This Study is appraising various alternative options and recommending a set of technical and institutional/financial proposals and a programme for implementation. Following review of the Feasibility Study by the Ministry of Tourism and the Municipalities, and agreement of a preferred scheme and programme, the scheme will proceed to detailed design and tender preparation, at which stage further EA studies may be required.

The EAR, at this stage, discusses the potential environmental impacts of the preferred options, and also presents a comparative review of the impacts of alternatives which have been considered during the Feasibility Study, to meet short and long term objectives.

1.2 Objectives of the Environmental Assessment

The objective of this EA is to ensure that the proposed Project defined in the Feasibility Study will be environmentally sustainable. This is achieved through the identification of negative environmental effects, if any, of the Project, and the incorporation of mitigation measures into the Project design to address all such concerns. It is a component of the Project Feasibility Study required for appraisal by The World Bank. The EAR has however been produced as a stand-alone document to facilitate inter-agency co-ordination and to be available to address the concerns of local Non-Governmental Organisations (NGOs) and the public.
Figure 1.1
Project Area Location

Şekil 1.1
Proje Alanı
2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 The World Bank Policy and Requirements

The World Bank's policy and requirements for EA are set out in Operational Directive OD 4.01, of October 1991. The Directive gives a sample outline of a project-specific EAR, and a checklist of potential issues to be included in an EA. These have both been used in the course of this Study. The Directive also states that Category B projects normally require more limited analysis than a full EA. The present Study therefore has comprised a preliminary investigation of potential effects and has focused only on those issues considered potentially significant.

2.2 Relevant Turkish Legislation

There are a number of laws that have been established in Turkey to organise activities such as industrial development, tourism, navigation and transportation, and fisheries in various sectors in the coastal strip. The laws that would relate in some manner to the development of water supply, sewerage and wastewater treatment, and solid waste disposal are discussed below.

2.2.1 Coastal Law No. 3621 (4.4.1990, Amendment 1.7.1992)

The objective of this law is to set out the principles for the protection of the sea and coastal areas whilst paying attention to the natural and cultural characteristics and allowing their utilisation for the public benefit. The law provides a definition for the "shoreline" but, although the location of the shore edge is important for managing development, its definition is not exact.

The law states that it is illegal to excavate on the coast and mine for sand. However, the construction of marine related infrastructure, treatment plants, pumping stations and buildings which cannot be located on land, is permitted. Apart from these developments, no other building is allowed in the first 50m from the shore, which is restricted for "pedestrian access, walking, relaxing, sight-seeing and recreational purposes".

Responsibility for enforcement of the Coastal Law is given to the municipalities within their borders and in their annexed areas, and to the Provincial Governors in the remaining areas. The final authority for planning in these areas is generally the Ministry of Public Works and Settlements (MPWS), unless the area is declared a tourism centre in which case authority is transferred to the Ministry of Tourism.

2.2.2 Environment Law No. 2872 (9.8.1983), Water Pollution Control Regulation (Official Gazette No. 19919 of 4.9.1988) and EIA Regulation (Official Gazette No. 21489 of 7.2.1993)

The Environmental Law sets out the framework for general environmental issues but depends on the subsequent Regulations for implementation. The relevant articles are as follows.
Article 8 refers to the Water Pollution Control (WPC) Regulations which cover various issues related to pollution of coastal waters. Article 14 of these regulations classifies coastal and seas waters according to their dominant use, whereas Article 15 provides water quality criteria for sea water. Rules and regulations concerning wastewater discharges from Municipalities are given in Articles 26, 27 and 32, whilst procedures and criteria for discharging sewage to the sea by outfall are given in Articles 33 to 42.

A Metropolitan Municipality, or the most senior local governor elsewhere, is responsible for permitting a sea outfall. However, the opinions of the Provincial (Ille) Bank and approval of the Ministry of Environment must be sought. The latter is authorised for the necessary controls on water quality, whilst local Governors, the Ministry of Health and Social Security, Metropolitan Municipalities and Municipalities, and harbour masters are able to carry out controls within their jurisdictions.

Article 10 of the law states that "organisations, companies and establishments, who may cause environmental problems through activities they plan to carry out, are required to prepare an environmental impact assessment (EIA) report".

The EIA regulations provide a list of projects for which EIA reports are required, outline the contents of the report and describe the authority and procedure for their approval.

Under the EIA regulations the development of a sea outfall and treatment facilities requires a preliminary EIA study. If the study shows that the environmental impact of the project may be significant, then a full EIA report should be prepared. However, if the development is in an environmentally sensitive area then a full EIA report is automatically required for those projects that would have been subjected to a preliminary EIA. Environmentally sensitive areas include: "national parks" defined under National Parks Law (9.8.1983); "natural assets"; "specially protected areas" (see Section 2.2.5 below); coasts near the production areas of living resources as defined under the Fisheries Law (see Section 2.2.4 below); and "historical and natural sites" (see Section 2.2.8 below).

The WPC regulations set out the legal and technical aspects required to protect water supplies and groundwater. They also cover issues such as treated effluent reuse. Technical standards and general criteria for treatment facilities, limitations on septic tank usage and treated effluent reuse are set out in the Communiqué on Technical Procedures (Official Gazette No. 20748 of 7.1.1991).

The following aspects are also included in the Environmental Law:

- waste concepts;
- approval for operations;
- pollution prevention fund;
- administrative penalties;
- incentives; and
- application to administrative authorities to cease activities.
2.2.3 Water Products Law No. 1380 (22.3.1971) Amendment 3288 (15.5.86)

This law has several subsequent amendments and regulations. It relates to the obtaining of water products from the seas and inland waters and the protection of these water products from harm.

2.2.4 Fisheries Law No. 6831 (22.3.1971, Amendments 15.5.1986)

This law covers the protection, exploitation, production and control of living resources. It prohibits the dumping of substances into, or adjacent to, production areas in the sea which may cause harm to the living resource, or to the people who catch or consume them, or to the vehicles, gears and tools which are used to catch or consume them.

2.2.5 Specially Protected Areas

The Council of Ministers' Decree of 19.10.1989 set up the Agency for Specially Protected Areas (SPA). The agency has responsibility for solving environmental problems, protect the environmental assets, establish plans for the protection and utilisation in these areas, and revise and approve plans of all scales and planning decisions. In 1994 there were twelve SPAs, nine of them being located in the coastal region.

2.2.6 Law of Special Environmental Protection Institution

Activities of all kinds of certification and organisation in regions declared to be Special Environmental Protection Areas are left to special environmental institutions and boards by this Law. In these areas, powers and duties of municipalities are transferred to these institutions and boards.

2.2.7 Bylaw on Establishment and Duties of the Ministry of Environment

This Bylaw includes establishment of the:

- Ministry of Environment;
- Higher Board of Environment;
- Council of Environment;
- Central Board of Environment; and
- Provincial Board of Environment.

In order to fulfil duties and responsibilities given to the State by the 1982 Constitution on environmental protection and development, the Ministry of Environment was established in Turkey. Types of organisations such as General Directorate, Under Secretary and State Secretary for Environmental Subjects were tested prior to the Ministry of Environment, and a significant step was taken to fulfil duties in Article 2 of the regulation of establishment with the organisation, staff and financial sources allocated by the State.

Article 2 also gives the duty of taking necessary measures for wastes, residues and fuels, defining the waste management policy of the country and providing the necessary
organisation, to the Ministry of Environment and to the Boards established by this bylaw.

2.2.8 Law for Protection of Cultural and Natural Heritage No. 2863 (21.7.1983)

This law defines all items of cultural and natural heritage which must be protected, as well as the means for protection. Cultural heritage is defined as "all mobile and immobile items, on land, underground or underwater, which reflect science, culture, religion and fine arts of historical and prehistorical periods." Natural heritage is defined as "assets on land or water, which belong to geological, prehistorical or historical periods, and which need to be protected because of their scarcity or their character and attractions". Some coastal sites have been designated as "natural sites" according to this law and restrictions to build on them are enforced.

2.2.9 Solid Waste Control Regulation

The first version of the regulation was published in the Official Gazette No. 20814 dated 14 March 1991 and legalised. The legal basis of the regulation is in the Law of Environment No. 2872 and the Decree on Establishment of the Ministry of Environment. The Solid Waste Control Regulation is only an administrative regulation, it is not a Law of Waste and is not stated clearly in the Law of Environment. Therefore, it is not possible to apply sanctions. The Regulation was amended on 2 November 1994 (Official Gazette No. 22099) and the definitions of concepts like "recycling" and "recovery" were added. It was also decided to establish a Commission of Recycling. The Solid Waste Control Regulation aims to provide for waste management which is in harmony with the environment.

The Regulation aims to reduce the generation of packaging waste by separate collection, recycling and recovery. Responsibility of these activities was given clearly to the producers. Each producer is in a quota system based on the return of packaging materials. Producers who cannot reach this quota should charge a deposit on their packaging to collect it.

The Recycling Commission under the Ministry of Environment defines recycling quotas for glass, plastic, metal and paper. Quotas were set quite high, but inspection for conformity to the quota and its practical application is not performed adequately. The main reason is the lack of basic data. Also, industry is often informed beforehand of inspections.

It is stated in Articles 18-21, that waste disposal not conforming to the rules is forbidden. Containers should be safe and covered and should not cause any harm to the environment. Waste transportation vehicles should also conform to the same rules. Industrial and tourism organisations, outside the borders of a municipality, should undertake the transportation of their wastes themselves and should deliver their wastes to waste disposal plants constructed by the municipality. Transfer stations are recommended where they are appropriate for economical waste transportation.

Also included in the Regulation are aspects concerning:

- definition of waste and solid waste;
- waste terminology;

2-4
principles on generation, disposal and incentives;
deposit and recycling (quota) application;
sanitary landfills; and
certification, operation and control of sanitary landfills.

According to the Law of Metropolitan Municipalities, they have the powers for solid waste disposal, including recycling, and can transfer them to private companies. The Solid Waste Control Regulation encourages reduction in waste by supporting recycling in general and by approving the separate collection of recyclable wastes.

In order to form the Recycling Commission, comprising representatives of various industrial sectors and under the chairmanship of an authorised person from the Ministry of Environment, a modification was made to the Regulation in September 1994. This Commission has undertaken a consultancy duty rather than an administrative one, and is responsible for defining the targets on recycling glass, plastic, metal, paper and similar materials. The Commission is also responsible for advising the Ministry of Environment about alternatives of developing separate collection and separation system for recyclable and recoverable wastes. In accordance with recommendations of the Commission, the Ministry of Environment has published a bulletin which advised the construction of separation plants near all new landfills to be constructed in Turkey.

Articles 33-37 of the Regulation recommend the use of compost obtained from previously separated kitchen and garden wastes. Technical requirements of compost plants having an annual capacity exceeding 200 tonnes, require filtration of the intake air before release to the atmosphere, if a ventilation system is used. The cleaning and treatment of discharged water should be in accordance with the standards specified by the Regulation of Water Pollution Control. Compost plants should not be constructed on water or groundwater protection sites and should be at least 1km away from residential areas.

2.2.10 Clinical Waste Control Regulation (20.5.1993)

This Regulation determines the standards on definition, transportation, storage and disposal of clinical wastes and specifies the penalties in case of non conformity. Permission for construction of clinical waste incinerators is given by Provincial Environment Boards and approved by the Ministry of Environment as the higher authority. Operating certificates for clinical waste incinerators and storage plants are given and cancelled by the relevant municipality in Metropolitan Municipalities.

The Regulation also includes aspects such as definitions of clinical waste and applicable sanctions.

2.2.11 Hazardous Waste Regulations (August 1995)

Hazardous Waste Regulations developed by the Ministry of Environment were introduced in August 1995, and include:-

- controls on the importation of hazardous wastes;
• encouragement of the minimisation of hazardous waste at source;
• requirements for producers to register with, and for collection and disposal contractors to obtain licences from, the Ministry;
• continuous "cradle to grave" accountability;

• powers for the Ministry to:
  - ensure co-operation and co-ordination;
  - determine waste characteristics and define hazardous waste;
  - approve plans and locations for plant; and
  - establish a commission for waste management;

• powers for Governors to:
  - ensure waste management plans are applied within their Provinces;
  - convey applications for treatment and disposal plants from municipalities to the Ministry of Environment; and
  - issue licences to firms operating waste transport in their Province;

• powers for municipalities to:
  - develop, or have developed on their behalf, treatment and disposal plants for hazardous wastes.

2.3 International Treaties Signed by Turkey for Protecting the Mediterranean Sea

Turkey is one of the countries that signed the Agreement on the Protection of the Mediterranean Sea Against Pollution in Barcelona on 16 February 1976. The agreement was put into effect in Turkey in 1981 after being issued in the Official Gazette. According to this agreement, the parties have to take all necessary measures for pollution prevention and mitigation in order to protect and to improve the aquatic environment in the Mediterranean Region. They also agree to develop programs for the monitoring of pollution in the Mediterranean. For the purpose of realising the targets set in the Agreement, parties shall cooperate in scientific and technical fields and take common actions in emergency situations arising as a result of excessive pollution.

Within the context of this agreement, Turkey has also signed four protocols. These are: The Protocol on the Protection of the Mediterranean Sea from Pollution Caused by Discharges of Ships and Airplanes, Protocol on the Cooperation and Actions to be Taken in Extraordinary Situations of Pollution of the Mediterranean Sea by Petroleum and Other Hazardous Substances, Protocol on the Protection of the Mediterranean Sea Against Land-based Pollution (1980) and finally Protocol on the Special Protection Zones in the Mediterranean Region (1986). The last two protocols were put into effect in Turkey in 1987 and 1988 respectively.

The Protocol on the Protection of the Mediterranean Sea from Pollution Caused by Discharges of Ships and Airplanes prohibits the discharge of some materials and residues
to the Mediterranean Sea. Examples of such types of substances are mercury, cadmium, radioactive wastes, organohalogen and organosilicon compounds. The discharge of some substances like arsenic, lead, copper, zinc, chromium and nickel compounds, cyanide, pesticides and many others listed in Annex 2 of the protocol are subject to special permission from authorities.

The Protocol on the Cooperation and Actions to be taken in Extraordinary Situations of Pollution of the Mediterranean Sea by Petroleum and Other Hazardous Substances aim at developing pollution control systems, emergency plans, continuous monitoring systems and information exchange systems by establishing a cooperation among Mediterranean countries for the protection of the Sea against pollution by petroleum and other hazardous substances.

The parties signing the Protocol on the Protection of the Mediterranean Sea Against Land based Pollution agree to take all the measures for the prevention, monitoring and removal of pollution resulting from discharges from rivers, facilities on the coastal areas, sewage systems etc. The parties shall protect the protocol area against pollution by the following substances: halogenated organic compounds, organic phosphorus and tin compounds, mercury, cadmium, used machine oil, synthetic substances, carcinogenic substances, radioactive substances. They will also limit the discharge of a list of chemical substances together with non-biodegradable detergents, raw petroleum, inorganic phosphorus compounds, pathogenic microorganisms and thermal discharges. The permission for their discharge will be given according to their composition, the characteristics of the receiving media and the presence of waste technologies. The parties will formulate and accept common criteria and standards on sewage systems and sea water quality, and will substitute pollution creating technologies gradually by environmentally friendly ones.

The Protocol on the Special Protection Zones in the Mediterranean Region is about the establishment of special protection zones for the protection of areas with biological and ecological value, the protection of genetic diversity of species, population levels and habitats and also the protection of areas with scientific, aesthetic, historical, archeological, cultural and educational value. The parties may come together to set up common targets and standards for the selection, establishment and management of protection zones.

2.4 Related EU Directives

Given that Turkey has a recent agreement to join the European Customs Union, momentum is gathering towards the possibility that Turkey may fully join the European Union in the near future. Therefore, early consideration needs to be given to the potential ramifications of European Legislation that has a direct bearing on this project. A review of relevant EU legislation is discussed in this section.

2.4.1 EU Drinking Water Directive

On the 15th July 1980, EU Directive 80/778 was approved relating to the quality of water intended for human consumption. The water quality targeted for this Project will be the quality standards set out in the EU Directives. However, until such time as the final recommended option is installed and operational, the minimum quality standards are to be those contained in Turkish Standard TS 266. A comparison of the two standards is given in Table 2.1.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Expression of Results</th>
<th>Guide Level (Turkish)</th>
<th>Maximum Level (Turkish)</th>
<th>Guide Level (EU)</th>
<th>Maximum Level (EU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Colour Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>50</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Turbidity</td>
<td>mg/l</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>25</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Odour</td>
<td>Dilution Number</td>
<td>Normal</td>
<td>Normal</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>pH</td>
<td>pH Unit</td>
<td>7.0 to 8.5</td>
<td>6.2 to 9.2</td>
<td>6.5 to 8.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Conductivity</td>
<td></td>
<td>-</td>
<td>500</td>
<td>1,000</td>
<td>400</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/l Fe</td>
<td>30</td>
<td>100</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/l Mn</td>
<td>10</td>
<td>50</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Calcium</td>
<td>mg/l Ca</td>
<td>75</td>
<td>200</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/l Mg</td>
<td>50</td>
<td>150</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Chlorides</td>
<td>mg/l Cl</td>
<td>200</td>
<td>600</td>
<td>25</td>
<td>200</td>
</tr>
<tr>
<td>Sulphates</td>
<td>mg/l SO₄</td>
<td>200</td>
<td>400</td>
<td>25</td>
<td>250</td>
</tr>
<tr>
<td>Aluminium</td>
<td>mg/l Al</td>
<td>-</td>
<td>-</td>
<td>0.05</td>
<td>0.2</td>
</tr>
<tr>
<td>Nitrates</td>
<td>mg/l NO₃</td>
<td>-</td>
<td>45</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>Nitrites</td>
<td>mg/l NO₂</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.1</td>
</tr>
<tr>
<td>Total Hardness</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>60</td>
</tr>
<tr>
<td>Total Organics</td>
<td></td>
<td>-</td>
<td>3.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Residual Chlorine</td>
<td>mg/l</td>
<td>0.1</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
The following comments apply:-

Turbidity  This is an aesthetic problem with no health risk.

Colour  An increase in the colour will generally increase the organics.

Odour  Not generally an issue.

Conductivity  Increases above 1000 will indicate either salinity problems or increased hardness of the water.

Iron  This is an aesthetic problem with no health risk.

Manganese  Same comments as iron.

Chlorides  This is a health related issue. Increases above 200 will risk high blood pressures and increase the corrosion within the pipe networks.

Sulphates  Same comments as iron.

Aluminium  Same comments as iron.

Nitrates  This is a health related issue. For values above 50, drinking should be prohibited to babies.

Organics  This is a health related issue.

Chlorine Residual  There is no EU limit. The parameters are generally controlled by the THM (trihalo methane) limits.

2.4.2 EU Bathing Water Directive

Key water quality standards that a proposed wastewater treatment plant must achieve are implemented through the EU Bathing Waters Directive (76/160/EEC). The EU Directive allows a Member State to designate bathing water areas around its coasts, provided that they meet certain microbiological and chemical water quality requirements. The designated bathing water is then sampled routinely throughout the bathing season (which is specific to the climate of the country).

Under the terms of the EU Directive concerning the quality of bathing water, the following mandatory or imperative ('I' value) bacteriological standards are stipulated:-

- 2,000 E. coli per 100ml;
- 10,000 Total Coliforms per 100ml.
The EU Directive also gives Guideline (‘G’ value) bacterial levels. These levels are not mandatory, but are shown below:-

- 100 E. coli per 100ml;
- 500 Total Coliforms per 100ml.

For a bathing beach to be considered compliant, 95% of water samples taken during the bathing season must have less than or equal to these concentrations of bacteria. In the UK for example, bathing beaches are generally sampled once per week from May to September, inclusive. The above standards apply only to the water quality and do not relate to beach quality or facilities.

Coliform bacteria are not responsible for disease but they are generally accepted as indicator species of pollution by potential pathogens. The Directive also requires the monitoring of the pathogens, salmonella and enterovirus. Some chemical parameters are required to be monitored when inspection of the bathing water indicates that the quality of the water has deteriorated.

In February 1994, proposals to change the EU Bathing Waters Directive were announced in Brussels. The objective of these changes is to target the sampling towards specific indicator bacteria and to remove unnecessary sampling of redundant parameters. The main changes in the Directive are likely to be the loss of sampling for Total Coliforms and salmonella. However, sampling for faecal streptococci, which originally only had a guideline value of 100 per 100 ml, will, in future, also have a mandatory standard of 400 per 100 ml.

2.4.3 The EU Urban Waste Water Treatment Directive

The EU Urban Waste Water Treatment Directive (UWWTD), (91/271/EEC) was agreed by EU Environment Ministers at the Environment Council on the 18th March 1991. The Directive was required to be introduced into the national law of member states by June 1993.

Article 3 of the Directive requires that in general all municipalities of more than 15,000 population equivalent (pe) will be provided with urban wastewater collecting systems by 31/12/2000 and by 31/12/2005 for those with a pe of 2000-15,000. If discharges are to be made to "sensitive areas", as defined in Article 5 of the Directive, then collection systems for municipalities with more than 10,000 pe should be provided by 31.12.1998.

Article 4 defines the minimum standards of wastewater treatment needed for discharges from both municipalities and certain industries. The level of treatment required for a discharge is directly related to the magnitude of the serving municipality and the nature of the receiving water into which the effluent discharges.

Target compliance dates and treatment types are shown in Table 2.2.
Table 2.2 - Summary of EU Urban Waste Water Treatment Directive

<table>
<thead>
<tr>
<th>Population Equivalent (pe)</th>
<th>Receiving Water</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fresh</td>
<td>Estuarine</td>
<td>Coastal</td>
</tr>
<tr>
<td>&gt; 150,000</td>
<td>Secondary</td>
<td>Secondary</td>
<td>Secondary</td>
</tr>
<tr>
<td></td>
<td>31/12/2000</td>
<td>31/12/2000</td>
<td>31/12/2000</td>
</tr>
<tr>
<td>100,000-150,000</td>
<td>Secondary</td>
<td>Secondary</td>
<td>Secondary</td>
</tr>
<tr>
<td></td>
<td>31/12/2000</td>
<td>31/12/2000</td>
<td>31/12/2000</td>
</tr>
<tr>
<td>15,000-100,000</td>
<td>Secondary</td>
<td>Secondary</td>
<td>Secondary</td>
</tr>
<tr>
<td></td>
<td>31/12/2000</td>
<td>31/12/2000</td>
<td>31/12/2000</td>
</tr>
<tr>
<td>10,000-15,000</td>
<td>Secondary</td>
<td>Secondary</td>
<td>Secondary</td>
</tr>
<tr>
<td></td>
<td>31/12/2005</td>
<td>31/12/2005</td>
<td>31/12/2005</td>
</tr>
<tr>
<td>2,000-10,000</td>
<td>Secondary</td>
<td>Secondary</td>
<td>Appropriate</td>
</tr>
<tr>
<td></td>
<td>31/12/2005</td>
<td>31/12/2005</td>
<td>31/12/2005</td>
</tr>
<tr>
<td>&lt; 2,000</td>
<td>Appropriate</td>
<td>Appropriate</td>
<td>Appropriate</td>
</tr>
<tr>
<td></td>
<td>31/12/2005</td>
<td>31/12/2005</td>
<td>31/12/2005</td>
</tr>
</tbody>
</table>

Under Article 5, the Turkish Government would be required to identify "sensitive areas", as defined in Annex II of the UWWTD, around the Turkish coast and would then be required to meet the more stringent requirements for these areas. If so identified, on the basis of potential eutrophication problems, then secondary treatment would be required within 7 years. It is possible that Çeşme Bay, may be categorised as sensitive, although the southern coastal waters would be likely to be a "less sensitive area" in this context.

Under Article 6 of the UWWTD for 10,000 to 150,000 pe, derogation from secondary to primary treatment may be acceptable subject to undertaking "comprehensive studies" that illustrate the 'high natural dispersion' characteristics of the receiving water so that discharges will not adversely affect the environment. In this context, primary treatment means a process in which the BOD5 of the incoming waste water is reduced by at least 20% before discharge, and that the total suspended solids of the incoming waste water are reduced by at least 50%. The requirements for secondary treatment performance are as summarised in Table 2.3 below.

Table 2.3 - UWWTD Requirements for Secondary Treatment

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Concentration</th>
<th>Minimum % of reduction (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemical oxygen demand (BOD5 at 20°C) without nitrification</td>
<td>25 mg/l</td>
<td>70-90</td>
</tr>
<tr>
<td>Chemical oxygen demand (COD)</td>
<td>125 mg/l</td>
<td>75</td>
</tr>
<tr>
<td>Total suspended solids</td>
<td>35 mg/l (2)</td>
<td>90 (2)</td>
</tr>
</tbody>
</table>

2-11
Notes:

(1) Reduction in relation to influent load
(2) This requirement is optional

There may be potential to argue 'high natural dispersion' on the basis of natural ultra violet radiation kill in the more southern countries of the EU. However, this has not been tested and is considered unlikely.

Under Article 8 of the UWWTD (where in exceptional circumstances it can be demonstrated that more advanced treatment will not produce any environmental benefit) there may also be potential for the Çeşme- Alaçatı plants to consider derogation to primary treatment when the population is in excess of 150,000 pe. However, again this is considered unlikely.

As noted in the above Table 2.2, there are set time deadlines for implementation of the UWWTD. However, given uncertainties regarding when, or if, Turkey will join the EU, it is difficult to make definitive conclusions regarding the impact of these deadlines on the options for Çeşme- Alaçatı. It is likely that secondary treatment will be requested, although there may be potential, given the appropriate studies, to request derogation under Article 6 to primary treatment only up to 2020, thereafter derogation under Article 8.

2.4.4 Blue Flag Award Criteria

In addition to the EU Bathing Waters Directive, there is one other designation for bathing beaches in common use; namely the Blue Flag Award. In order to qualify for this award, a beach must meet the mandatory EU water quality standards and a maximum number of "guideline criteria" will be taken into account. The beach must also meet a number of other requirements unrelated to water quality, including adequate litter bins, clean sanitary facilities with access for the disabled, first aid facilities and dog ban or strict control on dogs.

The European Blue Flag for beaches is awarded annually and is only valid for one year.

2.4.5 EU Directives on Solid Wastes

To regulate the national disposal of solid wastes, a "Waste Framework" was prepared and issued through Council Directive 75/44/EEC. After three years, to broaden the framework for control to toxic and hazardous wastes and their prevention, recovery and recycling, a new "Directive on Toxic and Dangerous Waste" (78/319/EEC) was published. In this Directive, which is similar to the Turkish Solid and Hazardous Waste Control Regulations, the responsible party for storage, treatment and disposal of such waste is the producer of the product and/or the holder or the previous holder of the licence. ("Polluter-pays-principle").

In 1985 and 1986 the EU published the Council Directives on "Beverage Containers" (85/339/EEC) and "Sewage Sludge" (86/278/EEC). These issues are covered under the Turkish Solid Waste Control Regulation where recovery of packaging waste, minimisation of plastic and metal package use, recycling and composting of solid wastes, usage of sewage
sludge in agriculture, incineration plant technical features, disposal of waste and landfill site selection are regulated in considerable detail.

2.4.6 Outline Design Standards

The Turkish Water Pollution Coastal Regulations do not require specific levels of treatment to discharges, unlike the Urban Wastewater Treatment Directive and are therefore more rationally based on the needs of the environment. The degree of treatment prior to discharge is therefore determined by the requirements of the receiving water.

The bacterial standards required by the Regulations are more stringent by an order of magnitude than the EU bathing water requirements. Provided these standards can be met at proposed recreation areas then there is no requirement for other than preliminary treatment to be provided.

Adoption in future of the Urban Wastewater Treatment Directive will require the ultimate provision of secondary treatment, although it is presumed that a revised timescale would be agreed. Designation of an area of high natural disposal (HNDA) which would allow provision of primary treatment only is considered unlikely.

The formulation of options for the disposal of sewage has therefore been on the basis of:

- $< 1000 \text{ TC}/100\text{ml}$ or $< 200 \text{ FC}/100\text{ml}$ at the boundary of proposed recreation areas;
- Initial dilutions $> 100$;
- Initially only preliminary treatment (fine screening and grit removal) shall be provided unless the pollution levels in the receiving waters require a higher standard;
- Future provision has been made for primary and secondary treatment to meet the requirements of the UWWTD; and
- The BOD$_5$ after preliminary treatment will be less than 250 mg/l.
3.0 PROJECT DESCRIPTION

3.1 Objectives of the Project

The primary objective of the Project is to improve the delivery of the basic urban services of water supply, sewerage, wastewater treatment and solid waste collection and disposal in the Municipalities within the Project Area and to enable the Municipal authorities concerned to operate these services on a financially and environmentally sustainable basis.

More specifically, the Project would help the Municipal authorities to:

- address the needs for water supply, sewerage, wastewater treatment, solid waste collection and disposal in ways that are financially affordable to these authorities and represent technically satisfactory least cost solutions;
- develop new institutional and financial arrangements for the management of the above services, as well as the possible involvement of private sector operators in service delivery; and
- improve the environmental conditions in the Project Area and reduce the risk of health hazards that could adversely affect the local population and the tourism industry.

3.2 Project Overview

The Project has been developed following an extensive review of the problems associated with the water supply, sewerage and wastewater treatment, and solid waste collection and disposal infrastructure serving the Municipalities of Çeşme and Alaçatı and the nearby villages of Reisdere and Germiyan. The Study Area is located on the Karaburun Peninsula on the Aegean coast about 80km west of Izmir. The area is important for tourism and is connected to Izmir by a new 6-lane motorway. An airport is currently under construction to the south-east of Alaçatı. Development is predominantly around the northern coastal fringe with the small port town of Çeşme to the west and the town of Alaçatı located inland in the centre of the peninsula. The remainder of the peninsula consists of hills which become steep and rocky in places. Tree cover is limited. (See Figure 1.1).

The present wastewater system for most of the area consists of septic tanks, which effectively operate as holding tanks which are emptied regularly by tanker, and the sewage discharged at a number of locations where it has severe localised impacts. Only the town of Alaçatı and the seasonal summer housing area of Şantiye (on the coast north of Alaçatı) have piped collection systems. These systems have physical problems and discharge untreated wastewater into streams. (See Figure 6.1 and Photographs 6.1 to 6.3).

In an attempt to alleviate the present problems, separate sewerage systems are under construction for both Çeşme and Alaçatı. The Provinces Bank (İller Bank) funded work has proceeded slowly since it was started in 1989 and, to date, main trunk sewers, two pumping stations (buildings only), and two 1300m long sea outfalls have been completed. Wastewater
EXISTING SEWERS IN OPERATION
MEVCUT KULLANILAN KANALIZASYON BORULARI

APPROXIMATE SEPTIC WASTE COLLECTION AREA
VIDANJÖR TOPLAMA ALANI (YAKLAŞIK)

WASTEWATER PUMPING STATION
ATIKSU TERPI MERKEZI

SEPTIC TANK WASTE DISPOSAL LOCATION
VIDANJÖR BOSALTMA YERI

SOUTH WEST COAST ENVIRONMENTAL PROJECT,
FEASIBILITY STUDY FOR ÇEŞME-ALACATI AND SURROUNDING AREA
AKDENİZ - EGE TURİZM ALTYAPISI KIYI YÖNETİM PROJESİ
ÇEŞME-ALACATI VE ÇEVRESİ FIZIBİLITE ETDOO.

EXISTING WASTEWATER DISPOSAL FACILITIES
MEVCUT ATIKSU DEŞARJ TESISLERİ

FIGURE
ŞEKİL 6.1
Photograph 6.1
Şantiye Area - Ilica

Fotograf 6.1
Şantiye Bölgesi - Ilica

Photograph 6.2
Alaçatı Wastewater Drainage

Fotograf 6.2
Alaçatı Atıksu Drenaji

Photograph 6.3
Wastewater Disposal at Istanbul Hill

Fotograf 6.3
İstanbul Dağında Atıksu Tasfiyesi
treatment plants for the two towns are currently being designed by local consultants, with the present design specification being for secondary biological treatment. The current programme for the scheme will not see the systems operational until at least the end of 1999, and this depends on funding availability. See Figure 6.3.

After consideration of the existing system and future plans, the Phase 1 scheme proposed under this Study has been developed to gain maximum benefit from the investment already made by achieving an operating system as soon as possible. The proposals are therefore to use the maximum affordable Municipality funds to:

- provide preliminary treatment (6mm screening and grit removal) initially at the new pumping stations then later at the Alaçatı treatment works, deferring primary and/or secondary treatment until they are required;
- construct secondary sewers in a phased programme commencing with priority areas;
- install mechanical and electrical works into the new pumping stations;
- construct additional area pumping stations and main collectors; and
- as an immediate improvement, renovate the pumping stations in Şantiye and improve the present discharge point of the Şantiye system on İstanbul Hill (to the north east of Alaçatı).

Since 1992, the water supply to the area has come partly from the Ildır Springs to the north-east and a number of small wells located around the Municipalities. The Ildır source, which lies east of Ildır Bay is, however, affected by saline intrusion caused by over-pumping. Protection of this aquifer is of key importance. Some of the other wells, which are not generally very deep, suffer contamination from the present method of sewage disposal in the area.

An additional water supply source should be available from 1999, with the completion of the Kutlu Aktaş Dam, which impounds a small catchment to the east of Alaçatı. The dam started filling in February 1996, but the treatment works for the water has not yet been constructed. However, a plant, pumping station and link into the network were tendered in October 1996 and should commence construction in 1997. Funding has been allocated by the Special Provincial Administration. The distribution system is otherwise in place.

In addition to the provision of treatment facilities for the dam water, the proposed scheme will aim to provide protection to the Ildır aquifer, and improvement of the yield from Ildır, together with minor local improvements to the supply network and leakage control measures.

Solid waste in the area has historically been disposed of at two unlined landfill sites, one 2km south-east of Çeşme, the other 4km east of Alaçatı. See Figure 7-1 and Photographs 7.3 and 7.4. Waste disposal at the latter ceased in 1992, when the construction of the nearby Alaçatı Dam commenced, and therefore all the waste generated within the Study Area is currently disposed of at the Çeşme dump. The potential groundwater contamination at the closed Alaçatı site and implications for the Alaçatı Dam water were recognised and in mid 1996, the waste from the abandoned site was removed.
FIGURE 6.3

EXTENT OF CURRENT WASTEWATER CONSTRUCTION CONTRACT MEVCUT ATIKSU YAPIM SOZLESMESI KAPSAM
REPUBLİK TÜRKİYE TURİZM BAKANLIĞI

SÜWET APKLIEVİ RTİRİYETI TURİZM BAKANLIĞI

SOUTH WEST COAST ENVIRONMENTAL PROJECT.
FEASIBILITY STUDY FOR ÇEŞME-ALACATI AND SURROUNDING AREA
AKDENIZ - EGE TURİZM ALTYAPISI KIYI YÖNETİMİ PROJESİ
ÇEŞME-ALACATI, VE CEVRESİ FİZİBÜLE ETİDOO.

EXISTING SOLID WASTE DISPOSAL FACILITIES
MEVCUT KATI ATIK BOSALTMA TESİSLERİ

FIGURE 7.1
ŞEKİL
Photograph 7.3
Existing Çeşme Solid Waste Site
Fotoğraf 7.3
Çeşme Mevcut Katı Atık Sahası

Photograph 7.4
Existing Çeşme Solid Waste Site
Fotoğraf 7.4
Çeşme Mevcut Katı Atık Sahası
Following consideration of the various options available for solid waste management, the following scheme has been proposed. A sanitary landfill would be developed at a new location, to the south of the new İzmir motorway, midway between Alacati and the village of Ovacik, together with pilot waste separation, recycling and composting projects. Remedial work at the existing Çeşme dump site would also be carried out.

Funding is currently being sought for Phase 1 of the Project, which will meet the requirements of the area until 2005. Future developments, which might be required in Phase 2, could include the upgrading of wastewater treatment by construction of a treatment plant south of Alacati providing primary or secondary treatment, the construction of additional phases of the sanitary landfill and extensions of recycling and/or composting schemes. While the scope of this EA is only concerned with Phase 1, any significant issues which might be associated with Phase 2 are highlighted where appropriate.

3.3 Çeşme - Alacati Wastewater Systems

Following a detailed technical and economic analysis of alternative collection and wastewater treatment options (refer to Section 6.2), it has been proposed that treatment of collected wastewater from Çeşme be carried out in the Alacati wastewater treatment plant.

Refer to Drawing No. ATK/CES/FR/08 for the layout of the proposed wastewater scheme.

The existing 1300 m long Çeşme sea outfall, which is not yet in operation, will be retained under the proposed option for possible future use to discharge treated wastewaters from future local developments in Altinkum along the south of the peninsula.

3.3.1 Alacati Wastewater Treatment Plant

The site proposed by the İller Bank for the Alacati wastewater treatment plant is situated in an isolated rocky upland area at a distance from residential areas and presently covered with scrub vegetation. The corridor of land disturbed by construction of the main sewer is clearly visible as a white scar. The site is exposed to strong winds in the winter season, hence measures to counter their effect on settlement tank performance would be required, if such tanks were proposed in Phase 2. (See Photograph 6.5 in Section 6) of this Report.

Preliminary treatment only is now proposed for Phase 1, since more advanced treatment is not presently required on technical grounds (because of the outfall location and its dilution and dispersion characteristics) or by the current legislation. The effectiveness of this treatment will be monitored to ensure that the Turkish Water Quality Standards are met at all times. The proposed Alacati treatment plant site is not expected to be required during Phase 1.

Wastewater from the Çeşme and Alacati systems will receive preliminary treatment at the two terminal pumping stations TM6 and TM17, prior to pumping to the existing discharge pipeline adjacent to the treatment plant site. Treatment will comprise:

- screening by 6mm screens; and
* grit removal.

Both screenings and grit will be removed automatically, bagged and transported by road to disposal in the proposed sanitary landfill site. No sludge will be produced by the proposed treatment processes.

If and when required, after extensive monitoring of the operation of the Phase 1 scheme, or if Turkey joins the European Union (EU) and is required to meet EU Directives, Phase 2 of the Project may involve upgrading to primary or secondary biological treatment. Land will be made available at the Alacati site for these future treatment needs, which would probably include primary sedimentation tanks, secondary activated sludge plants and final settlement tanks. Sludge would be thickened and mechanically dried on site before removal by road, probably to the proposed sanitary landfill.

Future operational and maintenance facilities at the treatment works site will include administration buildings and a watchman’s house.

The other works which are proposed for the wastewater collection systems are as follows:

- construction of additional sewer connections, particularly secondary sewers linking in with residential areas in a phased programme, following an assessment of priority areas;
- design and construction of new area pumping stations;
- design and installation of mechanical and electrical works for pumping stations already constructed.

The Alacati sea outfall, the construction of which was completed in 1995, is located to the south of the peninsula. The DN800 pipe is constructed from glass reinforced plastic, and is 1330m in length.

The discharge point has been designed in accordance with the Water Pollution Control Regulations, the main criteria of which are:

- Total coliform will be < 1000/100 ml in the protection area, where there is risk of human contact, 90% of the observation time; and
- Faecal coliform will be < 200/100ml in the protection area, where there is risk of human contact, 90% of the observation time.

The outfall cannot currently be used because the necessary sewerage pipelines and connections have not been laid and the treatment plant construction has not started. Since the outfall is in place, it is not included in the future investment plan.
3.3.2 Population and Loadings

Population figures (1995) for the whole area are given in Table 3.1. The table also includes projected figures up to 2020, anticipating annual growth rates of 6-7% until 2005 and then decreasing. The figures have been discussed at length and agreed with the Ministry of Tourism and the Municipalities. The total peak summer population is expected to rise to around 217,000 by 2020. As can be seen from Table 3.1, the population increases five times in the summer as a result of tourists and seasonal residents, who own summer houses in the area.

Table 3.1 Present and Future Population Estimates in the Municipalities

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Çeşme</td>
<td>13,405</td>
<td>17,939</td>
<td>24,006</td>
<td>29,916</td>
<td>38,291</td>
</tr>
<tr>
<td>Resident Population</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Housing Pop.</td>
<td>41,650</td>
<td>47,701</td>
<td>52,665</td>
<td>58,147</td>
<td>65,836</td>
</tr>
<tr>
<td>Tourism</td>
<td>14,400</td>
<td>18,378</td>
<td>23,456</td>
<td>28,538</td>
<td>36,527</td>
</tr>
<tr>
<td>Total</td>
<td>69,455</td>
<td>84,018</td>
<td>100,127</td>
<td>116,601</td>
<td>140,654</td>
</tr>
<tr>
<td>Alaçatı</td>
<td>7,248</td>
<td>9,700</td>
<td>13,605</td>
<td>17,781</td>
<td>24,476</td>
</tr>
<tr>
<td>Resident Population</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Housing Pop.</td>
<td>28,000</td>
<td>30,914</td>
<td>34,977</td>
<td>38,617</td>
<td>44,811</td>
</tr>
<tr>
<td>Tourism</td>
<td>272</td>
<td>1,463</td>
<td>3,640</td>
<td>5,105</td>
<td>7,557</td>
</tr>
<tr>
<td>Total</td>
<td>35,520</td>
<td>42,077</td>
<td>52,222</td>
<td>61,503</td>
<td>76,844</td>
</tr>
<tr>
<td>Resident population</td>
<td>20,653</td>
<td>27,639</td>
<td>37,611</td>
<td>47,697</td>
<td>62,767</td>
</tr>
<tr>
<td>Summer Housing Pop.</td>
<td>69,650</td>
<td>78,615</td>
<td>87,642</td>
<td>96,764</td>
<td>110,647</td>
</tr>
<tr>
<td>Tourism</td>
<td>14,672</td>
<td>19,841</td>
<td>27,096</td>
<td>33,643</td>
<td>44,084</td>
</tr>
<tr>
<td>Total</td>
<td>104,975</td>
<td>126,095</td>
<td>152,349</td>
<td>178,104</td>
<td>217,498</td>
</tr>
</tbody>
</table>

The projected wastewater flows resulting from these populations are given in Table 3.2.
Table 3.2 Wastewater Flows to Alacati Treatment Plant

<table>
<thead>
<tr>
<th>Period</th>
<th>Projected Wastewater Flow DWF (l/s)</th>
<th>BOD (kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>156</td>
<td>5,146</td>
</tr>
<tr>
<td>2020</td>
<td>490</td>
<td>13,891</td>
</tr>
<tr>
<td>Winter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>53</td>
<td>1,675</td>
</tr>
<tr>
<td>2020</td>
<td>156</td>
<td>4,341</td>
</tr>
</tbody>
</table>

The major business in the area is tourism. The only other industry is two slaughterhouses operating at low capacity.

All the treatment options have been designed in accordance with the Turkish Water Pollution Regulations, which set out the minimum standards permitted for wastewater to be discharged without treatment through a long sea outfall. The main criteria are given in Table 3.3. The proposed Project has been designed so that these standards will be met at all times.

Table 3.3 Turkish Standards for Wastewater Discharge to Sea

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limiting Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended Solids (SS)</td>
<td>350 mg/l</td>
</tr>
<tr>
<td>BOD</td>
<td>250 mg/l</td>
</tr>
<tr>
<td>COD</td>
<td>400 mg/l</td>
</tr>
<tr>
<td>Total numbers of coliform within the borders of a protection area with risk of human contact</td>
<td>1000/100ml</td>
</tr>
</tbody>
</table>

3.3.3 Şantiye District Wastewater System

The most urgent problem with the current wastewater arrangements in the Study Area is the inadequate operation of the Şantiye sewerage system in Ilica, which currently disposes raw sewage at Istanbul Hill. (See Photograph 6.3). It is proposed to make immediate improvements to this system, prior to commissioning of the main sewerage network and
Alaçatı preliminary treatment facilities. To ensure the reliable operation of the three pumping stations serving Şantiye, most or all of the pumps and pipework will need to be replaced and automatic controls installed. This should alleviate the problem of overflows from the pumping stations in the summer period.

The existing discharge chamber on İstanbul Hill will be replaced with a new concrete tank with internal baffles. The tank will have a manually cleaned screen and an access for occasional desludging by vacuum tanker. The outlet from the tank will be discharged through a series of filter drains or terraced infiltration bays on the hillside to control the flow of effluent to Şifne stream. The existing pumping main to the tank will also be protected to avoid leakage and potential cross-contamination with the Ildır water main which is laid up İstanbul Hill. Although this is not an ideal solution, it must be considered as a temporary solution providing a significant benefits until the pumping stations can discharge to the new sewerage network.

3.4 Water Supply System

3.4.1 Current Supply and Projected Demand

Water sources for the area currently consist of the Ildır aquifer and smaller aquifers in the Çeşme and Alaçatı areas, which are tapped by many small private abstraction wells. By the year 2000, water is also planned to be supplied by the recently completed Alaçatı Dam. İller Bank are currently progressing with the pre-construction formalities for the water treatment works to treat up to 300 l/s of water from the dam. In conjunction with the treatment plant, a pumping station will be provided to transfer the treated water to a service reservoir on İstanbul Hill. The treatment works, pumping station and pipeline, all have committed funding from the Special Provincial Administration in İzmir. (See Drawing No. ATK/CES/FR/05).

Construction of an extensive water supply network commenced in 1989 in Çeşme and Alaçatı, and currently around 80% of the transmission lines, pumping stations and reservoirs have been completed. It is anticipated that the network will be complete by 1997, subject to funding availability. The key problems with the current situation are saline intrusion in some of the springs at the Ildır source, constraints on the peak yield from the Ildır source, cross-contamination from sewage in the shallow wells in the urban areas, and the lack of operational control of the system.

The proposed Project will therefore aim primarily to overcome these problems. New sources will not be required in Phase 1. The Project will include aquifer protection works at the Ildır source, relocation of some wells there, localised extensions to the distribution network and uprating of the existing systems. Construction of the dam treatment plant, pipelines and pumping station will also be carried out.

Present per capita Municipal water consumption in the Study Area is estimated to be 100 l/d for residents with higher consumptions for summer house residents and tourists. Levels of consumption are projected to rise steadily over the period 1995 to 2020 due to the increasing usage and availability of water and increasing affluence. The predicted per capita
consumption until the year 2020 is summarised in Table 3.4.

Table 3.4 Predicted Municipality Water Consumption (Residents)

<table>
<thead>
<tr>
<th>Year</th>
<th>Resident Consumption (l/h/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>100</td>
</tr>
<tr>
<td>2000</td>
<td>106</td>
</tr>
<tr>
<td>2005</td>
<td>113</td>
</tr>
<tr>
<td>2010</td>
<td>120</td>
</tr>
<tr>
<td>2020</td>
<td>135</td>
</tr>
</tbody>
</table>

Estimates for total water demand until 2020 have been calculated by using predictions for resident consumption together with estimates of the demand from summer residents, tourists, hotels and commercial users. Account has also been taken of all other “free” water uses and an allowance made for physical losses within the system. Table 3.5 details both current and future water demand and the current production capacity.

Table 3.5 Projected Total Water Demand to 2020 and Current Production Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>1995</th>
<th>2000</th>
<th>2005</th>
<th>2010</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>104,975</td>
<td>126,095</td>
<td>152,349</td>
<td>178,104</td>
<td>217,498</td>
</tr>
<tr>
<td>Total Demand (m³/year)</td>
<td>3,755,022</td>
<td>4,961,111</td>
<td>6,337,893</td>
<td>7,409,689</td>
<td>10,161,018</td>
</tr>
<tr>
<td>Total Demand (m³/d)</td>
<td>10,288</td>
<td>13,592</td>
<td>17,364</td>
<td>20,301</td>
<td>27,838</td>
</tr>
<tr>
<td>Peak Demand (m³/d)</td>
<td>19,362</td>
<td>26,709</td>
<td>34,841</td>
<td>41,524</td>
<td>57,024</td>
</tr>
<tr>
<td>Total Production Capacity (m³/year)</td>
<td>3,755,022</td>
<td>6,119,254</td>
<td>6,119,254</td>
<td>6,119,254</td>
<td>6,119,254</td>
</tr>
<tr>
<td>Safe yield including Alaçatı Dam (m³/year)</td>
<td>15,010,000</td>
<td>16,790,000</td>
<td>16,790,000</td>
<td>16,790,000</td>
<td>16,790,000</td>
</tr>
</tbody>
</table>

As can be seen from Table 3.5, the projected demand can be met from existing sources, once the Alaçatı Dam source and treatment plant is commissioned in 1999. Additionally, it is believed that the predicted levels of demand are within the capacity limits of safe yield of the groundwater aquifers.

The yearly groundwater potential in the aquifers, except for the Karaburun carbonates which include the İldrı source, are limited. Surveys carried out to date show the existence of a high amount of potable water in the Karaburun carbonates, which extend to around 45m below sea level. However, as noted above, saline intrusion affects parts of this aquifer.
The water quality standards targeted for the Project are the Class 1 standards of the EU Water Quality Regulations (EU Directive 80/778/EEC). However, the minimum standards will comply with the Turkish Standard TS266.

3.4.2 Aquifer Protection Works

The Ildir Springs are of major importance to the future water supply of the Study Area and therefore their protection is of paramount importance. It is proposed to sink exploratory boreholes and build up monitoring data on the extent of the aquifer and the groundwater quality.

Saline intrusion into parts of the aquifer is known to be increasing year by year with the rising demand in production. A measure, which is known to be effective in reducing such intrusion, is to provide an impervious curtain wall between the sea and the freshwater aquifer. This practice is not uncommon in Turkey and has previously been recommended by DSI at this location. Trial grouting of cement/bentonite mix at chosen locations will provide the necessary parameters to design the permanent grout walling. It is estimated that a permanent wall approximately 500 m in length to a depth of 45 m will be required.

3.4.3 Leakage Reduction and Localised Improvements to the Networks

The likely leakage rates from the current distribution systems and the network nearing completion cannot be assessed until detailed studies have been carried out. However, the Feasibility Study has estimated a level of 46%. The Project will implement a number of measures to reduce this, and a gradual reduction to around 20% in 2020 is targeted.

Measures will comprise:

- a detailed survey of all networks and development of a network model;
- a comprehensive leak detection and control programme; and
- installation of water meters at all production wells.

3.4.4 Closure of Private Wells

In conjunction with the above improvements, there should be a major campaign to close private wells and require the population to utilise the Municipality systems only.

3.5 Solid Waste Collection and Disposal

3.5.1 Çeşme- Alaçatı Sanitary Landfill

The Çeşme-Alaçatı sanitary landfill would be designed as a safe, environmentally controlled solid waste disposal site for waste arisings from the Municipalities until the year 2020. The location of the proposed Site 2B, (refer to Drawing No. ATK/CES/FR/09), which was suggested by Çeşme Municipality, is 8 km south-east of Çeşme, 4 km south-west Alaçatı, and 4 km south-east of Ovacık Village. The site is generally flat and is easily accessed by a road of good standard, which crosses under the İzmir motorway. There are no residential areas
within a 1 km radius of the site. See Photograph 13.4 in Section 6.

According to the information obtained in the waste analyses made in during 1996, the percentage of recyclable material was found to be about 23%. However, a significant factor in the waste composition was the amount of waste generated as slag and ash from the coal used as fuel in winter. In the summer period, this material will not be included, and the amounts of recyclable wastes and organic materials such as vegetables, fruit and garden wastes are likely to increase. Chemical analyses of waste samples in summer and winter were used to determine the feasibility of composting.

Waste arisings have been predicted based on the projected population figures. Per capita waste generation was taken as 0.7 kg/d for 1996 and increased annually by 1.5% until 2020, when it is expected to reach 1.0 kg/d. Experience in other countries shows that values of 1.1 - 1.2 kg/d are attained before gradually reducing. Recycling and waste recovery would have to be significant to keep a 'no growth' prediction in per capita generation. Predicted waste arisings for the period to 2020 are shown in Table 3.6. The predicted total amount has been the base criteria for calculating the required sanitary landfill capacity.
Table 3.6  Required Capacity of Sanitary Landfill

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Waste Amount (t)</th>
<th>Total Waste Amount (t)</th>
<th>Total Waste Amount (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>15,543</td>
<td>15,543</td>
<td>18,286</td>
</tr>
<tr>
<td>1999</td>
<td>16,439</td>
<td>31,982</td>
<td>37,626</td>
</tr>
<tr>
<td>2000</td>
<td>17,355</td>
<td>49,337</td>
<td>58,043</td>
</tr>
<tr>
<td>2001</td>
<td>18,503</td>
<td>67,840</td>
<td>79,812</td>
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<tr>
<td>2002</td>
<td>19,678</td>
<td>87,519</td>
<td>102,963</td>
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<tr>
<td>2003</td>
<td>20,905</td>
<td>108,424</td>
<td>127,558</td>
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<td>2004</td>
<td>22,161</td>
<td>130,585</td>
<td>153,630</td>
</tr>
<tr>
<td>2005</td>
<td>23,416</td>
<td>154,002</td>
<td>181,178</td>
</tr>
<tr>
<td>2006</td>
<td>24,719</td>
<td>178,721</td>
<td>210,260</td>
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<tr>
<td>2007</td>
<td>26,050</td>
<td>204,771</td>
<td>240,907</td>
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<td>2008</td>
<td>27,442</td>
<td>232,213</td>
<td>273,192</td>
</tr>
<tr>
<td>2009</td>
<td>28,831</td>
<td>261,044</td>
<td>307,111</td>
</tr>
<tr>
<td>2010</td>
<td>30,283</td>
<td>291,327</td>
<td>342,738</td>
</tr>
<tr>
<td>2011</td>
<td>31,633</td>
<td>322,961</td>
<td>379,954</td>
</tr>
<tr>
<td>2012</td>
<td>33,011</td>
<td>355,971</td>
<td>418,790</td>
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<tr>
<td>2013</td>
<td>34,415</td>
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</tr>
<tr>
<td>2014</td>
<td>35,885</td>
<td>426,271</td>
<td>501,496</td>
</tr>
<tr>
<td>2015</td>
<td>37,343</td>
<td>463,641</td>
<td>545,429</td>
</tr>
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<td>2016</td>
<td>38,618</td>
<td>502,233</td>
<td>590,862</td>
</tr>
<tr>
<td>2017</td>
<td>39,915</td>
<td>542,148</td>
<td>637,821</td>
</tr>
<tr>
<td>2018</td>
<td>41,275</td>
<td>583,422</td>
<td>686,379</td>
</tr>
<tr>
<td>2019</td>
<td>42,614</td>
<td>626,037</td>
<td>736,514</td>
</tr>
<tr>
<td>2020</td>
<td>44,019</td>
<td>670,056</td>
<td>788,301</td>
</tr>
</tbody>
</table>

The required capacity of the landfill is therefore around 670,000 t, which, at the estimated compacted waste density in the landfill of 0.85 t/m³, gives a required landfill volume of around 800,000m³, excluding daily cover material.

The landfill site will be a fully engineered facility with a range of environmental controls. The detailed technical aspects of the landfill site have not yet been finalised but will include the following:-

- sealed base comprising impermeable layer of compacted clay, 2mm HDPE (high density polyethylene) plastic liner, geotextile protection layer, leachate drainage layer
including leachate collection pipes, and a geotextile filter layer;
- leachate drainage system and on-site treatment plant (when required, tanking to the sewer network will be used initially);
- surface water cut-off trenches;
- passive landfill gas extraction; and
- phased restoration to open space.

Waste will be disposed of in a sequence of working cells and covered with suitable inert cover material at the end of each working day. It is proposed to set up pilot composting and recycling plants at the site.

3.6 Pre-Construction Activities

In addition to the design work which is an obvious pre-requisite of any major construction project, there are a number of pre-construction activities to be undertaken.

3.6.1 Land Acquisition

Land will be required permanently for the Alacati water and wastewater treatment plants. It is understood from the Municipalities that the Alacati site is publicly owned but that the Çeşme site is partly privately owned. The proposed works at İstanbul Hill and at the Ildir source are also within publicly owned land. The landfill site is owned by the Ministry of Forestry but most recently 15 ha of this land was leased for a landfill.

3.6.2 Planning and Liaison

All works will need to be approved in advance by the Municipality, the Ministry of Tourism and the Provincial Environment Department. The sanitary landfill site required an EIA to be carried out under the 1993 Turkish EIA Regulations due to the previous status as lying within a Protected Zone. This EIA was prepared and submitted for approval to the Ministry of Environment in August 1996.

The site has been approved by the Municipality Mayors for use as a landfill and in November 1996, the status of the site was amended by the Ministry of Culture to enable its use for this purpose. However, a full EIA was still obligatory, since the site was owned by the Ministry of Forestry. Eventually, the EIA report was approved by the Ministry of Environment in March 1997, following evaluation and public-hearing meetings.

Planning and liaison will be carried out throughout the design process, co-ordinated by the two Municipalities through their local councils. It will be necessary to consult with the Municipalities to ensure that the chosen sewer routes are acceptable; with the traffic police to ensure that the construction works minimise disruption to the flow of traffic and with the various utility companies to minimise conflict with existing and proposed water, electricity and telephone services.
3.6.3 Public Relations

Although careful planning and liaison should help to minimise disruption to the general public, public consultation should be undertaken by the Municipalities to inform the public of the benefits of the Project and keep them informed of construction activities. This commenced in 1996, with public meetings being held in Çeşme in July and September, and followed with a public hearing meeting for the proposed sanitary landfill in February 1997.

3.7 Construction Activities

3.7.1 General

In accordance with local requirements, major construction activities in coastal and tourist areas will not be undertaken during the summer tourist season. This will significantly reduce the potential disturbance of construction activities, since they will be carried out in the winter when traffic, pedestrian activity and recreational usage are all much lower than in the summer.

3.7.2 Wastewater Systems

It is likely that only one or two contracts will be let for construction of new secondary sewer networks, pumping stations, pumping mains and the initial preliminary treatment equipment in Alaçatı. The construction period is proposed to commence in 1998 and have a duration of 3-4 years. The current İller Bank construction contract is also expected to continue during the period but with its emphasis changed to the construction of secondary network sewers.

The extent of the proposed system to be constructed under the Phase 1 Project will be constrained by the limited availability of funds. The recommended strategy is to construct the essential backbone of a single collection system to serve the main urban residential areas of Çeşme and Alaçatı to provide a year round base flow. The system will then be expanded outwards to serve the other urban areas in order of priorities and as funds permit. Construction of new pumping stations TM2 is likely with TM4, TM16 and 20 possible. These will serve the areas of Çeşme town, Alaçatı town, İlica, Boyalık and Dalyanköy.

Laying of pumping mains and sewers in urban areas will be quite extensive in some districts to provide for an adequate and comprehensive house and property connection programme. Concrete pipes are expected to be manufactured by the contractor on site in a purpose built production facility. Asbestos cement pipes, if used in limited quantities, will be brought in by road.

Phase 1 could also involve the construction of the Alaçatı preliminary wastewater treatment plant. General site preparation and levelling would be required before construction, for the location of site works, machinery, and equipment. A concrete mixing plant would not be required for initial construction works and concrete is expected to be trucked in. It is not anticipated that significant volumes of material will need to be removed from the site. An improved site access road will be required to replace the existing track which was used for construction of the pipeline to the site. However, to minimise Phase 1 costs preliminary
treatment (fine screenings and grit removal) is proposed to be carried out at existing pumping stations rather than at the new treatment plant site.

An advance works contract for refurbishing the Şantiye area pumping stations and construction of a new tank and infiltration field at İstanbul Hill will be let in early 1998.

### 3.7.3 Water Supply

A single contract is expected to be let by the SPA for the construction of the Alaçatı Dam treatment plant, pumping station and the pipeline to İstanbul Hill. Tenders were submitted in October 1996 and award is expected in early 1997.

The geological and hydrogeological studies on the İldır aquifer will commence in 1998 and take one year to complete. Construction of the cement grout curtain wall is expected to be carried out by a specialist contractor during the following year together with relocation of some İldır wells. Miscellaneous work such as installation of network water meters and chlorination facilities will be awarded to a single contractor for purchase and installation.

During the above works, there is not expected to be any significant disruption to residents or traffic as most transmission pipelines are already constructed in built-up areas. Any future distribution networks to be completed will generally be in newly developing areas and will be constructed in the winter season.

### 3.7.4 Solid Waste Systems

If sufficient funding is available, construction of the proposed sanitary landfill site will probably start in 1998 and, together with the pilot recycling and composting facilities, be complete within two years. The proposed site is isolated from the urban areas and will require a new local access road to be constructed.

### 3.8 Operation and Maintenance

Once the scheme has been constructed, appropriately qualified and trained staff will be appointed to operate and manage the water supply and wastewater systems, and the landfill site and waste transfer stations. This is likely to be carried out under a strengthened Municipality structure initially or by a newly established Union or Union Corporation. In the latter cases management and operation may be performed by private sector contractors under the control of the Union.

It has been recommended that all operations within the two Municipalities be combined to improve operation and maintenance practices.

### 3.9 Timescale

The anticipated timescale for the design and implementation of the Phase 1 Project is shown in Figure 14.7.
4.0 DESCRIPTION OF THE BASELINE ENVIRONMENT

4.1 The Study Area

The Project is located on the Karaburun Peninsula on the western coast of Turkey, in the Province of İzmir. The coast of the peninsula is deeply incised with a series of rocky headlands and sandy bays. Although the peninsula is generally hilly, tree cover is limited.

The majority of the population and tourism developments are located along the northern coast from the small port town of Çeşme in the west to Şifne in the east. The southern coast is generally undeveloped. The old town of Alaçati lies in the middle of the peninsula. Both Çeşme and Alaçati are linked to İzmir by a recently completed motorway. An airport is under construction to the south-east of Alaçati. Until it is opened, the nearest facility is 80km away in İzmir.

The Study Area for the assessment consists of the areas to be serviced by the water supply system, wastewater systems and solid waste collection (the Municipality areas of Çeşme and Alaçati); and the areas of marine water potentially affected by the effluent discharge. The Study Area is also extended to include the main water supply source at Ildir to the north-east.

Since the proposed Project does not involve effluent reuse or sludge disposal or reuse at this stage, a review of potential future reuse areas are not included in this Report. Furthermore, because the Project will not generate any significant atmospheric emissions, the airsheds have not been included in the Study Area.

4.2 Physical Environment

4.2.1 Geology

The Karaburun Peninsula is the westernmost point of the three zones in the paleotectonic structure of Western Anatolia, which covers the whole of the Study Area. The Menderes Massif, which is composed of different metamorphic rocks, lies to the east of these three zones. The Karaburun Zone covers the Karaburun and Çeşme Peninsulas and consists of platform type continuous carbonates.

The Paleozoic greywacke and limestone found around Karaburun and Çeşme are the basic elements in this zone. These basic elements are overlaid with mixed Mesozoic carbonates.

In the late Cenozoic and Neogene periods, after a long stratigraphical break, lake formation and volcanic eruptions resulted in the whole area being covered with tuff, agglomerate and andesite. The tuff is generally at the base of the volcanic series. The lake formations can be seen as sandstone, clay, marl and clayey limestone successions on this base.

The Quaternary period is represented by sand, gravel, clay and shale levels. They cover small areas in Ovacik, to the east of Alaçati, in the Nohutalan and Uzunkuyu plains and along the valley floors.
The proposed landfill site is bordered by sedimentary rocks, but it is situated entirely on volcanic Pliocene aged tuffs which have low permeability. Folding, faults and local faults are widespread in the area, however it is understood from geological maps that no faults have been defined at the selected site. The Study Area is generally in a first degree seismic zone.

4.2.2 Soils

There is limited available information on the soils of the Study Area, although the Ovacık plain is known to have good quality agricultural soils. The Çeşme wastewater treatment plant site, proposed by the İller Bank is located on an area of prime agricultural land.

4.2.3 Climate

The climate of Çeşme and the surrounding area is typically Mediterranean with hot, dry summers and cool, rainy winters. As can be seen from Table 4.1, the average annual precipitation is 589.8 mm and average annual temperature is 17 °C. Surface water and groundwater are fed by high precipitation in the winter, but for the rest of the year precipitation is low. The wind blows from north and north-west in summer and from the south and south-east in winter. The average annual wind speed is 2.9 m/s. Wind speeds up to 33.8 m/s have been recorded during storms.

The proposed landfill Site 2B is likely to experience winds throughout the year because it is on the prevailing NNW - SSE wind axis. There is little possibility however for the site to be affected by significant precipitation.

Table 4.1 Climatic Data for the Study Area

<table>
<thead>
<tr>
<th>Months</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>Yearly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitation (mm)</td>
<td>124.4</td>
<td>83.4</td>
<td>63.7</td>
<td>33.2</td>
<td>18.4</td>
<td>5.1</td>
<td>1.8</td>
<td>0.4</td>
<td>15.4</td>
<td>30.5</td>
<td>65.2</td>
<td>65.2</td>
<td>589.8</td>
</tr>
<tr>
<td>Temperature °C</td>
<td>9.3</td>
<td>9.8</td>
<td>11.5</td>
<td>15.0</td>
<td>19.1</td>
<td>23.6</td>
<td>25.4</td>
<td>24.8</td>
<td>22.1</td>
<td>17.8</td>
<td>14.0</td>
<td>11.0</td>
<td>17.0</td>
</tr>
<tr>
<td>Evaporation (mm)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>94.7</td>
<td>139.1</td>
<td>173.4</td>
<td>188</td>
<td>169</td>
<td>115.3</td>
<td>81.7</td>
<td>50.0</td>
<td>51.8</td>
<td>946.1</td>
</tr>
<tr>
<td>Wind Direction</td>
<td>S</td>
<td>ENE</td>
<td>ENE</td>
<td>S</td>
<td>NNW</td>
<td>NNW</td>
<td>NNW</td>
<td>NNW</td>
<td>NNW</td>
<td>NNW</td>
<td>NNE</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Wind Speed (m/s)</td>
<td>3.5</td>
<td>3.7</td>
<td>3.2</td>
<td>3.0</td>
<td>2.6</td>
<td>2.5</td>
<td>2.7</td>
<td>2.6</td>
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<td>71</td>
<td>70</td>
<td>71</td>
<td>71</td>
<td>70</td>
<td>65</td>
<td>64</td>
<td>66</td>
<td>68</td>
<td>71</td>
<td>73</td>
<td>72</td>
<td>69</td>
</tr>
</tbody>
</table>
4.2.4 Surface Water and Wastewater

There are no major sources of surface water in the vicinity of the proposed site for the Alaçatı wastewater treatment plant (or the previously proposed Çeşme site).

At the sanitary landfill site, the dry stream bed of Alancık Creek lies along the eastern side of the proposed landfill. In consultations made with relevant institutions, it was stated that the site was not thought to be at risk from flood, landslide or erosion. Site investigation also confirmed this situation. The landfill site is not situated within a protection zone relating to surface water or catchment areas.

There are a number of existing discharges to the marine environment. These include diffuse inputs from septic tank soakaways via groundwater and surface watercourses, from boat and shipping discharges and from Municipal sources such as İstanbıl Hill (via Şifne stream) and Alaçatı Bay. The available information on microbiological water quality has been derived from the previous GKW and DEU reports and from sea water sampling results obtained from the Sub-Provincial Health Department in Çeşme. These results are summarised on Figure 8.1.

Mean concentrations of Total Coliform comply with the Turkish limit value of 1,000 TC/100 ml, but this parameter is not a reliable indicator of sewage pollution. The Faecal Coli sampling results exceed the compliance level at a number of locations. Failures at Boyalık are probably associated with the unsewered developments at this site and those at Tekke Plaji and Çeşme Körfezi with shipping and the tourist developments along the seafront in this area. It should, however, be noted that water quality is within the requirements of the current EU Bathing Water Standards (which are 10,000/100 ml for Total Coli).

In general, microbiological water quality problems are localised and probably associated with relatively small untreated sewage discharges. Low values of nutrients and chlorophyll indicate that eutrophication is not a significant factor in the region (considering the agricultural activity in the area south of Çeşme). The same is true of the values of ammonia, nitrate, nitrite and phosphate.

4.2.5 Groundwater

The main areas from which groundwater can be derived are the Karaburun carbonates, Çeşme carbonates, Neogene limestones and the levels of volcanic tuff, agglomerate and andesite. Water can also be found in the shallow alluvium plains of the Study Area.

The water potential from the various wells display significant variations in quantity and quality. The boreholes around Alaçatı supply water from the tuff and agglomerate levels and generally provide very low yields. Water quality is however very good.

The boreholes around Çeşme, Ovacık and Çiftlikköy supply water from the sand, gravel, conglomerate, marl and limestone levels of the lacustrine sediments. Yields from these sources are generally seasonal. Due to the excessive withdrawal by unregistered users, sea water intrusion is now observed in almost all the wells.
Sea Water Sample Results/100ml-Mean Values

Republic of Turkey Ministry of Tourism
Türkiye Cumhuriyeti Turizm Bakanlığı

South West Coast Environmental Project
Feasibility Study for Cesme-Alacati and Surrounding Area
Akdeniz - Ege Turizm Altarası Kıyı Yönetimi Projesi
Çeşme-Alacati, ve çevresi Fizibilite Etüdü

Project No.
440026

Figure 8.1

Acen Consultants Limited
7 Chancellor Court, Drink Road
Surrey Research Park, Guildford, Surrey, England 022 5CG

No. Rev Date/TUR3005/062/026/01

DENIZ SUYU ANALIZ SONUÇLARI/100ml ORTALAMA DEĞERLER

KEY
LEJEND

1. BUYUK UMAN
2. ILICA HALK PLAJI (Public Beach)
3. BOYALIK PLAJI (Beach)
4. AYOYORGİ PLAJI (Beach)
5. DALYAN HALK PLAJI (Public Beach)
6. CESME KORFEZİ
7. TEKKE PLAJI
8. ALTINKUM PLAJI
The boreholes around Çeşme and Dalyanköy are supplied from the Çeşme carbonates. Sea water intrusion is considerable, and a number of these wells have now been closed.

The boreholes around Ildir are supplied from the Karaburun carbonates. In the Camibogazi valley, the Ildir Springs are formed from the karstic Karaburun carbonates. There are three spring groups (lower, middle and upper) along the valley towards the coast. Large discharges are observed from these springs, although the lower group is affected by saline intrusion.

There are two potable water wells bored by İller Bank near the Çeşme wastewater treatment plant site proposed by İller Bank. There are no known groundwater abstractions near the Alacati wastewater treatment plant site.

Due to the boreholes being close to the landfill site, the foundation of the site is on tuff with a thickness of 100 m and there is no water up to 50 m depth. There are two wells operated by DSI 2.3 km north and 2.5 km north-west of the site. The landfill site is not situated within a groundwater protection zone.

High concentrations of chlorides and sulphates, well above the recommendations in Turkish Standard TS 266, are found in all sources.

Pollution of the groundwater is also occurring and an analysis of results produced by the Municipalities show unacceptable levels of coliform and organic matter (Refer to Appendix E.1 of Çeşme-Alaçati Feasibility Study by Hyder). The infiltration of wastewater into the subsoil from septic tanks is of major concern. One such incident in 1995 resulted in all the well sources in Çeşme being closed. Due to the shallow aquifers, pollution occurs as a result of seepage from septic tanks as mentioned above. In addition there is a likelihood of infiltration by fertilizers.

On the edge of the catchment of the Alaçati Dam, there is a solid waste dump site that has been used by the Alaçati Municipality. This site is no longer being used, and in recent months the accumulated waste has been removed to prevent any surface discharge or groundwater movement into the catchment. In a similar manner there are raw sewage discharges on İstanbul Hill, which is also being used as an illegal dumping site.

Reisdere village is also on the boundary of the catchment, and leakages from septic tanks must be considered. These areas must be examined and actions taken to ensure no discharges are directed into the catchment. Test boreholes are recommended in these areas to assess contamination levels.

Conductivity levels in all sources are generally high. Values ranging between 2000 to 3000 mmho/cm are detected in the Ildir Springs.
4.2.6 Topography

The topography of the region is generally hilly, with the towns of Çeşme and Alaçatı surrounded by a number of upland areas. In the west, Karadağ Hill rises to a height of 203m between the villages of Alaçatı and Ovacık. The main plains are the Ovacık Plain to the south of Çeşme, the İlica Plain to the north of Alaçatı, and the Nohutalan Plain and the Uzunkuyu Barbaros Plain to the east of the Study Area.

The sites proposed by İller Bank for the Çeşme treatment plant and the site proposed in this Study for the sanitary landfill site are topographically flat, lying in gently sloping valleys. The Alaçatı treatment plant site is situated in a rocky upland area.

4.2.7 Landscape

The landscape within the Study Area is generally of moderate to high quality, characterised by a series of rocky headlands and sandy bays. Inland, the peninsula is gently undulating and predominantly rural in character. The more rocky upland areas are generally vegetated by scrub and rough grassland; in the lower valleys agriculture predominates.

The northern coast to Sıfine in the east is heavily developed and the character of this area must be considered as urban. The architectural and aesthetic quality of the tourist areas is variable. The towns of Çeşme and Alaçatı have more architectural interest, with a number of attractive old areas featuring the characteristic traditional Çeşme Houses.

4.3 Biological Environment

4.3.1 Terrestrial Ecology

The vegetation in the Study Area generally comprises plants characteristic of arid land, such as olive trees, spring shrubs and wild grasses. In dry and stoney areas of Çeşme, short bushes like wild asparagus (asparagus acutifolius), great burnet (sarcopoterium), cistus with small pink flowers (cistus parvifolius), Judas-tree (cercis sililiasturn), timber heather (erica arborea), bitter-sweet (jasminum fruticans) and common broom (spartium junceum), and herbaceous plants like euphorbia, motherwort, thyme and lavender are common.

Common broom, wild gum, terebinth, wild strawberry and valonia oak form the scrub flora, while the pasture flora is formed by thyme, garden sage, wild tulip and orchids.

Çeşme Peninsula is situated to the west of an area quite rich for hunting animals. Wild boar, bear, jackal, wolf, roe-deer and fox are listed as most important among these. In Çeşme, there are also bird species like partridge, wood pigeon, duck and quail.

There is agricultural activity (arable crop cultivation) near the Çeşme wastewater treatment plant site proposed by İller Bank and the farmers are believed to use quantities of biocides (herbicide, insecticide, pesticide) on the land in an attempt to increase its fertility. These biocides may pose an environmental risk to the flora, fauna, and biological structure of the soil as well as to the groundwater.
At the proposed landfill site there are some areas formally used for tobacco planting. The flora of the site includes the spring bushes, mastic bushes, heather and few olive trees. The fauna of the site includes partridges, rabbits and possibly foxes.

4.3.2 Aquatic Ecology

The marine species in the region display some diversity but the biological productivity level is low. In the Mediterranean/Aegean Seas biodiversity increases from east to west. There is little diversity in the Çeşme region. Kekova-Uçağız (Antalya) and Gökova Gulf have been proposed as sites for the National Marine Parks which are due to be established in Turkey. No National Marine Park is planned near Çeşme.

The benthic marine ecology within the coastal zone is mainly determined by physical sediment type, with slight underlying influences from sewage discharges to the area, and the oceanographic nature (high salinity, high temperature) of the area. In general, the species are typical of semi-enclosed seas of this latitude, with relatively low species diversity and abundance. Within the coastal zone there are no designated shell fisheries, although there are some commercial and recreational fishery activities.

The area along the Çeşme outfall consists of a rocky biotope between the shoreline and 3m depth of water lying parallel to the shore with a width of 15-20m, which has considerable dense algal vegetation. Thereafter a sandy zone with a Posidonia oceanica covers the bottom completely in the deeper zones. In this region, 10 species of flora, 112 species of the benthic invertebrates, 13 species of the fishes and hence a total of 135 species in total were identified. There is no pollution at a level which can be effective on the biota at this location.

The Alacati outfall has a similar but wider 20-25m rocky band with dense algal vegetation down to a depth of 4m, thereafter a narrow sandy biotope appears. A distance of 250-300m from the shoreline where the water depth is 8-10m, a patchy distribution of Posidonia oceanica starts on a sandy biotope. After 10-15m water depth it covers the bottom completely. There is no pollution in the region where 17 species of flora, 129 species of benthic invertebrates, 13 species of fishes and hence a total of 159 species were identified. Among the benthic zones, there are 129 taxa in the upper infralittoral zone, which is typically the richest, while there are 73 taxa in the infralittoral zone.

Polythene bag techniques tests were carried out by the Dokuz Eylül University in July and September 1993 to determine the $T_{90}$ bacterial die-off. These tests concluded that a $T_{90} = 2$ hours 30 minutes is advisable for the Çeşme area.

4.3.3 Protected Areas and Species

Within the Study Area are a number of sites which have been granted protection by the Turkish Government. The classifications of protection zones present are defined in Table 4.2 and shown on Drawing No. ATK/CES/FR/04.
Table 4.2 Ecological Protection Zones

<table>
<thead>
<tr>
<th>Classification of Protection Zone</th>
<th>Prohibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Park</td>
<td>Housing prohibited outside existing settlement areas. Projects in accord with the Ministry of Forestry's plan for the Park may be approved by them.</td>
</tr>
<tr>
<td>1st Degree Natural Protection Zone</td>
<td>All types of physical activities in the zone are prohibited.</td>
</tr>
<tr>
<td>2nd &amp; 3rd Degree Natural Protection Zone</td>
<td>After the approval of the Cultural and Natural Protection Council, excavation and/or construction are allowed.</td>
</tr>
</tbody>
</table>

A large part of the Study Area has recently been designated as a 1st or 2nd Degree Natural Protection Zone in an attempt to control further development of the peninsula. This however conflicts with the current development plans.

The previously proposed Çeşme wastewater treatment plant site is not located within a Natural Protection Zone. However, the proposed site for the Alaçatı treatment plant lies within a 1st Degree Natural Protection Zone. The sanitary landfill site has recently been removed from a 2nd Degree Zone.

A number of water supply protection zones have been designated around the Alaçatı Dam reservoir and the closed former Alaçatı landfill site is within the 1st Degree zone.

There are no known plans to create any National Marine Parks around the Study Area.

The gum tree was historically one of the most important trees of the Çeşme area, although most have now disappeared as a result of construction and development pressures. The Municipality is now trying to protect the gum trees by registering them.

4.3.4 Species of Commercial Importance

Species of commercial importance within the Study Area relate to agriculture. The main products of the region are globe artichokes, grapes, melons, aniseed, corn, summer and winter vegetables and olives. Agricultural activity has, however, declined over recent years as a result of limited water supplies, and increases in residential and tourism developments. Tobacco, formerly a significant crop, has now almost disappeared due to poor quality yields.
4.4 Socio-Cultural Environment

4.4.1 Population and Community Structure

Present populations and future estimates for Çesme - Alaçatı and the surrounding areas are as scheduled in Table 4.3.

Table 4.3 Population Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Population</td>
<td>20,653</td>
<td>27,639</td>
<td>37,611</td>
<td>47,697</td>
<td>62,767</td>
</tr>
<tr>
<td>Visiting Summer House Population</td>
<td>69,650</td>
<td>78,615</td>
<td>87,642</td>
<td>96,764</td>
<td>110,647</td>
</tr>
<tr>
<td>Tourism</td>
<td>14,672</td>
<td>19,841</td>
<td>27,096</td>
<td>33,643</td>
<td>44,084</td>
</tr>
<tr>
<td>Total</td>
<td>104,975</td>
<td>126,095</td>
<td>152,349</td>
<td>178,104</td>
<td>217,498</td>
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</tbody>
</table>

The total population is projected to increase by around 45% by 2005 and to double by 2020. Surveys have shown that the (predominantly Turkish) visiting population, which resides in the area only during the peak summer months, is currently more than three times the year-round resident population. This dominance is, however, expected to decline over time and there is considerable optimism that the Çesme-Alaçatı tourist industry will expand at the expense of further summer house development. Construction of the new motorway link to İzmir and the airport to the south-east of Alaçatı should provide a strong impetus to further development of tourism.

Çesme has traditionally attracted the wealthier Turkish citizens to its health spas and beaches, but increasingly middle income visitors have come to the area and invested in summer housing co-operative developments.

4.4.2 Land Use

Land use in the Study Area is predominantly open space and agricultural land. The approximate areas of the main land use types are given in Table 4.4.
Table 4.4  Land Use

<table>
<thead>
<tr>
<th>Land Use Type</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential areas</td>
<td>1,095</td>
</tr>
<tr>
<td>Summer houses</td>
<td>1,750</td>
</tr>
<tr>
<td>Agricultural land</td>
<td>3,260</td>
</tr>
<tr>
<td>Recreational areas</td>
<td>550</td>
</tr>
<tr>
<td>Tourism facilities</td>
<td>1,440</td>
</tr>
<tr>
<td>Forest areas</td>
<td>1,200</td>
</tr>
<tr>
<td>Open space</td>
<td>9,480</td>
</tr>
<tr>
<td>Other</td>
<td>225</td>
</tr>
<tr>
<td><strong>Total Area</strong></td>
<td><strong>19,000</strong></td>
</tr>
</tbody>
</table>

The Çeşme wastewater treatment plant location proposed by İller Bank may be re-sited out of the area of high grade agricultural land, onto an area which is currently open space. Surrounding land uses are predominantly agriculture with a few isolated farmhouses. The Alaçatı wastewater treatment plant site is currently open land, in an open upland location.

Land use at the proposed sanitary landfill site is currently barren or grazing land surrounded by scrub-covered hills to the west, north and east. A dry stream bed is located to the east of the site.

4.4.3 Future Development

From the early 1980's significant social and economic changes have taken place in the Study Area, primarily as a result of tourism and summer house development. Previously the area mainly relied on agriculture.

The development of summer housing has been significant. Many housing co-operatives have now been developed and attract residents to the area for varying periods but especially in July - August and at weekends between April - October. The majority of the summer residents come from within the İzmir area.

The future development of the area will continue to depend extensively on the tourist and leisure industry. Tourism, agriculture and trade will therefore form the main economy of the
region. The main industrial and commercial activities will relate almost exclusively to servicing the tourist industry.

The new motorway recently completed linking İzmir with Alaçati and Çeşme will encourage further development. In additional, construction started in 1995 for an airport on the southern part of the peninsula. This will also improve the area’s transportation links. A new terminal at İzmir Airport for charter flights is also being considered. Furthermore, the construction of new marinas in Çeşme harbour, Alaçati and Dalyanköy will greatly increase the tourism potential for shipping and yachting activities.

The higher education facilities of the area are also being improved. A technical high school is now being constructed in Çeşme. In addition, a large area has been designated to the south-east of Alaçati for a new university facility. Completion of these facilities should reverse the current need for students to leave the area to seek higher education.

4.4.4 Employment

The main commercial activity in Çeşme and Alaçati is tourism. This is the single most significant employment sector and income source in the area. Although there are no major industrial plants in Çeşme or Alaçati, there are three small industrial areas. At these sites are carpentry workshops, repair and maintenance workshops, marble workshops, plastic workshops and 5 petrol stations. The increase in housing construction has led to an expansion of the construction industry and the number of businesses selling building materials.

There is no local Chamber of Commerce or Hotel Association, but the Small Business Association has 1800 members representing 90 different categories of commercial and industrial enterprises.

4.4.5 Cultural Environment

The region was called Kyssus in the ancient times. The port of Erythrai (Ildır) was one of the important cities of Ionia. Findings discovered in Mordoğan near Erythrai showed first residence in the region in the Bronze Age. The name Erythrai was derived from Erythros, which is the Greek term for red or a reddish colour. It means Red City, as a result of the colour of the soil. According to an other legend, Erythrai took its name from Rhadamanthes of Crete's son Erthros. According to other sources, the city was establish by Ionians who gave the name of their motherland to their new city.

Although there are many archaeological sites on the Çeşme Peninsula, no activity is seen today. There are two historical places in Çeşme, namely Çeşme Castle and the ancient theatre and ruins in Ildır.

In the museum in Çeşme Castle, there are archaeological and ethnographic works and coins. The castle was constructed in the 15th century on an area of 2 ha. Approximately 35,000 Turkish and 20,000 foreign tourists visit the castle each year.
It is known that there are many sunken wrecks off the Çeşme coasts. One of them lies north of Çeşme harbour. Studies are carried out by authorities from Bodrum Museum.

In Çeşme, several places are taken under archaeological protection. These are:-

1st. Degree Archaeological Site Areas

- 1 km² area around Deniz Limanı on the Dalyan Peninsula;
- Approximately 4 ha south of Baba Limanı on the Dalyan Peninsula;
- Approximately 2 km² area to the south of Reisdere village;
- 1 km² area around Karaköy; and
- Ildır village.

2nd. Degree Archaeological Site Areas

- Approximately 0.5 km² area around Baba Limanı;
- Kalem Peninsula east of Boyalik Limanı; and
- Approximately 2 km² area to the south of Ildır village.

3rd. Degree Archaeological Site Areas

- Approximately 1 km² south of Kalem Peninsula;
- Approximately 0.5 km² north Deniz Limanı;
- Approximately 0.3 km² south of Baba Limanı; and
- Approximately 0.3 km² at Çayırı, south west of Çiftlikköy.

It should be noted that the 1st Degree area south of Reisdere is now partially submerged under the new Alaçatı Dam reservoir.

The present protection zones (archaeological, natural and reservoir) in the Çeşme area are shown on Drawing No. ATK/CES/FR/04. The prohibitions with respect to the classification of protection zones are given in Table 4.5.

**Table 4.5 Archeological Protection Zones**

<table>
<thead>
<tr>
<th>Classification of Protection Zone</th>
<th>Prohibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Degree Archaeological Protection Zone</td>
<td>All types of physical activities in zone are prohibited.</td>
</tr>
<tr>
<td>2nd &amp; 3rd Degree Archaeological Protection Zone</td>
<td>After the approval of the Cultural and Natural Protection Council, under the supervision of an archaeologist, excavation is allowed.</td>
</tr>
<tr>
<td>Urban Protection Zone</td>
<td>After the approval of the Cultural and Natural Protection Council, excavation and/or construction are allowed.</td>
</tr>
</tbody>
</table>
None of these are within the areas to be affected directly by the Project.

4.4.6 Public Health

Potable water in Çeşme is derived from both public and private supplies. The water comes from numerous sources and very few, if any, are monitored or controlled. This situation is obviously undesirable since the overall quality of the water will vary considerably from place to place and source to source.

The population of Çeşme-Alaçatı increases greatly in the summer, creating demands for potable water and water for domestic purposes at a time when rainfall and the water table are low, temperatures are high, and the availability of good quality water is limited. The practice of supplementing the public supply with private supplies of unknown quality from wells is potentially hazardous, particularly if the water is consumed without further treatment.

In discussion with Health Department officials in both Çeşme and Alaçatı, they considered that there was no current evidence or problem of any regular or general gastro-intestinal or other infection, which could be the result of water supply or sea water pollution. However, several incidents of private well pollution, due to the close proximity of septic tanks, were reported in Alaçatı. Most houses have private wells. Incidences of dermatological illnesses were also reported by foreign tourists, after bathing in the thermal waters of Ilica Beach.

Although no detailed medical records were available, some summary data on bacteriological tests carried out on Municipal drinking water and bathing waters since 1990 were provided by Çeşme Sub-Provincial Health Dept. These are shown in Table 4.6.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Drinking Water Samples</td>
<td>34</td>
<td>58</td>
<td>43</td>
<td>86</td>
<td>70</td>
<td>76</td>
</tr>
<tr>
<td>% Failure</td>
<td>44</td>
<td>60</td>
<td>51</td>
<td>65</td>
<td>81</td>
<td>70</td>
</tr>
<tr>
<td>No. of Bathing Water Samples</td>
<td>102</td>
<td>152</td>
<td>145</td>
<td>144</td>
<td>136</td>
<td>152</td>
</tr>
<tr>
<td>% Failure</td>
<td>49</td>
<td>15</td>
<td>33</td>
<td>2</td>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

While the accuracy of test results was not verified during the Study, the general picture presented was of concern, in particular the apparent consistently high rate of failure of Municipal drinking water supplies. Further examination of the results showed that the failures were almost exclusively from public fountains, which have now been closed.

4.4.7 Public Attitudes

An informal questionnaire survey was carried out in January 1996 to assess the attitudes of the inhabitants of Çeşme and Alaçatı regarding the environmental conditions in the Municipalities. The sampled population was limited and, because of the time of year, was restricted to year round residents, so the results should be considered indicative only. While
a significant majority of the respondents (85%) believed the sea water to be clean, all of them stated that they believed the water supply to be of poor quality and they were unhappy with this situation. At the time of the survey, respondents were all obtaining their water from fountains or artesian wells. Although over half of the sample believed the overall environmental quality of the area to be good or very good, a third stated that they had suffered health problems which they believed to be due to environmental conditions or poor water quality.
5.0 POTENTIAL IMPACT OF THE PROPOSED PROJECT

5.1 Impacts of Çeşme-Alaçatı Wastewater System

5.1.1 Alaçatı Wastewater Treatment Plant

The proposed site for the Alaçatı wastewater treatment plant was largely dictated by the design already being implemented through İller Bank. In assessing the environmental impacts of the works, it should be noted that:

- the site lies in an isolated hill area far from habitation, (See Photograph 6.5 in Section 6);
- the area has already been disturbed by construction of the trunk sewer to and from the site;
- no construction work is required under Phase 1;
- the area is scrub land and construction of the works would have no impact on soils, agriculture or groundwater;
- no visual impact would result from the works due to the isolated nature of the site;
- although the site lies within a 1st Degree Natural Protection Zone, the selected site is not considered to be of high floristic quality, however construction activities could result in temporary disturbance to local fauna; and
- there are no residential properties near the site, so dust, noise and odour issues are not likely to be a problem.

Following completion of the works and commissioning of the recently constructed sea outfall there will be an increase in the level of wastewater discharged to the sea. However modelling carried out of the predicted flows and effluent quality achieved by the preliminary treatment has indicated that Turkish Water Quality Standards will be met. Bathing and water sports activities on the south coast of the peninsula are limited at this particular outfall location. Within this area there are no designated shell fisheries and limited commercial or recreational fishing activities.

In tandem with this localised reduction in marine water quality around the outfall, there will be significant improvements to surface water quality, aesthetics and public health risk at the locations where sewage is currently disposed by tanker. On completion of the sewerage system, all septage will be required to be discharged to the system. There should also be a significant beneficial impact on groundwater quality (and consequently public health) in the Çeşme-Alaçatı area as the present septic tanks are phased out. This is likely to be a gradual improvement but should, nonetheless, be significant.

The potential impact on groundwater in the locality is not considered significant. Since ground disturbance for construction of the works will be fairly limited, the main risk to the aquifer would be from accidental spillage of oil or chemicals. Neither of these will be stored at the site in Phase 1. If in the future full biological treatment is required small quantities of diesel fuel and chemicals will be used. These will be held in secure holding areas designed to contain any accidental spillage.
Future construction of the works in what is an open area will inevitably lead to a certain level of adverse visual impact, however there are no potential receptors. Visual impact is likely to be worst during the construction phase.

The plant will have an insignificant impact on terrestrial ecology, since the site has limited nature conservation interest. No trees will be lost. Although the site lies within a Natural Protection Zone, the scale of the development is too small to have an adverse impact. The environmental improvement resulting from the Project as a whole must be seen as beneficial to the aim of protecting the environment of the peninsula.

Commissioning of the sea existing outfall may have a localised adverse impact on the marine ecology. Although the marine ecology of the area is of relatively limited amenity value it is still significant in the local context and therefore the impact of the outfall should be monitored. The organic material content of the effluent may become food for fish. However, the initial impact on the fish must also be observed. It is likely that fishing and the living conditions in the marine environment will be affected. There are many economically important species of fish at the discharge point. Some of them (e.g. Gobius niger) thrive in polluted waters and some (e.g. Mugil capito, Mugil auratus, and Diplodus annularis) are resistant to pollution up to certain limits; but most of them, particularly the Sparidae family, prefer clean areas. It is possible that these species may disappear from the immediate area.

The benthic marine ecology within the coastal zone is mainly determined by physical sediment type, with slight underlying influences from sewerage discharges to the area, and the oceanographic nature (high salinity, high temperature) of the area. In general the species are typical of semi-enclosed seas of this latitude, with relatively low species diversity and abundance. Within the coastal zone there are no designated shell fisheries, and little significant commercial and recreational fishery activities.

Although the benthic species along the outfall route will have been disturbed, during construction in Sept. 1995, these impacts should not have been significant given the low species diversity and abundance categorisation of the DEU baseline survey in the area. The route will be quickly recolonised by similar and new species in the peripheral vicinity. There are only very few local species sensitive to suspended sediment settlement impacts in the area, and as such the impact of the trenching activities is likely to have been insignificant.

The operation of the new outfall will provide considerable benefits to the ecology of the area. The significant improvements in water quality will enhance the quality and health of shellfish, crustaceans and fin fish in the discharge area.

Construction machinery may cause noise during the construction process. Since current ambient noise levels in the area are low, this would have an adverse impact on those few properties near the site but fortunately none are present. To protect site staff, measures will be taken to ensure that noise levels do not exceed the limits laid down in the Workers Health and Work Safety Regulations. If the limits are reached, then ear defenders will be distributed to all staff. Operational noise levels will not be significant.
After the commissioning of the treatment plant, there may be occasional odour emissions. The odour will become more noticeable during high summer temperatures. However, odour is not considered a very significant problem because the site is situated in an isolated upland area exposed to the prevailing winds and far from residential areas.

After the construction of the treatment plant, insects and flies may be seen in and around the plant. Again, any nuisance will be localised and of low significance given the distance from residential areas.

There is potential for the generation of dust emissions during the construction period. It should be possible to minimise them by adopting a number of control measures.

The treatment plant is not envisaged to have any significant effect on land use. The adjacent land is not used for agriculture and is expected to remain undeveloped. The works will generate between 20 and 30 jobs for local people during the construction period.

Sludge will not be produced in Phase 1. Screenings and grit will not be stored on site but removed automatically from the plant, bagged and promptly transferred to the Municipal landfill site. No significant adverse impacts should result from this solid waste.

Construction and operation of the wastewater treatment plant will have no impacts on geology, climate, topography, future developments, archaeology or the cultural environment.

Possible future works carried out in Phase 2 of the Project would have limited potential for significant adverse environmental impact. Phase 2 would probably involve upgrading the works to include primary and possibly also secondary treatment which would improve the quality of the discharged effluent although the volume would be increasing steadily over time. The level of treatment would be specified to ensure continued compliance with water quality standards and continued protection of key environmental uses. Sludge would however be produced in Phase 2, and would be thickened and dewatered on site and then removed for disposal, probably at the new sanitary landfill site. The impacts of Phase 2 would be assessed in detail at the time and any EIAs required by Turkish legislation carried out.

If the strength of the raw wastewater in the early years is higher than anticipated, consideration may be given to the construction of some temporary anaerobic lagoons at the site. These would be incorporated or replaced if, or when, primary or secondary treatment is required.

5.1.2 Wastewater Collection Systems

The other elements of the proposed improvements to, and expansion of, the wastewater collection systems in Çeşme and Alaçatı have limited potential for adverse impacts. Construction of area pumping stations and secondary sewers will have temporary localised impacts such as noise, dust and disruption of traffic and pedestrians. This work would however, be restricted mainly to the winter season. The works may generate up to 200 jobs for local people during the construction period.
5.1.3 Şantiye District Wastewater System

The immediate improvements which are proposed to the existing Şantiye wastewater collection system will have very limited adverse impact. Refurbishment works at pumping stations may have minor noise impacts and cause some disturbance to nearby residents. The works will lead to significant local improvements in the sewerage service with the effective removal of the existing summer overflow occurrences from the pumping stations into residential areas and the Ilica Beach.

Construction of a new discharge tank and infiltration field on İstanbul Hill will cause localised noise impacts but there are no properties nearby. The tank will not have a long term visual impact. Overall the work will lead to an improvement in environmental conditions at İstanbul Hill and in the waters of Şifne Bay. The protection of the pumping main to the tank will also ensure against accidental cross-contamination of the water supply line from Ildır in the short term.

5.1.4 Impact of Retention Time and the Generation of Hydrogen Sulphide on the Sewerage System

The major cause of sewer corrosion is hydrogen sulphide (H₂S), or, more correctly, the sulphuric acid formed from H₂S on moist surfaces. Sulphides are formed under anaerobic conditions by the action of certain bacteria on sulphates and certain amino acids. When the system becomes aerobic again, the H₂S is converted to sulphuric acid by bacteria. The above describes the classic case of a rising main which discharges into a gravity sewer. However, sulphide can also be produced in the slime layer of gravity sewers. Sewage rarely becomes anaerobic in gravity systems because the flow is sufficiently turbulent to ensure that it is adequately aerated.

H₂S, a gas of only moderate solubility, can escape into the sewer atmosphere and the rate of escape will be greatest where excessive turbulence occurs, for example in wet wells, backdrops, manholes and gravity sewers. The unpleasant odour characteristics of sulphur is well known and the odour threshold concentration is very low, between 0.1 and 1 ng/l. The smell of H₂S is made worse by the presence of other malodorous sulphur compounds particularly mercaptans which are also formed in sewage under anaerobic conditions.

H₂S gas is potentially dangerous because it is toxic and the ability to detect it by smell is quickly lost as the concentration increases. Unconsciousness followed by death can occur suddenly from concentrations of approximately 300 ppm by volume in air.

The factors which influence the production of sulphides are:-

- Retention time. In a rising main, 10 minutes is usually long enough to give truly anaerobic conditions. The longer the time under anaerobic conditions, the greater the potential for sulphide production.

- B.O.D. The higher the B.O.D. the greater the sulphide production potential. The same applies to C.O.D.
- Sulphate concentration.
- Temperature. A 10°C rise in temperature can double the sulphide production.
- Wetted surface area. This relates to the slime layer where most of the sulphide is produced.

The system in Çeşme has a high potential for the generation of H₂S due to the long pumping mains, the high temperatures and the large variation in flows between summer and winter. There is a 16 times variation in flow between the 2000 winter DWF and the 2020 summer peak flow. The extent of the variation leads to a compromise between retention times, minimum velocities and pumping heads at peak flows.

Mitigating measures adopted at this stage is the phased construction of the pumping main from TM2 to TM6. This has been sized for flows up to 2010 when a second larger main will be required. The two mains will operate jointly in the summer and the smaller one only in the winter thereafter. No allowance has been made at this stage for chemical addition to prevent the formation of sulphides. At the detailed design stage, particular attention will be paid to the prevention of turbulence at discharges and to the ventilation to keep the chamber walls dry and hence prevent the formation of sulphuric acid forming bacteria. An emphasis has been placed on the construction of network sewers in the phasing of expenditure, within the affordable limits, to give as rapid an increase in flow as possible and hence reduce the retention times.

5.2 Impacts of Water Supply System

The assessment of groundwater potential has been based on records of test wells carried out over many years by İller Bank and DSİ. There has been no detailed hydrogeological study carried out covering the aquifers, particularly in the karstic limestones from which the main Ildir Springs develop.

The extent of the hydrogeological boundaries is unknown, particularly in relation to the known aquifers of the Sarpdere basin to the south and the Balikhova basin in the north. It is known that these basins are connected to the Ildir aquifers and details of them are essential to determine the total available yields from all these sources.

As has been stated previously, it is not possible to predict the impacts of the aquifer protection works or the revised arrangements of the boreholes on groundwater levels. The purpose of the hydrogeological study which includes the test grouting, exploratory boreholes and test pumping, is to optimise the design of the protective measures and the revised location of the boreholes to ensure the required quantities can be abstracted whilst meeting the specified water quality standards.

The proposed aquifer protection works at Ildir will alter patterns of groundwater flow in the area, with the intended effect of preventing flow of saline water into the aquifer. Before the works are designed, the aquifer will be studied in detail. There may be a consequential impact on marine water quality, through increased salinity. This would require careful
assessment as it may have consequential impacts on the biota of the area. There may also be a number of construction phase disturbance impacts, depending on the nature of the engineering activities. Current data is not sufficient to assess any of these impacts at this stage.

As the works for aquifer protection and relocation of wells will be carried out in the vicinity of archaeological sites, care must be taken with all excavation works to avoid any potential damage to buried structures.

Construction of extensions to the water supply could have temporary localised impacts such as noise, dust and disruption of traffic. This work would, however be restricted to the winter season and since the main network has already been installed will be of limited magnitude and significance.

The construction of the water treatment plant and pumping station, on the dedicated site below the Alaçatı Dam, will have an impact during construction but these will be similar to those currently experienced during the construction of the dam. As the plant will be seen from the İzmir motorway the design should take into account landscaping to minimise visual impacts.

5.3 Impacts of Solid Waste System

5.3.1 Sanitary Landfill Site

The proposed sanitary landfill will be designed incorporating a number of measures to minimise environmental risk, such as:-

- leachate collection, treatment and disposal;
- passive landfill gas ventilation and dispersion;
- lining the site;
- working in cells with daily cover applied; and
- phased restoration.

The selected site is an isolated valley, at least 2km distant from any residential area; which is not particularly suitable for agriculture and has few trees. (See Photograph 13.4 in Section 6).

Construction of the landfill site will result in some loss of soils, although both their depth and quality are poor at the chosen site. Restoration of the site will require the importation of suitable topsoil.

The access road to the Çeşme-Alaçatı Sanitary Landfill Site is a straight, asphalted road until the point where it intersects the underpass of the highway. After this connection, the road leading to Alaçatı is a stabilised road.

The part of the road up to the underpass is open to traffic between Çeşme and Alaçatı. However, the remaining part up to the landfill site is an unused pathway, since there are no
settlements in the surrounding. After the sanitary landfill starts to operate, this road will be improved.

Surface waters will be intercepted at the boundaries of the site and contact with waste avoided. The landfill will be designed to minimise leachate volumes and excess leachate will initially be removed by tanker for disposal into an appropriate manhole on the new sewerage system. If the quantities merit it in future, on-site treatment will be installed. There should be no significant adverse impact on surface waters.

The site is not located in a groundwater protection zone and there are no known abstractions within a 2km radius. Nevertheless the underlying ground, where no groundwater appears up to 50 metres below ground level, will be protected by clay liner and an HDPE liner (which will have a maximum acceptable permeability of $10^{-9}$ m/s).

The topography of the immediate area will be altered by the landfill operations, which will gradually fill an area which is currently a broad valley. The altered landform will not be visible from any residential areas.

The landfill will inevitably have adverse local visual and landscape impacts. Filling the site in cells, covering the waste daily, and providing phased restoration will reduce this impact. There is the potential for windblown litter if not properly controlled. The significance of these aspects is reduced by the lack of nearby receptors.

An area of ecological habitat will be lost to the site, which was recently removed from a 2nd Degree Natural Protection Zone. Some olive trees will have to be removed. It is difficult to assess the impact on ecology in the absence of detailed field surveys, however, it will probably be of local significance only. The phased restoration of the site will, however, offer the opportunity for habitat creation.

Noise impacts will be restricted to site workers, who will be issued with ear defenders if necessary to ensure that noise levels do not exceed the limits laid down in the Workers Health and Work Safety Regulations.

To prevent possible odour emissions, wastes in the landfill will be compacted and covered with at least 15cm depth of daily cover. Landfill gas will be ventilated passively. In future, it may be extracted actively from the site and burnt in an enclosed flare. Modern flares are highly effective at destroying Volatile Organic Compounds (VOCs) which, if not controlled, can lead to unpleasant odours. The proposed gas control system will also minimise explosion risk. Although vermin and insect risk is low, pesticides will be applied if any problems arise.

The site has the potential for considerable amounts of dust to be produced during the excavation and construction works and the operation of the landfill. Although there are no residential properties within 2km of the site, dust mitigation measures will need to be adopted.

The landfill site would constitute a temporary change in land use, but this is not considered
incompatible with the locality. A number of local jobs would be created in construction and operation of the site, however this should be offset against those few jobs presently associated with the existing landfill site which would be closed.

Contrary to open dumps, fires in waste cells of the landfill are uncommon, as the gas generated is collected and vented with a passive system and, in addition, wastes are covered with a layer of soil daily. However, in case of fire, a tanker and a bulldozer will be used to control the fire and the surface water collection channel surrounding the site and the control road will decrease the risk of fire spreading.

5.3.2 Rehabilitation of Existing Dump Sites

Once the new sanitary landfill site is operational, the existing dump site in Çeşme will be rehabilitated. This procedure will involve a number of measures including the provision of:

- surface water drainage;
- leachate drainage;
- gas venting;
- slope stability measures; and
- final cover.

The site will be landscaped to blend into the existing environment.

The abandoned dump site, adjacent to Alaçati Dam, should also be investigated to determine the extent of any ground and groundwater contamination. The waste mass has recently been removed and replaced and the area suitably landscaped.

5.4 Summary of Impacts and Benefits

The completion of the sewerage networks in Çeşme and Alaçati, the construction of preliminary wastewater treatment works, and the disposal of the effluent by sea outfall will have significant positive impacts and aesthetics at locations where raw sewage is currently discharged. There should, over time, be consequential benefits for tourism and public health.

There will be a number of short-term construction phase impacts (noise, dust, traffic, visual intrusion) and commissioning of the new sea outfall may have a localised adverse impact on marine ecology. These will be more than offset by the benefits of the Project.

The aquifer protection works and other improvement works to the water supply sources and network will result in improved groundwater quality and management and conservation of groundwater resources. The proposed works at Ildir do, however, have the potential for a number of adverse impacts (marine, archaeological, noise and vibration), which must be addressed as the nature of work required is finalised.

Provision of a sanitary landfill site will significantly reduce the environmental impact of solid waste disposal in the area, however, a number of minor adverse impacts will be inevitable. There is significant scope for effective mitigation of all these issues.
6.0 ANALYSIS OF ALTERNATIVES TO THE PROPOSED PROJECT

6.1 The Do-Nothing Option

The do-nothing option for Çeşme and Alaçatı would mean that only the present programme of İller Bank funded works would continue. This work has proceeded very slowly in the past and there is no reason to believe that the future would be any different.

In terms of wastewater, there would be continued slow implementation of the İller Bank sewerage and sewage treatment scheme, with eventual provision of two Municipal plants providing a level of treatment which this Study has concluded to be unnecessary at present under current Turkish legislation. In addition, there is concern over the operating efficiency of some parts of the sewer network under the reduced flows that are expected, at least in the short term.

The slower implementation of a piped sewerage network would result in delayed replacement of the existing septic tanks and the continuation of the problems of septic tank waste disposal and groundwater and marine contamination. Conditions at İstanbul Hill and in the Şanlıye area would also further deteriorate, the latter potentially adversely effecting tourism. Health risks, through possible contamination of water supplies, will remain.

The key problems associated with the water supply arrangements for the Municipalities would continue. In particular the water quality of the İldir source would further deteriorate as the saline intrusion becomes more widespread. In the medium term the area would probably experience supply problems due to not being able to maximise the potential of the İldir source. The current level of leakage from the system would continue.

Solid waste collection and disposal would continue as at present with gradual worsening of the current environmental impacts particularly in the summer. The continued use of the Çeşme landfill would sustain the health and groundwater risks and environmental impacts associated with an essentially uncontrolled site. In the urban areas the waste collection problems experienced during the peak summer months would steadily worsen.

6.2 Alternative Wastewater Collection and Treatment Options

During the Study period, several treatment options for wastewater collection, treatment and disposal were assessed and three main options defined:

Option 1: Generally as the İller Bank design with two separate sewage treatment plants, but modified to suit the revised flows from the latest agreed population projections. Refer to Drawing No. ATK/CES/FR/06.

Option 2: A single treatment works at Çeşme to serve both Municipalities.

Option 3: A single treatment works at Alaçatı to serve both Municipalities.

Within the framework of these options, four possible sites for the Çeşme treatment plant
were assessed together with the previously defined site for the Alaçatı plant. Two levels of treatment were also considered.

**Level 1:** Preliminary treatment only to 2020.

**Level 2:** Preliminary treatment to 2010 then full treatment to 2020.

**Option 3** was subsequently recommended and is discussed in Section 3.

### 6.2.1 Option 1 - Two Separate Collection and Treatment Systems

This option would retain the İller Bank scheme presently under construction and involve the use of two separate collection, treatment and marine disposal outfalls for Çeşme and Alaçatı.

This option was rejected for the following reasons:-

- Although the cost of this Option is the lowest when a preliminary standard of treatment is retained until the year 2020, if a higher standard of treatment is required at some future date then this option becomes the most expensive in terms of both capital and NPV costs.

- There are expected to be greater operation and maintenance problems when operating two separate systems due to the splitting of what is already considered to be a very low wastewater flow, particularly in the early years.

- The construction of a treatment plant in the valley south of Çeşme would result in the use of some of the only remaining good agricultural land in the area.

- This option would result in the discharge to the marine environment at two locations on the south coast, with the Çeşme outfall discharging from one of the most popular beaches at Altinkum.

### 6.2.2 Option 2 - One Combined System with a Treatment Plant at Çeşme

This option would transfer all wastewater from Alaçatı to Çeşme and utilise a single treatment plant and outfall.

This option was rejected for the following reasons:-

- The cost of this option was the highest in both capital and NPV cost, for both preliminary and full treatment cases.

- As in Option 1, it would require the siting of the treatment plant and acquisition of land in the agricultural valley south of Çeşme.
To provide sufficient flow capacity until the year 2020, the existing outfall would need to be duplicated in the future.

6.2.3 Alternative Levels of Treatment

The İller Bank scheme (Option 1), which has been partially constructed, provides for full secondary treatment at both Çeşme and Alaçatı treatment plants. Following a review of the initial dilution and dispersion characteristics of the outfalls constructed under the İller Bank scheme, it was concluded that the water quality standards in terms of Total Coliforms, will be met with only preliminary treatment. Compliance with the B.O.D. and C.O.D. standards in the Turkish Regulations may be borderline; however, representative sewage samples are not yet available and therefore an expedient solution has been adopted, within the affordable financial constraints, to place the emphasis of expenditure on the network sewers to lead to a rapid increase in flows as possible. This is required to alleviate the potential for septicity in the system leading to corrosion and odour problems.

Following monitoring during Phase 1, consideration could be given to the construction of temporary anaerobic lagoons to reduce the strength of the wastewater. This impact on the marine environment of domestic sewage at strengths exceeding the Turkish Regulations is not considered significant in relation to the potential problems within the sewerage system if the available expenditure was diverted to the construction of at least a primary treatment works.

The option of treating the wastewater to a standard which would permit beneficial effluent reuse was also considered. To meet Turkish and World Health Organisation standards, disinfection would be required as well as secondary (and possibly also tertiary) treatment. This option has been rejected for Phase 1 on economic grounds, but should be reviewed in the future, particularly if secondary treatment is provided.

6.2.4 Temporary Treatment of Septic Tank Waste

To eliminate the current discharge of septic tank waste from tankers at numerous sites around the peninsula, a scheme was considered to construct centres for the treatment and disposal of these wastes. Two reception and treatment centres were proposed to reduce tanker travel times. Because this would only be a temporary solution, until the sewerage network and wastewater treatment plants were commissioned, only low cost technical solutions were considered.

This option was rejected on grounds of potentially unacceptable environmental impact (particularly groundwater pollution, odour, noise and disturbance from tanker traffic) and cost. The overall environmental improvement on the existing situation, while significant, would be difficult to justify economically as a temporary measure.
6.2.5 Alternative Sites for Çeşme Wastewater Treatment Plant

The locations available for the Çeşme wastewater treatment plant were limited by the fact that the main sewer and outfall had already been constructed. Four options were considered: Site 1, which was the site selected by İller Bank; Site 2, to the north west of Site 1; and Sites 3 and 4 to the south west of Site 1. Refer to Drawing No. ATK/CES/TR/06.

Site 1 is situated to the northwest of the village of Ovacık, on the saddle of the valley at the highest point near the pumping main between Çeşme and the sea outfall. The area is good agricultural land, the loss of which was considered an unacceptable environmental and economic impact. See Photograph 6.4.

Site 2 is 400 m northwest of Site 1, to the south of Çeşme Karadağ and to the north of the area where excavated material from the construction of the İzmir motorway has been dumped. It is on a lower level than the site proposed by the İller Bank. Most of this land is privately owned and used for agriculture. It is within a 1st Degree Natural Protection Area and close to the new motorway. It was rejected on the grounds of potential acquisition difficulties, loss of agricultural land and pumping requirements to the outfall due to its lower elevation.

Site 3 is 700 m southwest of Site 1 on higher, uncultivated and mainly private ground. Part of the site may lie within the 1st Degree Natural Protection Area. As the area is at an elevation of about 80 m ASL, an intermediate pumping station would be required. The site was rejected on the grounds of potential acquisition difficulties and cost due to additional pumping.

Site 4 is 500 m south west of Site 1 and close to Site 3 but at a lower elevation. The land is partially owned by the Treasury, is uncultivated and lies outside the Protection Zone. It was therefore considered as the best alternative to Site 1 for the location of a treatment plant.

6.2.6 Alternative Sites for Alaçatı Treatment Plant

As with Çeşme, the locations available for the Alaçatı wastewater treatment plant were limited by the fact that the main sewer and outfall had already been constructed. In this case, it is understood that the site has already been acquired by the Alaçatı Municipality so, as no major constraints to the site were identified, no alternatives were considered. See Photograph 6.5.

6.2.7 Alternative Treatment Processes

Although the secondary treatment plant is not expected to be built until some time in the future, alternative forms of treatment were considered to the conventional activated sludge process presently under design by İller Bank. Waste stabilisation ponds and oxidation ditches were also reviewed.

Although more economical to operate, stabilisation ponds had a large land-take and were
therefore not pursued due to the general limitations on the site, which is in a 1st Degree Natural Protection Zone. Smaller anaerobic lagoons were considered as a possible temporary solution, should the wastewater prove to be stronger than anticipated and require some treatment prior to discharge.

Oxidation ditches would be an acceptable alternative to conventional activated sludge, but a financial analysis indicated that they could be slightly more expensive. Should secondary treatment be required in future, it is recommended that both conventional activated sludge and oxidation ditches be considered in the light of economics and technology advances at that time.

6.3 Alternative Water Supply Options

Options for alternative water supplies are extremely limited since capital investment has already taken place at the Ildır Springs and the Alaçatı Dam. The only alternative to aquifer protection work at Ildır would be to decrease the volume of water abstracted. This is not a viable alternative in the short term since the current lack of a treatment plant at the Alaçatı Dam restricts the value of this supply as an alternative.

6.4 Alternative Solid Waste Options

6.4.1 Alternative Treatment and Disposal Methods

Those alternative solid waste treatment/disposal methods considered as part of the Study were:-

- recycling;
- composting;
- sanitary landfill; and
- incineration.

Recycling can only ever be achieved for a proportion of the waste stream, and one or more disposal routes is still required for the non-recyclable waste component. Problems with this option would be the general lack of awareness, and the low proportion of suitable commercial waste in the area (for which recycling is more feasible). The cost of recycling is 10-20 US$/t depending on operation modus. It has been proposed to set up a pilot recycling project in Çeşme-Alaçatı to assess the long term potential for developing recycling as a significant means of waste management in the area.

Composting relies on the biological decomposition of organic wastes. The product obtained as compost is rich in humus and other nutrients and hygienically safe. Compost can play an important role in increasing soil fertility. The cost of composting technique is 30-50 US$/t depending on the composting process. The proportion of domestic waste in the area which is suitable for composting has been estimated at approximately 40%. Given the lack of local experience and information and the fact that an alternative disposal method would still be required for the inorganic waste component, it has been proposed to limit composting to a pilot plant to assess the long term potential for developing it as a significant
means of waste management in Çeşme-Alaçatı.

Incineration has the advantages of reduction of waste volume and the potential for energy recovery. Its disadvantages include high operating costs and concerns over atmospheric emissions. Incineration is the most expensive method among the others and its cost is 50-100 US$/t. Public perception of incinerators is also poor and it might be considered an unsuitable option for an area dominated by tourism. Incineration was rejected for these reasons and also because the calorific value of waste in the area is not sufficiently high in the winter due to the high proportion of ash present.

6.4.2 Alternative Landfill Sites

Alternative locations for the sanitary landfill proposed for the Project are summarised in Table 6.1

Table 6.1 Options for Sanitary Landfill Site

<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A, B</td>
<td>East of Ovacik Village</td>
</tr>
<tr>
<td>2 A, B, C</td>
<td>South-east of Ovacik Village</td>
</tr>
<tr>
<td>3 A, B, C</td>
<td>East of Germiyan Village</td>
</tr>
<tr>
<td>4</td>
<td>Zeytinli</td>
</tr>
</tbody>
</table>

The site of the existing solid waste dump at Çeşme was rejected as a possible site for the sanitary landfill because of limited capacity and proximity to a drinking water well, agricultural land and residential areas.

An important criterion in the evaluation of the landfill site options was the potential capacity of the candidate sites. A capacity of 800,000m³ is estimated to be required to the year 2020.

Site 1: East of Ovacik Village

The location of this site is 5 km from Çeşme and 3 km from Alaçatı, and the site is composed of two cells, west (1A) and east (1B). The site is reached by the road which accesses the current landfill site to the south of Çeşme, which is hilly and very steep for the last 2km. The nearest residence to the site is Ovacik village, 2km to the west. There is a
Both Sites 1A and 1B are in a drainage basin and connected to the Payam stream. This dry stream is connected to a dry creek bed and flows to the south-west to the sea. Both sites comprise valleys surrounded by hills on 3 sides. Municipality staff have stated that the site ownership is part public part private. Flat areas in the valleys are used for agricultural purposes, and other parts of the site are covered with bushes. The site is not situated in a protection zone relating to groundwater, surface water or catchment areas. However, the site is in a 2nd Degree Natural Protection Zone.

Sites 1A and 1B were rejected because of doubts on whether either had adequate capacity.

**Site 2: South-east of Ovacik Village**

Sites 2A, 2B and 2C are located 11 km from Cesme and 7 km from Alacati, and are reached from Cesme via Ovacik and directly from Alacati by a track which crosses under the new Izmir motorway. The sites are all valleys between low hills. There is no residential area within 1 km of the site. See Photographs 13.3 and 13.4.

Surface water was observed flowing on Site 2C during precipitation. There are DSİ water abstraction wells 2km north and 2.5km north-east of the site. A dry creek connecting to Kabagalek Creek begins on the western edge of Site 2A. This branch is connected to Buyukdere stream and flows west to the sea. The eastern side of Site 2B is connected to the dry bed of the Alanck stream.

Sites 2A and 2C are partially privately owned. Site 2B is publicly owned. The flatter parts of Site 2A are used for agriculture, Site 2B is generally barren land and is used for occasional grazing of sheep. Site 2C is presently scrub. The sites are not situated in a protection zone relating to groundwater, surface water or catchment areas. Sites 2A and 2C however remain in a 2nd Degree Natural Protection Zone.

Site 2B was selected as the optimum site for the sanitary landfill due its topography and its isolated and self-contained location. Sites 2A and 2C were rejected because 2A would entail a significant loss of agricultural land and 2C has insufficient capacity for the predicted waste volumes. Both 2A and 2C are also in locations exposed to view from the motorway.

**Site 3: East of Germiyan Village**

The location of the Sites 3A, 3B and 3C is 18 km from Cesme and 10 km from Alacati. The sites are all located in valleys. Site 3A is accessed most of the way by the asphalted Alacati-Germiyan road; Site 3B is reached by a poor quality track and Site C is 1 km to the east. There is no residence within 1 km of the site and no groundwater abstractions near the site. The three sites all have typical valley characteristics.

Sites 3A and 3B are currently barren land, and Site 3C is used for agriculture. The former two are believed to be publicly owned and the latter to be in private ownership. The sites are situated on the border the 4th Degree Protection Zone of the Alacati reservoir, and are
also within a 1st Degree Natural Protection Zone.

It is believed that Sites 3A and 3B do not have the required capacity. Given the agricultural usage of Site 3C and its location in the Alaçatı Reservoir Protection Zone, Site 3C has also been rejected.

Site 4: Zeytinli

Site 4, proposed as a possible regional solution for 12 municipalities including Çeşme, Alaçatı and Urla, is situated 5 km south of Uzunkuyu and 2 km east of Zeytinli Village. However, the distance of the site from Çeşme and Alaçatı would exceed 30 km and it is located in a 1st Degree Natural Protection Zone. Site 4 was therefore rejected.

6.4.3 Transfer Station Option

The use of transfer stations was considered as part of the solid waste disposal system, in order to increase the efficiency of the collection and transportation systems in the summer. Three transfer stations were considered to be built in Çeşme and Alaçatı in three phases, with one built in Phase 1 and the other two added in the Phase 2. (Refer to Drawing No. ATK/CES/FR/09).

The proposed transfer station sites had not been finalised, but the initial Transfer Station will probably have been located on high ground in the Sakızkoyun Çiftliği area to the southeast of Çeşme. This site is 300m from the existing landfill and about 2km from the centre of Çeşme.

However, during the cost analyses carried out to compare the waste collection with and without the transfer stations, it was clear that their inclusion could not be justified on economic grounds. Their use was therefore not pursued.

6.5 Costs of Alternative Options

Cost estimates have been prepared for the various options considered together with the necessary improvements to the existing systems.

Table 6.1 summarises both the total Capital costs and the Net Present Value (NPV) costs, inclusive of operational and maintenance costs to 2020 for the wastewater options. The target cost for the tariff for cost recovery is $1.0/m³.
<table>
<thead>
<tr>
<th>Option</th>
<th>Level A</th>
<th>Level B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Treatment Only</td>
<td>Staged Full Treatment *</td>
</tr>
<tr>
<td></td>
<td>Capital</td>
<td>NPV**</td>
</tr>
<tr>
<td>1</td>
<td>45,460</td>
<td>27,879</td>
</tr>
<tr>
<td>2</td>
<td>52,092</td>
<td>31,753</td>
</tr>
<tr>
<td>3</td>
<td>45,828</td>
<td>27,992</td>
</tr>
</tbody>
</table>

Notes:

(1) The capital costs are inclusive of price contingencies based on international US $ price adjustment, 10% engineering costs and 15% overall physical contingency.

(2) Operating costs are inclusive of replacement investments, energy consumption at 0.09 $/kWh, chemicals, and disposal charges. Full treatment energy costs for Level B is 50% higher due to the higher at $0.135/kWh industrial rates charged.

* Preliminary treatment until 2010 then full treatment thereafter.

** Discount rate used was 5%.

In the case of water supplies and solid waste disposal, no alternative scenarios were available.

The total proposed physical investment costs at January 1996 prices for the whole scheme based on the requirements, and including the most cost effective options, are as follows:-

- Water Supply Components: US $ 14,773,000
- Wastewater Components: US $ 47,669,000
- Solid Waste Components: US $ 11,226,000

**TOTAL** US $ 73,668,000

These total costs exclude 10% for engineering services, a 15% overall price contingency sum and price escalation contingency.

Following the analysis of Municipal affordability, the Proposed Investment Programme has a basic value of US$ 73.7 million of which approximately 22% or US$ 16.5 million is required for implementing the reduced Phase 1 Project Works.
7.0 MITIGATION AND MONITORING ACTION PLAN

7.1 Proposed Mitigation Measures

7.1.1 Alacati Wastewater Treatment Plant

Under the current design parameters, the Alacati wastewater treatment plant site will not be required to be developed until Phase 2 of the Project.

In future, if and when the development of a plant to provide preliminary or full treatment is necessary, the following mitigation measures would be required. These should be reviewed in detail at the time, but a preliminary list is as follows:

- scheduling of all work outside the summer tourist season if necessary;
- undertaking of aesthetic improvements to the outside of the facilities, including planting of trees/shrubs around the future boundary and designation of a buffer zone around the plant;
- liaison with local residents for all construction activities; and
- during construction, any site run-off should be passed through settlement ponds to minimise discharge of suspended sediments;
- any chemicals/fuels must be stored in sealed, bunded areas and all practicable measures taken to avoid any spillages;
- ensuring that screenings are promptly bagged and grit safely removed from the site.
- any wastewater produced during the construction period should be tankered to the nearest Municipality sewer for discharge;
- provide ear defenders to all construction workers if necessary;
- control dust during the construction phase by damping with water sprays or bowsers, use of wheel washes before vehicles enter public highways, restricting earth moving in windy conditions, and covering of soil stockpiles;
- restriction of construction traffic, particularly vehicles importing aggregate, to suitable routes (avoiding residential and tourist areas where possible) and normal working hours;
- adoption of similar restrictions for sludge traffic; and
- review all options for sludge reuse and undertake EIA if reuse proposed at a future date.

7.1.2 Wastewater Collection Systems

The following mitigation measures will be required to minimise the adverse impacts of the proposed completion and expansion of the wastewater collection system in the Municipalities:

- all work in urban areas to avoid summer tourist season;
- liaison with traffic police, utilities and local residents to minimise disruption from pipe-laying;
- use of well-maintained, sound suppressed equipment and acoustic screens for pipelaying were necessary in residential areas.
- installation, operation and maintenance of odour control equipment at pumping
stations where necessary;
- increase in flow as much as possible to reduce retention times;
- prevention of turbulence at discharges; and
- ventilation to keep the chamber walls dry and to prevent the formation of sulphuric acid forming bacteria.

7.1.3 Water Supply System

To minimise possible adverse impacts of the works, which are proposed to alleviate problems with the current water supply system, the following mitigation measures should be carried out:-

- liaison with officials from the Ministry of Culture and any other archaeological authorities regarding planned works at Ildir;
- extensive monitoring of extent, depths, flow patterns and quality of Ildir aquifer before designing protection works;
- control noise and vibration levels during installation of curtain wall by best practicable means;
- liaise with traffic police, utilities and local residents to minimise disruption from pipe-laying; and
- use well maintained sound suppressed equipment and acoustic screens (where necessary) for pipe-laying in residential areas.
- carry out similar mitigative measures at the Alaçatı Dam treatment works, to those listed in Section 7.1.1.

7.1.4 Solid Waste System

The proposed sanitary waste landfill is being designed to eliminate many of the impacts which can be associated with badly engineered and uncontrolled landfill sites, however the following mitigation measures should be adopted to ensure that adverse impacts are minimised:-

- erect a 3 m high litter fencing around area being filled to control wind blown litter, and remove litter from the fence daily;
- control dust by damping haul roads and stockpiles with water sprays or bowser, providing a wheel wash at the site exit, restricting earth moving in windy conditions and covering soil stockpiles;
- ensure surface water drainage system is effective by regular cleaning and maintenance of drainage channels;
- provide site workers with ear defenders if necessary;
- leachate will not be discharged untreated to surface or marine waters removed by tanker and discharged to the wastewater system in accordance with the Water Pollution Control Regulations; treatment on site should be installed when appropriate;
- landfill gas will be passively ventilated to the atmosphere. If required, in future, the gas will be actively extracted and burnt in an enclosed flare of high destruction efficiency;
as each phase of the site development is completed it will be capped, covered with topsoil and restored to open space;

- restoration plans will be approved in advance by the Municipalities;
- landscape maintenance will be carried out for at least 10 years to ensure the success of those species planted;
- daily cover and gas ventilation will minimise the risk of fire;
- use the tanker and dozer to control fire, if any;
- pesticides used to control any vermin problems will be selected to have minimal environmental impact; and
- all available topsoil to be segregated and carefully stored for use in restoration.

A sanitary landfill site may also cause an increase in the traffic on the road to the landfill. However, the access road does not pass near any inhabited areas. Another impact of collection vehicles may be damage to road surfaces, therefore improvement of the pavement or the sub-base may be needed.

7.2 Proposed Monitoring Arrangements

In order that the environmental effects of the Project are adequately controlled by the proposed mitigation measures, and to give a quantitative assessment of the level of environmental benefit resulting from Project implementation, it will be necessary for a formal Monitoring Plan to be prepared.

The objectives of the Monitoring Plan are:

- to provide a review of the baseline data;
- to indicate changing environmental conditions;
- to identify impacts of the Project as they occur;
- to identify any unforeseen aspects requiring monitoring, mitigative measures or institutional changes; and
- to make recommendations for changes to Project operation or existing mitigative measures.

Given the importance of tourism and associated bathing and water-based recreation in the area, a formalised rationale for routine water quality monitoring is needed. This should be based upon the existing bathing water monitoring programme in the area conducted by the Çeşme and Alaçatı sub-Provincial Health Departments and will provide a useful database for evaluating the levels of water quality improvement associated with the overall Project, and form the basis of an EU sampling protocol in line with the European Bathing Waters Directive. This would allow an accurate assessment of possible future compliance should Turkey join the EU and/or adopt its legislation.

Current monitoring procedures should be reviewed and amended as necessary during the detailed design stage in consultation with Provincial Directorate of the Ministry of Environment, the Public Health Department and the Municipalities. These should then be assimilated into an overall strategic Monitoring Plan for the Project which would be reviewed annually by all concerned. The Ministries of Agriculture, Forests and Tourism
should be informed of changes to the procedures and monitoring plan.

The preliminary proposals for environmental monitoring are as follows:-

- environmental monitoring to commence prior to commissioning of Project to give baseline data;
- continuous sampling at Alaçatı wastewater treatment works to enable control of the efficiency of the wastewater treatment process and to ensure effluent complies with current Turkish standards;
- at least weekly analysis of raw wastewater quality in each system entering the treatment plants;
- routine monthly monitoring of bathing water quality during the tourist season (April to October) at bathing beaches on both north and south coasts - sampling stations used in recent GKW and DEU studies and by the sub-Provincial Health Departments to be used for spatial consistency and continuity of data record;
- monitoring of marine ecology in the area to be carried out at the end of first year of operation of the outfall and then at 3 yearly intervals to monitor changes in diversity and abundance-survey scope to be an abridged version of the DEU baseline study (this monitoring will provide a key database for ongoing coastal zone management and conservation initiatives in Turkey and will contribute to furthering understanding of the marine impact of water quality improvement schemes in the region);
- regular water quality monitoring at all potable supply sources and at various points on the distribution network (with comprehensive analysis at least monthly);
- a major hydrogeological monitoring survey at Ildır before and after the aquifer protection works, covering groundwater levels, flow patterns and quality;
- at the sanitary landfill site, continuous monitoring of meteorological parameters (precipitation, temperature, wind speed and direction, evaporation and humidity);
- continuous monitoring of waste inputs to landfill site (weighing and waste analysis);
- regular monitoring of leachate, landfill gas and surface water flow rates and quality (for both open and closed parts of the site);
- regular monitoring of groundwater quality, and for presence of landfill gas, in a number of boreholes around the perimeter of the landfill site, to give an ongoing assessment of the integrity of the liner.

7.3 Implementation and Resourcing

The Monitoring Plan should be co-ordinated by the Provincial Environmental Directorate in İzmir to ensure independence. The Çeşme and Alaçatı sub-Provincial Health Departments, the representatives of the Ministry of Health, should retain their responsibility for sampling and testing of bathing waters and potable water supplies. Costs will be met from their budgets. The Municipalities, through their services delivery organisation will monitor, sample and test water supplies and wastewater regularly, and bathing water when necessary, to ensure that their options are meeting the desired criteria. All their costs will be met from their budgets. It is proposed that the Municipality organisation hire a chemist and prepare a small laboratory for daily sampling and testing purposes.
8.0 ENVIRONMENTAL MANAGEMENT AND INSTITUTIONAL REQUIREMENTS

8.1 Existing Institutions and Environmental Responsibilities

Environmental authority and responsibilities are vested with the Ministry of the Environment (MOE). MOE proposes any new legislation required, sets the environmental policies, monitors the implementation, and issues the necessary permits/licences for projects requiring EAs. At the provincial level, there are Local Environmental Councils, consisting of the provincial directors of such Central Government agencies as the Health and Agriculture Departments, the State Hydraulic Authority (DSİ), the Mayor and university and industry representatives. The Governor presides and the Provincial Environmental Directorate coordinates.

Health related issues are handled by the Health Department and commercial and industrial monitoring is carried out by the municipality. Enforcement authorised is vested with the Governor (Kaymakam). The Provincial Environment Directorate is authorized to coordinate between all public institutions with respect to pollution monitoring. In spite of their wide responsibilities, the municipalities have very limited enforcement authority. In coastal areas, the Agriculture Ministry has monitoring and enforcement authority in matters relating to water products (fish etc.), and transport related issues are handled by the newly established Marine (State) Ministry.

8.2 Recommendations for Institutional Change

Because of the existing overlaps, the authority and responsibilities are usually intermixed; clarity is required for implementation. Municipal influence is restricted to within municipal boundaries. Authority outside the municipal boundaries is vague. Where issues are of a regional character, extending beyond a province, as in the case of a drainage basin of a river, there is no regionally authorised entity.

For successful Project implementation and sustainability the Municipalities must retain responsibility for all aspects of monitoring of the services they provide and for policing all discharges to marine waters and sewerage systems within their Municipal boundaries. The sub-Provincial Health Departments should retain their responsibilities for ensuring that bathing water and drinking water standards are maintained by the Municipalities.

Sampling and testing programmes should be co-ordinated to avoid a waste of resources yet ensure an effective policing. Summaries of results should be submitted regularly to the Provincial Environmental Directorate to show compliance with regulatory standards.

As part of the Monitoring Protocol for Çeşme and Alaçatı, the testing laboratories should be equipped to carry out the necessary chemical and biological tests to ensure compliance with all regulatory standards.
8.3 Training Needs

There is a need to ensure an adequate level of understanding of technical, public health and environmental issues, as well as administrative procedures, within the concerned departments in Çeşme and Alaçatı.

It is recommended that training of all necessary staff be carried out as soon as possible in the following aspects:

- the legal and administration framework and responsibilities concerning water supplies and wastewater disposal;
- the technical procedures on the monitoring, sampling, testing and interpretation of results;
- the operation and maintenance of water and wastewater facilities to ensure compliance with Turkish (and EU) Standards and Water Pollution Control Regulations.

To ensure a smooth acceptance of the increased responsibilities within the Municipalities with respect to the Monitoring Action Plan, it is recommended that some technical assistance be provided during the first year of the Project. This training would comprise a mix of on-the-job and classroom training in Çeşme, together with selected external training courses for key staff in other well run organisations in Turkey and overseas.
Throughout the Study, meetings have been held with the Ministry of Environment and the Provincial Environmental Directorate in Izmir to seek advice on the preparation of pre-EIA and EA Reports on specific technical options on water, wastewater and solid waste issues.

All discussions and submissions to the various Environment Ministry Departments have been co-ordinated through the Ministry of Tourism.

In addition to meeting with the above organisations and the local representatives of the Ministries of Tourism and Agriculture, meetings were held by the Study Team with several NGOs, including the Small Business Association, TÜRSAB the Travel Agents' Association, the Fishermen's Co-operative and Diving Association and managers and owners of some of the larger hotels. There is no Chamber of Commerce or Hotel Association in Çeşme or Alaçatı at present.

They are 39 associations which are active in various fields in Çeşme, but only two of them are actively working in environmental, nature or animal protection issues. These are the Çeşme Beautification and Nature Protection Association and the Nature and Animal-Lovers Protection Association.

The view of senior representatives of these associations is that the local environment is being destroyed by the development of tourism and urbanisation. They believe that Çeşme’s infrastructure is insufficient and that the proposed improvements, such as the collection and treatment of wastewater, will solve many of these problems.

Informal surveys to canvas the views of residents in Çeşme and Alaçatı on environmental issues were carried out during the Study.

The Project developments were discussed with local people and the related public entities in two Citizens' Forums. The first was on July 20, 1996, after the submission of the Interim Study Report. Present were a large assembly of local participants, including winter and summer residents, representatives from both Çeşme and Alaçatı Municipalities; the Provincial Environmental Directorate, from Dokuz Eylül, Ege and İstanbul Technical Universities and from various potentially interested private sector companies.

The İller Bank, MOT and Study Team representatives described the Project’s technical institutional and financial aspects related to water, wastewater and solid waste. In addition to the Municipal comments, views were expressed by the University and Environmental Directorate participants, members of Çeşme Municipality’s Advisory Council, local business and hotel owners and the local residents. Among the various issues raised, were the degree of wastewater treatment, the fund raising mechanisms and cost and tariff levels.

The second public consultation meeting was held in Çeşme on September 13, 1996, during the World Bank pre-appraisal mission. Again attendants similar to those in the First Forum were present. A general presentation of the technical Project developments was followed by the financial requirements based on the pre-appraisal.
On September 12, 1996, a brief presentation was made to the İzmir Provincial Members of Parliament with Çeşme and Alaçatı Mayors, the MOT, the Study Team and The World Bank representatives. The legal issues were explained and political support sought for the Project implementation.

In addition, a public hearing meeting was held in February 1997 for the proposed sanitary landfill. The landfill project was presented to the participants and their views were evaluated.

Further discussions and consultations should be held during the detailed design phase of the Project.
10.0 CONCLUSIONS AND RECOMMENDATIONS

The Southwest Coast Environmental Project will significantly improve the present arrangements for wastewater, water supply and solid waste management in the Municipalities of Čeşme and Alaçatı.

Although wastewater collection and disposal, and water supply infrastructure is gradually being provided under a number of İller Bank funded schemes, the implementation is slow and continues to be restricted by funding availability. In the absence of the Southwest Coast Environmental Project, the current problems of groundwater contamination, septic tank waste disposal to land, overflows of untreated sewage to sea and environmentally damaging waste disposal practices will continue and, in many cases, worsen over time.

Following commissioning of the İller Bank water supply scheme, the situation will improve but saline intrusion at the İldır source will continue to contaminate the water supply and the problems currently associated with solid waste collection and disposal will prevail, particularly in the peak summer period.

The Project has been designed to utilise, as fully as possible, the existing infrastructure and, in Phase 1 to concentrate on high priority improvements. Future phases would upgrade the wastewater treatment level if necessary and address any need for further increasing water supply capacity.

The primary objective of the Project is to provide environmental improvements to the area and a number of significant positive effects should result:-

- reduction in contamination of groundwater (and hence the water supply) by sewage discharges, infiltration and saline intrusion;
- improvement in surface water quality at locations currently impacted by raw sewage discharges;
- improvement in sea water quality at locations currently impacted by sewage pollution;
- reduction of pollution resulting from current landfill arrangements;
- improvement in public health resulting from reduced contact with raw sewage and improved potable water quality;
- elimination of practices which have the potential to damage the tourist growth of the area.
- improvements to quality and quantity of the water supply system.

A review has been carried out of all the major infrastructure components anticipated in the recommended Project.

In assessing the most suitable schemes to recommend, environmental considerations have been an important factor. The potential adverse impacts have been analysed for a range of technical options and the most advantageous selected within the affordability of the Municipalities concerned. The potential impacts on the physical, biological (terrestrial and aquatic) and socio-cultural environments have been considered.
All infrastructure projects, however, have the potential for adverse environmental impacts which must be weighed up against the above benefits. For this Project, most of the potentially significant adverse effects have been eliminated by extensive site selection studies which have included comparative environmental appraisals of all options. The key environmental constraints of the Study Area, such as Natural and Archeological Protection Zones; high grade agricultural land; planned forested areas and sensitive residential and tourist developments have all been addressed.

The negative impacts of the Project components will generally be small and, in most cases, restricted to the construction phase. The proposed mitigation measures should reduce these to acceptable levels. Collection and treatment of wastewater from the area and discharge through one of the recently constructed outfalls on the southern coast will inevitably increase the wastewater loading in the vicinity of the outfall.

However, the current numerous raw sewage discharges to land, surface waters and coastal waters will gradually be eliminated. Whilst the new discharges to deeper coastal waters may have a local impact in terms of displaced sensitive species, the overall benefit to the environment (in terms of positive impacts elsewhere, with species reinhabitation, and species diversity and abundance improvements) will counter any localised negative impacts.

Modelling has been carried out for both outfalls and demonstrates that the Turkish National standards should be met. Furthermore, a comprehensive monitoring programme has been proposed which will provide a temporal record of environmental quality which will assist in defining future treatment standards.

While the proposed aquifer protection works at Ildir should bring significant benefits in terms of a secure, uncontaminated water supply, the potential hydrogeological, hydrological and ecological effects of the works should be assessed in detail as part of the programme in dealing with proceeding with this element of the Project.

Every effort has been made to discuss and obtain the views of the Government and NGOs. Procedures have been followed to ensure that no unavoidable delays occur in obtaining approvals from the necessary authorities to enable the Project to proceed.

The overall conclusion of the environmental assessment is that the Southwest Coast Environmental Project should proceed as a matter of urgency. With the adoption of the proposed mitigation and monitoring plans, the Project should not have any significant adverse impacts.
11.0 LIST OF REFERENCES AND BIBLIOGRAPHY

1. - Contract for Consultancy Services between Ministry of Tourism and Acer Consultants Ltd dated August 1995.


13. - Çeşme and Alaçatı 1994/95 Annual Reports.


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APPENDICES

A. Assessment Preparers

This Environmental Assessment Report has been prepared by members of the Consultant's Study Team, both Turkish and expatriate. Specialists in environmental assessment from within the Consultant's firm and support organisations have been involved throughout the preparation and Study period in both home office and field investigations.

B. Records of Inter - Agency and Public / NGO Communications

All formal documentation and submissions to the Environment Ministry have been conducted through the Ministry of Tourism in Ankara. Documents and correspondence are available within their files.

Communications with the public and NGOs have to date been of an informal nature during the Feasibility Study stage of the Project. As such no formal records of meetings have been disseminated by the Consultant. However, records of the Citizens' Forum Meeting held on 20 July 1996 were published by Çeşme Municipality (refer to Section 11 Reference No. 33).

The minutes of the public hearing meeting for the proposed sanitary landfill were prepared by the Ministry of Environment.

The results of the informal public survey on environmental issues conducted by the Consultant have been submitted in the Appendices to the Study Main Report.

C. Data and Unpublished Reference Documents

All references made have been to published data and reference documents.