1.2 ADMINISTRATIVE FRAMEWORK TABLE

Key environmental functions within the EIA procedure	Governmental Institutions	Local Self Government
Notification	*MOEPP* *-Environmental Administration Unit*	
Access of the public to the environmental impact assessment documents and information	*MOEPP publishes the notification*	
Screening	*MOEPP* *-Environmental Administration Unit*	
Access of the public to the environmental impact assessment documents and information	*MOEPP publishes the decision for screening*	
Scoping	*MOEPP* *-Environmental Administration Unit* + *List of Experts*	*Bodies of the state administration, bodies of the municipality and of the City of Skopje and of the municipalities of the City of Skopje give information relevant to the development of the study*
Access of the public of the EIA Study	*MOEPP publishes the study and the non technical report of the study*	*The Mayor of the Municipality, of the City of Skopje and of the municipalities of the City of Skopje may give their opinion about the study.* *Consultation for the non technical report of the study*
Reviewing of the EIA Study	*MOEPP* + *List of Experts*	
Public Hearing for the Study, and access of the public to the environmental impact assessment documents and information	*MOEPP organizes the public hearing and publishes the adequacy report for the study*	*The report is submitted to the bodies of the municipality, of the City of Skopje and of the municipalities of the City of Skopje on the territory of which the project would be implemented*
Decision making and consent	*MOEPP issues and publishes the decision*	
Monitoring and Mitigation	*MOEPP* *-Environmental Administration Unit*	
Transboundary issues	*MOEPP and MOFA*	

Key environmental functions within Water management[1]	Governmental Institutions	Local Self Government
Defining the boundaries of the river basin districts Adoption of the National Strategy for Waters at the proposal of the Government Adoption of the Water Master Plan upon the proposal by the Government	*The Assembly*	
Granting the concession seen as economic activities involving use of water from surface and ground water bodies	*The Governmentof R. of Macedonia*	
Adoption of the approved River Basin Management Plans		
Adoption of a programme for measures for each River Basin District		
Preparation of the programme of measures		
Determination of quality and suitability of water for use for various purposes		
Establishment water protection zones		
Coordination of the plans for the management of international river basin district and the programmes of measures with the competent authorities of neighbouring states	*State Administrative Body for Water Management* *(According the Governmental Decision dated April 2007 the responsible body is the MoEPP starting from December 2009)*	
Limit water use due to safety, conservation and protection of available water resources and preservation and improvement of natural balance of water ecosystems and water dependent ecosystems		
Limit the use of ground waters in case it is ascertained that the groundwater reserves used to meet the needs of public water supply have been or will be exhausted		
Development of the National Strategy for waters and the River Basin Management Plans		

[1] On the Government Session held in April 2007, the Government passed a decision that the competency for water management will be given to the MoEPP. The transitional period for transferring the competencies from the MAFWE to the MoEPP is until December 2009, as of when the competencies for water resource management and related institutional set up will be in the MoEPP

Key environmental functions within Water management[1]	Governmental Institutions	Local Self Government
Prescribing the detailed content and the method of development of the river basin management plans		
Once in three years inform the Government on the implementation of the River Basin Management Plans		
Annual reporting to the Government on implementation of the Programme		
Adoption of a programme for protection from adverse effects of waters within each river basin		
Adoption of a Monitoring Programme		
Performing all monitoring of water bodies within state monitoring network		
Implementation, operation, maintenance & development of state water monitoring network		
Management of river basin district	*Ministry of Environment and Physical Planning*	
Establishment of international river basin districts with the relevant neighbouring states for river basins which extend beyond the territory of R.M	*Ministry of Foreign Affairs and Ministry of Environment and Physical Planning*	
Perform all monitoring of the water bodies within the local water monitoring network and is responsible for the implementation, operation, maintenance and development of the local water monitoring network.		*Municipalities and the City of Skopje*

Key environmental functions within Waste Water management	Governmental Institutions	Local Self Government
Carrying out the procedure for the issuance of the permit for discharging into waters	*The Ministry of Environment and Physical Planning- Administration of Water Management*	
Publication of application and public participation in the permit issuance procedure	*The Ministry of Environment and Physical Planning- provides to the public, access to the information needed for shaping of the opinions and attitudes*	*The Mayor of the municipalities and of City of Skopje submits to the MOEPP, an opinion regarding the application*
Public Hearing for the application		*The Mayor of the municipalities and of City of Skopje regarding the application, may organize a public hearing regarding the application*
Issuance of the permit for discharging into waters	*The Ministry of Environment and Physical Planning*	
Carrying out a water resource management acceptance of the water management structures and facilities and issuing to the holder of the permit a confirmation of the water resource management acceptance of the structures and facilities	*The Ministry of Environment and Physical Planning- a Commission established by the Minister of the MOEPP*	
Issuing a decision on putting the permit under temporary compulsory management	*The Ministry of Environment and Physical Planning*	
Management of the Cadastre of Environment and the Register of Pollutants and Polluters	*The Ministry of Environment and Physical Planning*	
Utility infrastructure, covering the issues of wastewater treatment and water supply	*Ministry of Transport and Communications*	
Collection, removal and treatment of waste waters originating in a local area, and collection and treatment prior to discharge		*The Municipalities and City of Skopje*
Providing a wastewater collection and treatment system for all agglomerations (centres of population) greater than 2,000 p.e., and meeting quality targets	*The Government*	*The Municipalities and City of Skopje*
Adoption of a programme for wastewater collection and treatment system for all agglomerations (centres of population) greater than 2,000 p.e.	*The Government at a proposal of the MOEPP, in agreement with the Ministry for transport and communications*	*The council of the municipality and of the City of Skopje give programme proposals*
Pre-treatment of Commercial and Industrial Waste Water	*The Minister managing the MOEPP, in agreement with the Minister managing the MOTC*	*The mayor of the municipality, and of the City of Skopje*
Issuance of the permit for re-use of Treated Municipal Waste Water	*The Ministry of Environment and Physical Planning*	

Key environmental functions within Waste Water management	Governmental Institutions	Local Self Government
Water management works approval	*The Ministry of Environment and Physical Planning*	
Carrying out water management services and waste water management services		*Public or private entities founded by the competent authorities of the Republic of Macedonia or by the council of the municipalities or of the City of Skopje*
Setting the limit values for emissions into the water bodies	*The Ministry of Environment and Physical Planning*	

Key environmental functions within establishing of Protection zones	Governmental Institutions	Local Self Government
Proclamation of protected, sensitive and vulnerable zones	*The Government* *The Minister managing the MOEPP and the Minister managing the MOH give proposals*	
Management of protection zones	*The Ministry of Environment and Physical Planning*	

Key environmental functions within Expropriation	Governmental Institutions	Local Self Government
Receiving of the proposal for expropriation	*The Administration for property affairs (authority for expropriation)*	
Organising a hearing regarding the request for expropriation	*The Administration for property affairs (authority for expropriation)*	
Issuance of a decision for accepting or rejecting the request for expropriation	*The Administration for property affairs (authority for expropriation)*	

Key environmental functions within the use of Sewage Sludge	*Governmental Institutions*	Local Self Government
Regulation of the manner and the conditions for the use of sludge, the maximum values of the concentrations of the heavy metals in the soil in which the sludge is used, the values of the concentrations of the heavy metals in the sludge, the maximum annual amounts of such heavy metals that can be introduced into the soil, as well as the type of information that sludge producers shall submit to the users on a regular basis, and the manner, conditions and procedures for issuance of a permit for use of sludge; regulation the content and the form of the application and of the permit for re- use of sludge resulting from the treatment of the municipal waste water, as well as the manner and procedure for issuing the permit	*The Minister of the MOEPP in agreement with the Minister of MOAFWM*	

2 COLLECTION AND ANALYSIS OF BASELINE ENVIRONMENTAL DATA

The first step within the identification of the possible significatnt impacts of the project – Waste water treatment plant for Skopje City to the environment, social and economic life of the citizants is the accurate description (with new "fresh" information and data where it is possible) of the existing environment. This will ensure that we are aware about the baseline data on the current state of the main media as air, water, soil, waste management due to the pressure – pollution of the driving forces – main human activities as industry, traffic, energy production and consumption, agriculture etc., biological environment and social-economic and cultural environment . These baseline information and data can be used also later on for environmental monitoring of the impacts of the WWTP when it would be constructed and operated.

For the identification of the baseline environmental data within the Environmental and Social Consideration Survey (IEE Study) the Consultant Team uses the simplify version of the DPSIR Methodology[2] (Driving forces, Pressure to the environment, State of the environment, Impact of the state of environment to the human beings and nature, Response on the environmental changes) that has been accepted as a National Methodology during the development of the National Environmental Action Plan II (2005) and adapted into the National Methodology for preparation of the Local Environmental Actions Plans for the municipalities (2006). The Consultant Team will use the already adopted strategic national and municipality documents where this methodology was implemented for policy and planning purposes.

For the analysis of the baseline environmental data within this Study, the connection between all elements of the above mentioned methodology will be addressed for the entire Skopje City with all ten municipalities and especially the potential location for the Waste Water Treatment Plant – Trubarevo settlement within the Gazi Baba Municipality.

This so called "receiving environment" assessment will include at least: ***physical environment*** (topography, geology, hydrogeology, geomorphology and soils, land use and landscape, meteorology, climate and air quality, noise level, water, ground water and waste water- sewage and industrial, solid waste management and possible disposal of the sludge to teh sanitary landfill "Drisla"), ***biological environment*** (fauna and flora, biodiversity, sensitive habitats and reserves, protected areas and wetland resources) and ***socio-cultural environment*** (land

[2] Mrs. Slavjanka Pejcinovska-Andonova,Mrs. Dragica Camovska, 2005, Set of core indicators for Water during the preparation of the Local Environmental Action Plan in Macedonia, EMEC 6 Conference, Belgrade, Serbia

acquisition, water rights, architecture, historical and cultural valuable areas, human being activities as industry, traffic, public health conditions).

The Consultant Team reviewed the all strategic national documents covering the sustainable development of the country as well as the development planning documents for the municipalities and City of Skopje. The reference documents-source of information and data have been presented in ANNEX 1.

Also, several interviews with responsible persons within the City of Skopje (Meeting with Ms. Cvetanka Ikonomova and Ms. Liljana Oncevska) and the Ministry of Environment nad Physical Planning (Mr. Zoran Bosev) were held and some relevant information about the state of environment were pointed out and they have been included into the main findings given below.

2.1 Physical Environment

2.1.1 Tophograhy

Skopje Valley is surounded by high mountains – Skopska Crna Gora on the north (1.626m), on the west by the mountains Zeden (1.254m) and Osoj (1.369m), mountain Jakupica (2.540m) on the south and Katlanovo hill on the east. The Skopje Valley is oriented from north-west to south-east in length of 47 km. The width varies between 28 and 50km. The Valley area is 2.100 km^2. The lowest point of the Valley is at altitude of 175m and the highest point is at Jakupica mountain (2.540m).

City of Skopje borders Čučer-Sandevo municipality and Serbia in the north, Jegunovce municipality and Želino municipality in the west, Sopište municipality and Studeničani municipality in the south, Ilinden municipality, Lipkovo municipality and Aračinovo municipality in the east. City of Skopje is located in the central part of Skopje Valley at 42°0'N, 21°26'E, on the upper course of the Vardar River and is located in the central part of Skopje Valley on 230-240 meters above see level spreaded on 7656 ha in total.

Planned location of Waste water treatment plan for Skopje is on the south-east part of Skopje Valley which presents a homogenous physical-geographic area, that occupies the lowest part of the Skopje Valley. As such this area is a high quality cultivated land in this region.

The natural predisposition looked from physical and geographic aspect and the land configuration, indicate that the Skopje Valley, have an extraordinary suitable traffic and communication position, possibly higher than the utilization rate so far.

The rapid economic, cultural and physical development of the city of Skopje resulted in technical ventures on the area that led to changes in the geographic environment (melioration on Vardar River, the swampy and muddy areas, construction of transportation and energy systems, etc.). These changes in the natural environment increased the attractive power of the space, which is

expressed by the population and activities concentration, i.e. the location of complementary and supplementary city operations *(Source: Feasibility Study on Integral Development of the Vardar Valley, Skopje, 1997).*

The Topography map of Skopje City urban part is given in ANNEX 1a.

The Topography map of WWTP location in Trubarevo is given in ANNEX 1b.

2.1.2 Geological characteristics of the area

According to the regional geological research data presented on the Basic Geological Map, scale 1:100.000, sheet Skopje, the ground of Skopje basin is made of masses of rocks from the Paleozoic and Mesozoic complex.

The Paleozoic complex encompasses: schist, marble and quartzite, which altogether spread from north-east to south-west.

Considering the stratigraphic characteristic, the oldest rock masses in the Paleozoic complex are the amphibolites, the amphibolite schist, more exactly, here present through several varieties of minerals. The schist is dark-green, cracked, but firm and solid, containing relicts of metamorphosed diabase and gabbro.

Under super position, the marble appear next as interstratifications or in bands in the schist masses. They are mostly gray and white, or with striped, on some places with schist texture and significant percentage of mica, which point out the gradual transition with the surrounding mica schist.

According to their presence in the Paleozoic complex, the biotite and quartz-sericite schist represent the basic mass. Mostly they are in a tectonic relation with the rest of the litostratigraphic members. They are clayey-sand products, which, metamorphosing during the long geological history, transformed into different varieties of schist. Their color is gray and brown, their surface is mostly degraded and dilapidated (frail), striped and with extended schists-like characteristic.

The quartzite, same as the marble, appears as interstratificated masses and layers or bands. Their color varies from gray to gray and white and are more solid than the schist masses, liable to cracking.

The sediments and magmatites of the Mesozoic complex are found to contain creations of the period of Triassic, Jurassic and Cretaceous.

Triassic sediments are present through clayey and soils deposits from Lower Triassic period, tile-shaped limestone of the Middle Triassic and massive limestone of Upper Triassic. The sediments of the Lower Triassic are present through clayey and sandy soils. It has been established that they contain fossils of marine shells, which determined the age of the sediments. The tile-shaped limestone from the Middle Triassic appears in association together with chert and

lie inside the previous rocks. The Upper Triassic is represented with massive limestone with gray on the surface.

The Upper Cretaceous sediments are represented with facies of red quartz conglomerate, which are in a trans-agressive relation with the Triassic sediments and a tectonic position towards the Jurassic formation.

Basic geological ambience on the wide-spread area of Skopje basin is Neogene - Pliocene sediments and Quaternary-alluvial deposits. The basic rock masses are the Pliocene lake sediments taking about 700 meters, covered with Quarternary mostly alluvial-terrace sediments. Characteristics of the Quarternary sediments of upper layers were determined basically as gravel and sand and clay layers up to the terrain surface. Their genesis is connected with the alluvial flows of the river Vardar, as well as the flood deposits from the surrounding river basins.

Detailed information on the lithological structure of the ground and the level of groundwater are obtained from the analyses performed by the Institute Office for geo-technique in the Civil Engineering Institute of Macedonia.

According to the same source, the ground down to 12.0 m is composed of the following substances:

- Humus soil;
- Soil with small particles and silt, medium solid consistency, very confined, dark-brown colored;
- Clay flour, small and coarse sand and gravel and organic ingredients, medium plastic, medium solid consistency, brown color;
- Small to coarse gravel, sandy, medium to thick concentration with presence of silt, oscillating percentage of granules Ømax 50 – 60 mm, unconfined, reddish and brown.

Generally, the soil on the location is composed of proluvial deposits represented by flour clay mixtures and gravel ingredients. The geo-mechanical features of these deposits are relatively low due to the narrow angles of internal friction and low modules of pressure. Therefore, such layers can be used only for low specific loads. Under this layer there is a layer of gravel deposits and sandy mixtures including small particles, very compact. This layer has satisfactory geo-mechanical features and can be used as direct foundation base.

Form seismic and tectonic aspect of the region, the location belongs to the Vardar seismic zone, where the Skopje epicenter area is the most striking by the level of the earthquake destructive effects. These aspects should be taken into consideration while dimensioning the statistical parameters for construction, in order to provide a seismic protection and inviolability in case of earthquake with anticipated intensity.

Geological map of Skopje area is given in ANNEX 2.

2.1.3 Soil Quality

Pedological composition of Skopje Valley is heterogeneous. Different soil types are represented such as: regosoils, coluvial, deluvial soils, vertisoils, chromium cambosoils (cinamonic forest soils), cambosoils (brown forest soils), fluvisoils (alluvion soils), fluvial-medow soils (humus flovsoils) etc. Generally, the major part of the soil in Skopje Valley is mixed clay and alluvial with high organic contents. The soils in the lower parts of the Valley is fertile having a high agricultural value. The upper 50 cm of the soil is porous, with vegetation and habitat.

Urban development and industry on the territory of Skopje Valley make impacts to soil quality. Even it is required by the legislation (Law on Environment), regular monitoring of soil quality is still not in place in the Republic of Macedonia.

Data about soil contamination by heavy metals in Skopje Valley are presented in the Project for geochemical monitoring of heavy metals and geochemical mapping of soils for City of Skopje and its surroundings, prepared by Faculty of technology and metallurgy –Skopje, 2000.

In the above mentioned Project, more than 300 samples have been analysed and determination of some heavy metals (Pb, Zn, Cd, Cu, Ni, Cr, Y, Ba, Zr, La, As) have been performed. That research covers of urban as well as rural soil samples from village Rasche (north) to the village Katlanovo (south) including locations of bigger industrial capacities. The samples were taken from the top soils cover of various lawns of cca 10-40 cm depth. The soil quality location samples are given in ANNEX 3.

Table 7 Overview of the contaminants having anthropogenic origin

Element	Reference Value***	Contamination	Origin
Pb`	85 (mg/kg dry matter)	Indicatively increased level; Higher concentration in urban areas. Contamination localized around industrial capacities, and main traffic roads	anthropogenic activities, industrial activities
Zn	140 (mg/kg dry matter)	below MLV	industrial activity
Cu	36 (mg/kg dry matter)	Seriously contaminated On some sampling location up to 2-3 times above MLV	anthropogenic activities

Source: Geochemical monitoring of heavy metals and geochemical mapping of soils for City of Skopje and its surroundings, prepared by Faculty of technology and metallurgy –Skopje ,2000.

*** In Macedonian legislation standards for soil quality have not been adopted still. Therefore comparison is made in accordance with Dutch standards (These soil quality standards are very often used, for example in IPPC Permitting process and similar documents)

With exceptions for few heavy -industry complexes, general conclusion of the above mentioned Geochemical monitoring of heavy metals is that on the territory of Skopje and its surroundings, there are no significant pollution of soil with heavy metals.

2.1.4 Ambient Air Quality

In Macedonia there are three ambient air quality monitoring networks responsible for air quality measurement and data management as follows:

- The national network of the Ministry of Environment and Physical Planning;
- The network of the Public Health Institute (PHI) and its regional branches located in Skopje and major cities in the country;
- The network of the Hydro-Meteorological Administration (HMA) under the Ministry of Agriculture, Forestry and Water Economy.

The monitoring network of the MoEPP is a national automatic ambient air quality monitoring network, managed by the Macedonian Environmental Information Centre (MEIC). The two other networks work on manual basis.

Each of the monitoring networks operates on the basis of separate programmes under the annual work programme of each of the above mentioned institutions.

Macedonian Environmental Information Centre is collecting and analysing all data and information about the emissions and ambient air quality from the stationary sources and other institutions monitoring and it reports them into the Annually Ambient Air Quality Reports for Macedonia.

2.1.4.1 Locations of the air quality monitoring stations in Skopje

The Health Institute in City of Skopje has established the monitoring network for measurements of the CO_2 and the black smoke on 7 measurements locations in Skopje.

The Hydro Metrological Administration has established the monitoring network on 9 measurements locations in Skopje with measurements of the CO_2 and the black smoke.

There are 4 fixed automatic monitoring stations on ambient air quality measuring several environmental and metrological data in Skopje (Karpos, Center, Lisice and Gazi Baba), one station for air quality monitoring from the traffic located in the Skopje center (Nain Buiding-Rektorat at the University "St. Cyril and Methodius).

Additionally in 2005 the two low volume samplers were placed at locations Lisice and Karpos for performing PM_{10} measurements.

Figure 1 Fixed automatic monitoring station

The main on-line monitoring parameters that are performed are:

- SO_2 [$\mu g/m^3$];
- NO_2, NO_x, NO [$\mu g/m^3$] ;
- CO [mg/m^3] ;
- O_3 - ozone [$\mu g/m^3$];
- SPM – suspended particulate matters (PM_{10}/opt. $PM_{2.5}$) expressed in $\mu g/m^3$.

These Automatic Air Monitoring Stations perform also the metrological measurements of the following parameters:

- wind speed [m/s];
- wind direction ;
- temperature [°C] ;
- pressure [hPa] and humidity [%];
- global radiation [W/m^2].

The locations of these monitoring locations and main characteristics of the stations, parameters that they are analysing are given in the Table 8.

Table 8 Monitoring stations for ambient air quality measurements in Skopje

	Monitoring station	Site coordinates			Parameters measured	Type of the station	Type of area	Characterization of the zone
		N	E	Elevation				
Public Health Institute Skopje	CHPI Skopje DDD	42º 00.995'	21º 26.873'	254	SO_2, Black smoke	Background	Urban	Residential/commercial/ agriculture
	CHPI Skopje Evropa	41º 59.865'	21º 27.887'	249	Acidity, Black smoke	Background	Urban	Residential/commercial/ industrial
	CHPI Skopje Insitute for forensic medicine	41º 59.280'	21º 25.116'	279	SO_2, Black smoke	Background	Urban	Residential/commercial/ industrial
	CHPI Skopje Kinder garden Srnicka	41º 59.293'	21º 27.890'	256	Acidity, Black smoke	Background	Urban	Residential/commercial
	CHPI Skopje PHI	41º 59.253'	21º 26.482'	240	SO_2, Black smoke, Pb (twice a year)	Background	Urban	Residential/commercial/ industrial
	CHPI Skopje Elementary school Dimo Hadzi Dimov	42º 00.292'	21º 22.411'	268	SO_2, Black smoke	Background	Urban	Residential/commercial/ industrial
	CHPI Skopje Usje	41º 58.170'	21º 27.484'	247	Acidity, Black smoke	Background	Urban	Residential/commercial/ industrial
Hidro Metrological Administration	HMA AMSM	41º 59.657'	21º 25.233'	271	SO_2, Black smoke	Traffic	Urban	Residential/commercial/ industrial
	HMA Avtokomanda	41º 00.142'	21º 27.736'	251	SO_2, Black smoke	Traffic	Suburban	Residential
	HMA Dracevo	41º 55.792'	21º 32.023'	243	SO_2, Black smoke	Traffic	Suburban	Residential
	HMA Josip Broz Tito	41º 59.701'	21º 25.555'	263	SO_2, Black smoke	Traffic	Urban	Residential/commercial
	HMA Karpos 4	42º 00.253'	21º 23.452'	270	SO_2, NO_2, NO_x, O_3, Black smoke	Traffic	Urban	Residential/commercial/ industrial
	HMA	41º	21º 28'	236	SO_2, Black	Traffic	Urban	Residential/commercial

	Lisice	59'03.23"	31.80"		smoke			
	HMA UHMR	42º 00'59.57"	21º 23' 59.15"	291	SO_2, Black smoke, Temp., pressure, humidity, wind dir., wind vel.	Backgroun d/Traffic	Suburba n	Natural
	HMA Univerzitetska	41º 59.281'	21º 25.116'	279	SO_2, Black smoke	Traffic	Urban	Residential/commercial
	HMA Agiculture insitut	41º 58.13'	21º 28'	243	SO_2, Black smoke		Urban	Residential/commercial
Ministry of Environment and Physical Planning (MoEPP)	MOEPP Centar	41º 59.343'	21º 26.015'	254	SO_2, CO, NO, NO_2, NO_x, PM_{10}, Meterological parameters	Traffic	Urban	Residential/commercial
	MOEPP Gazibaba + High sampler for PM_{10}	42º 00.139'	21º 27.078'	250	SO_2, CO, NO, NO_2, NO_x, Meterological parameters	Backgroun d Traffic	Suburba n	Commercial
	MOEPP Karpos + High sampler for PM_{10}	42º 00.247'	21º 23.452'	302	SO_2, CO, NO, NO_2, NO_x, O_3, PM_{10}, Meterological parameters	Traffic	Urban	Residential/commercial
	MOEPP Lisice + Low sampler for PM_{10}	41º 58.660'	21º 27.874'	255	SO_2, CO, NO, NO_2, NO_x, O_3, PM_{10}, Meterological parameters	Industrial	Urban	Residential/commercial/ industrial
	MOEPP Rektorat	41º 59.943'	21º 26.458'	270	SO_2, CO, NO, NO_2, NO_x, O_3, PM_{10}, benzene, toluene, ethyl-benzene, orto-xylene, para-xylene	Traffic	Urban	Residential/commercial

Source:The Macedonian Environmental Information Center , MoEPP, Annual Report on Air Quality 2006

The average monthly data from the automatic monitoring stations for different pollutants (year 2006) has been given in the Table 9.

Table 9 The average monthly data from the automatic monitoring stations

SO_2 [µg/m^3] – Limit value (daily average): 150												
Location	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Karpos	49.19	50.53	33.76	18.86	14.44	12.46	14.19	14.32	15.80	20.45	65.19	92.57
Centar	42.51	46.94	34.55	22.38	11.18	9.81	8.68	9.24	10.01	17.44	76.86	107.10
Lisice	30.55	37.92	29.44	20.55	12.13	7.93	7.17	10.16	12.22	23.52	47.88	67.83
NO_x [µg/m^3] – Limit value (daily average): 85												
Karpos	57.89	60.86	47.11	40.75	36.96	32.10	29.32	37.42	42.58	47.49	60.59	60.40
Centar	66.96	66.58	54.32	44.96	42.93	42.72	40.51	42.02	47.84	52.58	64.74	66.59
Gazibaba											54.87	50.93
Lisice	58.83	68.58	48.16	41.65	40.47	32.03	36.79	34.48	38.21	34.34		
Rektorat	94.57	98.82	67.89	49.09	45.59	39.65	39.71	35.40	40.91	49.76	53.04	51.56
CO [mg/m3] – Limit value (daily average): 1												
Karpos	1.66	1.24	0.87	0.66	0.62	0.63	0.60	0.67	0.70	1.41	0.53	1.58
Centar	4.22	3.07	2.49	1.96	1.24	1.89	0.91	0.81	1.33	2.63	4.63	4.49
Gazibaba											3.56	3.71
Lisice	3.01	3.00	2.15	1.12	1.26	1.86	1.26	1.32	1.65	1.25	2.67	4.14
Rektorat	3.02	3.09	0.95	1.31	1.43	1.09	1.69	1.33	1.75	2.07	5.96	2.03
Ozone – O3 [µg/m3] – Limit value (daily average): 110												
Karpos	32.29	26.96	44.49	48.11	58.89	52.02	62.94	52.00	33.99	8.87	6.92	25.96
Lisice	15.22	14.26	34.18	31.09	38.18	34.94	35.95	51.04	41.62	31.51	21.28	15.84
Rektorat	42.36	73.95	34.37	36.96	43.37	33.19	42.05	37.65	31.64	24.48	16.18	14.45
PM_{10} [µg/m^3] – Limit value (daily average): 120												
Karpos	175.88	133.57	69.12	52.58	53.95	57.24	56.96	60.54	58.80	88.94	117.53	144.87
Lisice	209.73	170.00	81.75	64.30	59.78	41.34	62.92	52.25	69.16	80.02	184.90	191.90
Rektorat	246.01	197.91	91.85	71.80							166.59	198.50
PM_{10} [µg/m^3] with low volume samplers												
Karpos		80.28	63.87	50.25	50.20	54.61	45.19	42.86	52.88			
Lisice		51.51	81.16	46.3	46.68	47.87	43.55	36.55				
As[ng/m^3] with low volume samplers												
Karpos				0.83	1.13	3.20	2.4					
Lisice				1.12	1.62	2.67						
Cd [ng/m^3] with low volume samplers												
Karpos				1.15	2.43	0.93						
Lisice				1.53	3.90	1.98	1.09	0.25				
Ni [ng/m^3] with low volume samplers												
Karpos				5,10	9.47	4.45	49.18					
Lisice				25.13	10.20	4.47	13.45					
Hg[ng/m^3] with low volume samplers												
Karpos				0.15								
Lisice				0.10	0.10	0.20	0.52					
Cr [ng/m^3] with low volume samplers												
Karpos				12.60	22.75	23.76						
Lisice				24.72	57.28							
Pb[ng/m^3] with low volume samplers												
Karpos				0.05	0.09	0.04	0.04					
Lisice				0.06	0.09	0.09	0.09					
V[ng/m^3] with low volume samplers												
Karpos				16.95	5.22	6.14	5.50					
Lisice				2.26	4.95	5.48						
Mn[ng/m^3] with low volume samplers												

Karpos		15.58	23.09	65.06	27.50
Lisice		17.14	20.29	28.48	
Fe [ng/m^3] with low volume samplers					
Karpos			644.32	732.84	790.10
Lisice		444.40	493.42	872.80	
Zn[ng/m^3] with low volume samplers					
Karpos		0.83	243.03		
Lisice	974.10	314.59	251.77	246.72	
Mg [ng/m^3] with low volume samplers					
Karpos			255.05	509.46	547.90
Lisice		193.13	238.70		
Cu[ng/m^3] with low volume samplers					
Karpos		13.63	16.22	13.56	13.20
Lisice		16.60	18.57	12.05	

Source:The Macedonian Environmental Information Center , MoEPP, Annual Report on Air Quality 2006

Analysis of the ambient air quality data gain from the automatic monitoring stations under the MoEPP and monitoring stations under the Public Health Institute and the Hydrometrological Institute was performed by the Macedonian Environmental Information Center under the Ministry of Environment and Physical Planning.

The comparison has been done with the national legislation and limit values given into the national primary and secondary legislation:

- Decree on limit values for the levels and the types of polluting substances in ambient air and alarm thresholds, terms for achievement of these limit values, margins of tolerance for the limit value, target values and long-term goals. ("Official Gazette of RM" No.50/2005)
- Rulebook on the criteria, methods and procedures for assessment of the ambient air quality ("Official Gazette of RM" No.82/2006)
- Law on Environment (Official Gazette no.53/2005)
- Law on Ambient Air Quality (Official Gazette no.67/2004);

The review of the average annually concentration of some parameters relevant for the air quality and number of days when this concentration exceed the limit values has been given into the Table 10.

Table 10 The review of the average annually concentration of some parameters

Monitoring station			Average annually concentration	Max	Min	Limit values	Number of days with average daily concentrations above limit values
Ministry of Environment and Physical Planning Automatic monitoring stations	SO_2 [µg/m^3]	Karpos	33.45	250.11	9.59	150	7
		Centar	32.99	248.65	5.578	150	7
		Lisice	27.93	135.94	5.567	150	0
	NO_x [µg/m^3]	Karpos	46.08	133.99	17.11	85	21
		Centar	52.68	127.33	18.08.	85	26
		Gazi Baba	52.83	81.99	27.33	85	0
		Lisice	46.13	11.55	19.08	85	14
		Rektorat	56.00	254.76	2.54	85	35
	CO [mg/m3]	Karpos	0.90	4.26	0.035	1	84
		Centar	2.46	9.03	0.372	1	292
		Gazi Baba	3.62	6.91	0.246	1	52
		Lisice	2.16	8.98	0.077	1	257
		Rektorat	2.17	8.74	0.157	1	225
	Ozone – O3 [µg/m3]	Karpos	37.80	90.05	1.943	110	0
		Lisice	29.20	88.32	5.197	110	0
		Rektorat	35.57	209.90	8.685	110	8
	PM_{10} [µg/m^3]	Karpos	89.28	503.09	15.656	120	73
		Karpos Sampler	52.23	131.29	13.61	120	2
		Lisice	114.63	539.93	9.407	120	74
		Lisice Sampler	48.35	129.50	12.37	120	1
		Rektorat	172.78	661.07	47.67	120	71

Source:The Macedonian Environmental Information Center , MoEPP, Annual Report on Air Quality 2006

Main conclusions

The analysis show that the SO_2 concentration in Skopje are under the limit value according the national secondary legislation (expressed as maximum allowed concentrations) at the monitoring location Lisice, but the limit values have been exceeded in the period of 7 days at the monitoring locations Karpos and Centar.

There are several days (the largest number of days are for monitoring location Rektorat) where limit values for NO_2 have been exceeded due to the traffic and metrological conditions into the winter period of the year.

All data for CO concentrations are above limit values at all monitoring locations due to the traffic, burn of wood and fuel for heating and metrological conditions.

The exceedance of the PM_{10} concentrations at all monitoring locations have been registered by all three monitoring stations more than 71 days in the year especially in the winter months.

The results of the analysis performed on the monthly concentrations of SO_2 and black smoke at the monitoring stations under the Public Health Institute and the Hydrometrological Administration show the exceedance of the limit values for black smoke at all monitoring locations. There is light exceedance of the limit values for SO_2 at several monitoring locations within a few days in the year. The results from the monitoring stations under the Public Health Institute and the Hydrometrological Administration have been given in the Table 11.

Table 11 The results from the monitoring stations under the Public Health Institute and the Hydrometrological Administration

	Monitoring station	Average annually concentration	Max	Min	Limit values	Number of days with average daily concentrations above limit values
	SO_2 µg/m^3					
Public Health Institute Skopje	CHPI Skopje DDD	11.16	81.80	0.30	150	0
	CHPI Skopje Elementary school Dimo Hadzi Dimov	11.85	113.60	0.10	150	0
	CHPI Skopje Insitute for forensic medicine	16.59	88.90	0.20	150	0
	CHPI Skopje PHI	17.78	122.10	0.20	150	0
Hidro Metrological Administration	HMA AMSM	40.54	469.51	8.58	150	4
	HMA Avtokomanda	32.68	677.23	2.89	150.	1
	HMA Dracevo	16.96	128.19	3.52	150	0
	HMA Josip Broz Tito	32.97	281.27	8.37	150	2
	HMA Karpos 4	25.10	257.57	8.04	150	3
	HMA Lisice	23.94	210.89	6.45	150	1
	HMA UHMR	26.72	518.46	8.08	150	2
	HMA Univerzitetska	34.54	298.91	8.45	150	3
	HMA Agiculture insitut	34.38	338.02	0.00	150	1

	Monitoring station	Average annually concentration	Max	Min	Limit values	Number of days with average daily concentrations above limit values
	SO_2 µg/m^3 black smoke µg/m^3					
Public Health Institute Skopje	CHPI Skopje DDD	36.37	273.40	1.60	50	55
	CHPI Skopje Elementary school Dimo Hadzi Dimov	25.25	202.00	2.10	50	45
	CHPI Skopje Insitute for forensic medicine	19.20	100.70	3.20	50	20
	CHPI Skopje PHI	26.08	182.90	2.10	50	54
	CHPI Skopje Evropa	25.38	241.30	4.90	50	40
	CHPI Skopje Kinder garden Srnicka	23.34	229.60	4.40	50	44
	CHPI Skopje Usje	22.46	155.10	5.80	50	38
Hidro Metrological Administration	HMA AMSM	56.77	332.77	0.00	50	129
	HMA Avtokomanda	35.70	332.77	0.00	50	67
	HMA Dracevo	20.25	135.00	1.55	50	35
	HMA Josip Broz Tito	50.22	338.63	1.58	50	113
	HMA Karpos 4	47.19	341.83	1.37	50	97
	HMA Lisice	43.23	316.77	1.00	50	93
	HMA UHMR	26.58	334.62	1.09	50	49
	HMA Univerzitetska	54.12	330.26	2.22	50	123
	HMA Agiculture insitut	59.03	349.28	0.00	50	124

Source:The Macedonian Environmental Information Center , MoEPP, Annual Report on Air Quality 2006

2.1.5 Ambient noise

The institutions that measure and monitor the level of noise in Macedonia are:

- The Central Laboratory of the MoEPP, which performs only ad-hoc measurements upon request. They are using the state off the art technology for noise measurements.
- The Public Health Institute with its regional branches which perform measurements on the 14 monitoring locations in Skopje.

In compliance with the legal regulations, the data from the measurement and monitoring of noise levels are submitted to the Macedonian Environmental Information Centre within the MoEPP, where such data is stored, processed and published in the Annually Reports on the noise levels.

Locations of the noise monitoring stations in Skopje are given in the Figure 2.

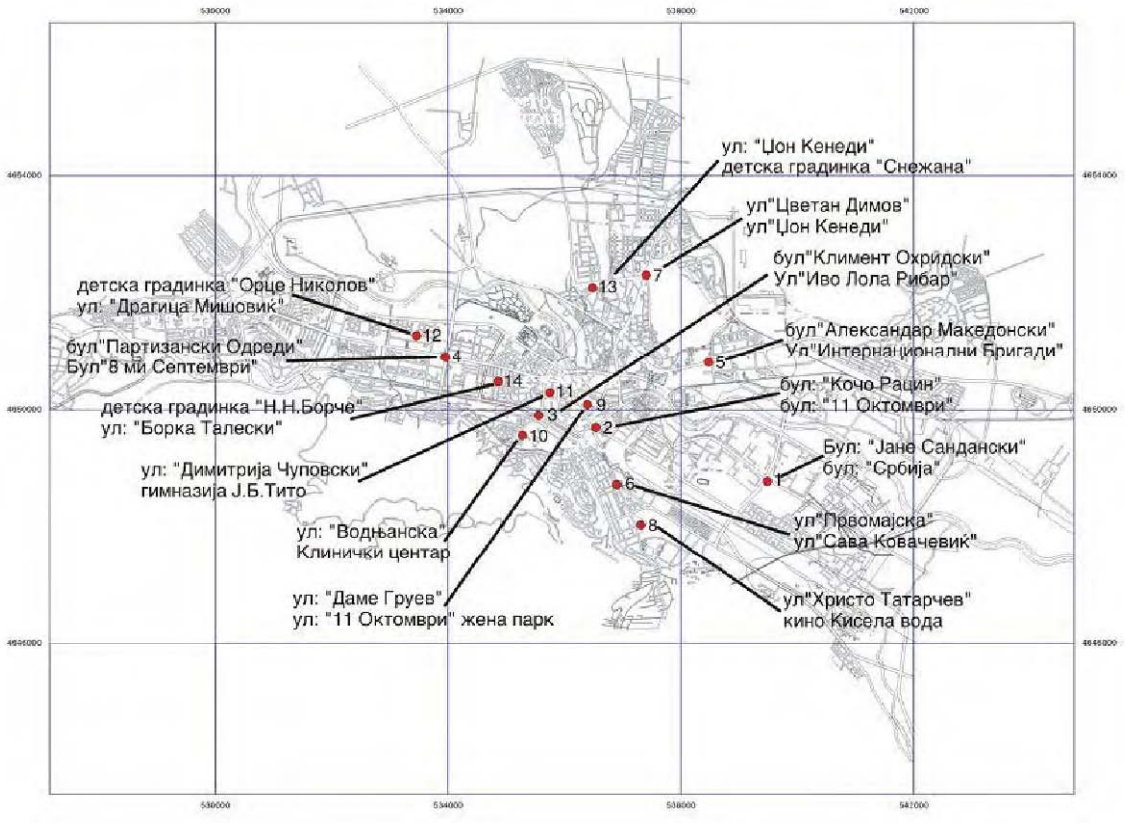

Figure 2 Map of the noise monitoring stations

The List with noise monitoring stations are given into the List with locations of the noise monitoring stations

Table 12 List with locations of the noise monitoring stations

Location of the station	Address	Municipality	Identification point on the map
Kinder garden "Orce Nikolov"	Ul. "Dragica Misovic"	Center	12
Bul. "Partizanski Odredi"	Bul. "8-mi Septemvri"	Karpos	4
Kinder garden "N.N.Borce"	Ul. "Borka Taleski"	Karpos	14
High School "Josip Broz Tito"	Ul. "Dimitrija Cupovski"	Center	11
Clinical Center	Ul. "Vodnjanska"	Center	10
City Park-Zena park	Ul. "Dame Gruev"	Center	9
Cinema "Kisela Voda"	Ul. "Hristo Tatarcev"	Kisela Voda	8
Ul. Prvomajska	Ul."Sava Kovacevic"	Kisela Voda	6
Bul."Jane Sandanski"	Bul."Srbija"	Aerodrom	1
Bul. "Koco Racin"	Bul. "11 Oktomvri"	Center	2
Bul. "Aleksandar Makedonski"	Ul. Internacionalni Bigadi"	Gazi Baba	5
Bul. "Kliment Ohridski"	Ul. "Ivo Lola Ribar"	Center	3
Ul. "John Kenedi"	Ul. "Cvetan Dimov"	Cair	7
Ul. "John Kenedi"	Kinder Garden "Snezana"	Cair	13

The monitoring data for the period 1995-2005 has been analyzed by the Macedonian Environmental Information Center under the Ministry of Environment and Physical Planning.

The analysis and main conclusions are given into the Table 13 refer to the exceedance of the limit values through the whole 10 years period with max. noise level and year when this max. level occurred. Also the noise level trend of increasing/decreasing or consistency through years has been presented.

Table 13 Main conclusions on the noise monitoring data

Location of the station	Period 1995-2005	Max. noise level (dB (A)/year	Noise level trend through years
Kinder garden "Orce Nikolov"	Exceed the limit value through all years period	63.06 dB / 1991	Decreasing trend
Bul. "Partizanski Odredi"	Exceed the limit value through all years period	89.92 dB / 2001	Increasing trend
Kinder garden "N.N.Borce"	Exceed the limit value through all years period	67.13 dB / 1998	Increasing trend
High School "Josip Broz Tito"	Exceed the limit value through all years period	69.69 dB / 2000	Increasing trend
Clinical Center	Exceed the limit value through all years period	62.75 dB / 1996	Slight increasing trend
City Park-Zena park	Exceed the limit value through all years period	71.95 dB / 1995	Consistency trend
Cinema "Kisela Voda"	Exceed the limit value through all years period	73.16 dB / 1996	Slight decreasing trend
Ul. Prvomajska	Exceed the limit value through all years period	85.57 dB / 1998	Decreasing trend
Bul."Jane Sandanski"	Exceed the limit value through all years period	90.3 dB / 2000	Consistency trend
Bul. "Koco Racin"	Exceed the limit value through all years period	87.16 dB / 1998	Consistency trend
Bul. "Aleksandar Makedonski"	Exceed the limit value through all years period	88.9 dB / 2002	Consistency trend
Bul. "Kliment Ohridski"	Exceed the limit value through all years period/exept 1997	88.91 dB / 2005	Increasing trend
Ul. "John Kenedi" ul. "Cvetan Dimov"	Exceed the limit value through all years period	86.2 dB / 1997	Slight decreasing trend
Ul. "John Kenedi" Kinder Garden "Snezana"	Exceed the limit value through all years period	63.06 dB / 1991	Decreasing trend

2.1.6 Climate and Meteorology

The meteorological measurements in the Skopje valley since 1968 are performed in the weather station at the airport Skopje in Petrovec and Skopje-Zajcev Rid.

2.1.6.1 Temperature

The Skopje valley is the final bay where the warm air circulation are present in the valley of the river Vardar from the Aegean Sea and it represents a separate thermal (/thermic) area where the valley climate affects the temperature regime. On the other side, Skopje valley is surrounded with high mountains, which keep away the direct influence of the Mediterranean climate from south, while from north and north-west there is almost a free passage for the continental air flows that in winter time bring low air temperatures. The valley configuration affects even more by lowering the temperature of these air flows, so that during some years there have been extremely low air temperatures. During the warm months, especially in summer time, when this area is influenced by high air pressure, the air temperature here is very high.

The Average monthly and annual air temperature in °C for the period 1971-2000 has been given in the Table 14

Table 14 Average monthly and annual air temperature

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Skopje-Petrovec	0.2	3.0	7.4	12.2	17.2	21.3	23.5	23.2	18.8	12.6	5.9	1.3	12.2
Skopje-Zajcev Rid	0.6	3.1	7.5	12.6	17.6	21.5	24.1	23.6	19.2	13.2	6.6	1.7	12.6

The Absolute maximum monthly and annual air temperature °C for the period 1971-2000 has been given in the Table 15.

Table 15 Absolute maximum monthly and annual air temperature

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Skopje-Petrovec	16.0	24.3	28.0	34.8	36.1	39.4	42.4	43.2	36.8	32.8	24.5	19.8	43.2
Skopje-Zajcev Rid	16.0	23.3	26.2	33.7	34.2	37.8	41.9	40.2	36.9	31.5	27.2	21.3	41.9

The Absolute minimum monthy and annual air temperature °C for the period 1971-2000 has been given in the Table 16

Table 16 Absolute minimum monthy and annual air temperature

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Skopje-Petrovec	16.0	24.3	28.0	34.8	36.1	39.4	42.4	43.2	36.8	32.8	24.5	19.8	43.2
Skopje-Zajcev Rid	16.0	23.3	26.2	33.7	34.2	37.8	41.9	40.2	36.9	31.5	27.2	21.3	41.9

The graphs that present the temperature data for the period 1971-2000 for the two measurements stations have been given in the Figure 3.

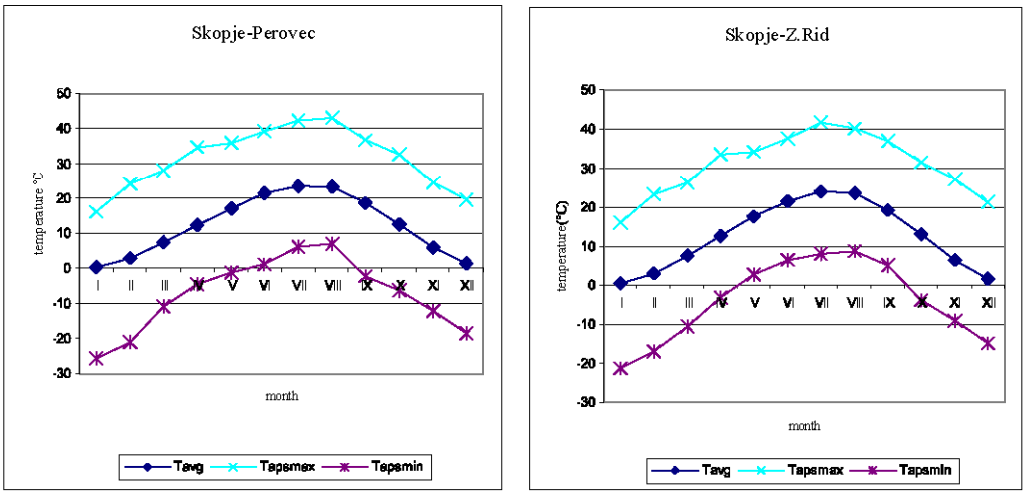

Figure 3 Temperature data for the period 1971-2000

The temperature air inversions appear every month, but they are most present during the winter. The lowest temperatures during the days when temperature inversions are present are in the low parts of the valley, while the temperature gets high at the higher parts. The difference in the temperature in situations of inversion between the lowest parts of the valley and the surrounding high areas during winter can exceed 10°C, depending the inversion intensity.

2.1.6.2 Precipitations - Rain falls

The average annal quantity of the rain falls in Skopje valley for the period 1971-2000 is 499 mm measured at Skopje-Petrovec station and 294 mm measured at Skopje-Zajcev Rid.

The precipitation is unequally distributed during the year (months and weather seasons). The biggest precipitations are in May and November. The smallest quantities of rain falls are January and August. The rain falls appear in any hour of the day of night and their distribution during this period has different values and frequency. According to the ombrographic measuring in the Skopje valley the rain falls are more frequent and with larger quantities during the afternoons, than the mornings. During the warm part of the year, there are strong rain falls with various intensity and duration.

The Average monthly and annual precipitation sums in mm for the period 1971-2000 has been given in the Table 17.

Table 17 Average monthly and annual precipitation sums in mm

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Skopje-Petrovec	33.5	36.1	35.6	43.2	56.0	45.1	36.8	28.7	38.2	43.9	54.4	47.8	499.3
Skopje-Zajcev Rid	25.1	31.4	26.9	40.7	40.0	39.5	39.4	33.1	31.5	39.6	52.0	42.0	294.1

The graphs that present the precipitations data for the period 1971-2000 for the two measurements stations have been given in the Figure 4

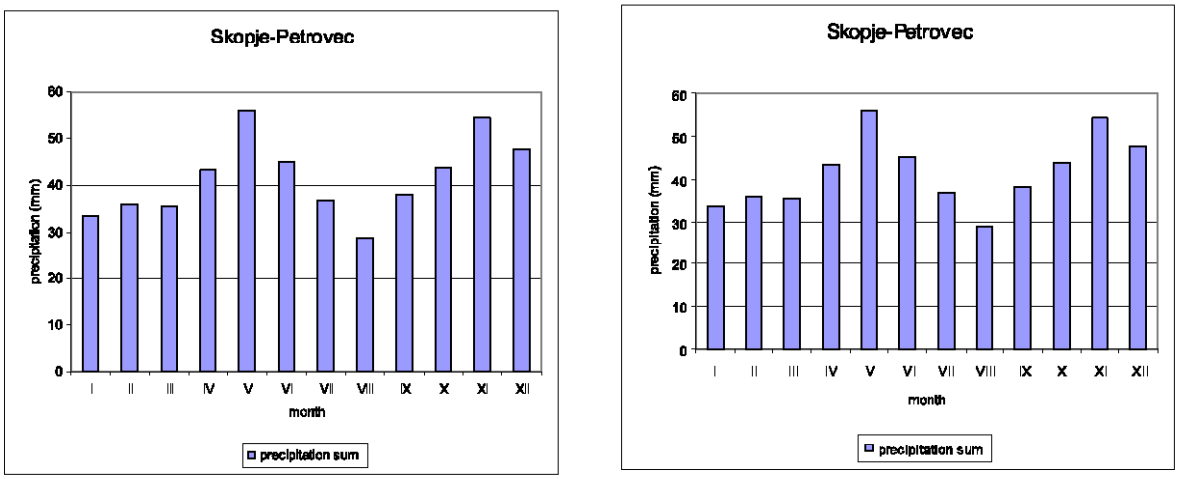

Figure 4 Precipitations data for the period 1971-2000

The maximum monthly and annual precipitation sums in mm for the period 1971-2000 has been given in the Table 18

Table 18 The maximum monthly and annual precipitation sums

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Skopje-Petrovec	38.0	45.6	37.5	46.7	109.2	35.2	77.2	31.8	52.3	74.2	125.2	50.0	125.2
Skopje-Zajcev Rid	28.6	24.4	20.7	33.5	44.0	37.8	41.3	50.1	31.7	40.8	48.4	26.1	50.1

2.1.7 Wind speed

In the Skopje valley the wind flows from the north and south quadrant are most frequent. But the orographic conditions have great impact on the wind paths.

The Average monthly and annual wind speeds in m/sec for the period 1971-2000 has been given in the Table 19.

Table 19 Average monthly and annual wind speeds in m/ sec

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Skopje-Petrovec	1.2	1.6	1.8	1.8	1.6	1.6	1.7	1.5	1.4	1.2	1.1	1.1	1.5
Skopje-Zajcev Rid	2.2	2.7	2.9	2.9	2.7	2.7	2.7	2.7	2.6	2.3	2.4	2.3	2.6

The wind rose graph for the Skopje-Zajcev Rid measurement station (Figure 5) has shown how wind speed and direction are typically distributed at that particular location. Presented in a circular format, the wind rose shows the frequency of winds blowing *from* particular directions. The length of each "spoke" around the circle is related to the frequency that the wind blows from a particular direction per unit time. Each concentric circle represents a different frequency, emanating from zero at the center to increasing frequencies at the outer circles.

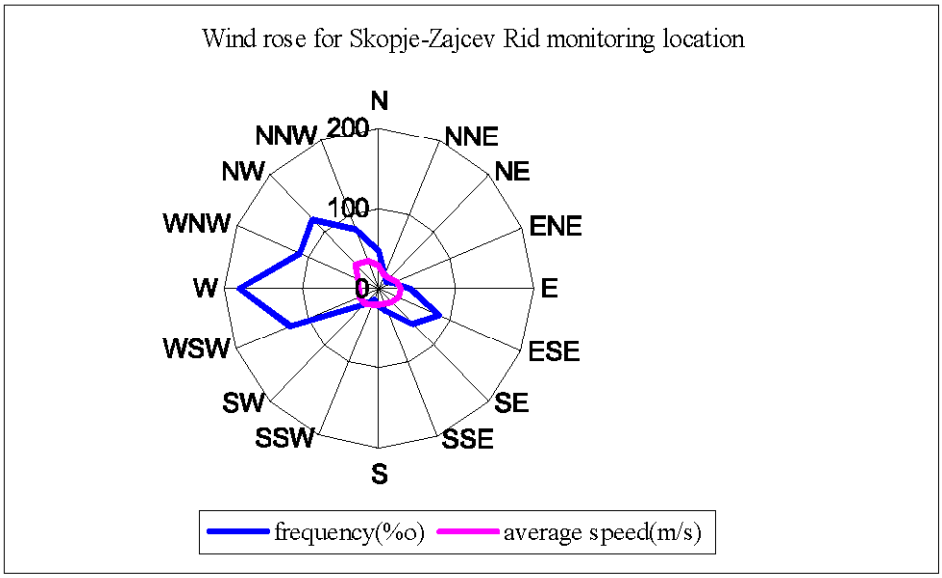

Figure 5 Wind rose

In the open east part of the Skopje valley, the regime of the winds is quite different from the one in the city. Most presents are the north wind with an average of 142‰/year and middle year speed of 3,9 m/sec. It is present during the whole year, but it appears to be most frequent in July - 210‰, middle speed 4,6 m/sec, and least frequent in May - 109‰ and middle speed 1,8 m/sec. After the north wind, the most frequent is the wind from the north-east path with an average of 120‰/year and average speed of 3,3 m/sec. It is also present during the whole year, but most frequent is in March - 154‰ and middle month speed of 3,1 m/sec, and least frequent in October and November with 95‰ and 98‰ with middle speed 3,3 m/sec.

In the east part of the valley for this period, the north wind has the highest average speed without considering the month - 3,5m/sec, than the north-east with 3,3m/sec and the south-east with 1,8 m/sec. The south-west, north-west and the west wind have a speed of 2,7 m/sec, and the south 2,2 m/sec. Considering the month, the highest speed of the wind is in February and March - 4,6 m/sec.

The winds in the Skopje valley have their distinct and their daily path. In the mornings dominating are the west and north-west winds, while the south-east are quite rare.

2.1.8 Water

2.1.8.1 River Vardar in Skopje Region

Vardar is the longest and largest river of Macedonia (302.6 km), with an average elevation of the basin at 793 m (the Vardar spring in the Shara massif near Vrutok/Gostivar is at only at 683 m), at average rainfalls of 660 mm and a total annual discharge of 4.56×million m³.

Upper Vardar flows through few big industrial cities with a total population of around 300,000 located upstream of Skopje: Gostivar (100,000 inhabitants), Tetovo (180,000). Treska river and Lepenec inflow Vardar river within the city boundaries.

The size of the river basin areas, discharges, runoff modules and other catchment and hydrological characteristics for Vardar in Skopje are presented in Table 20.

Table 20 Hydrological characteristics for Vardar in Skopje

Hydrological station:	Skopje -Zelezen Most	
River	Vardar	
Station code	63050	
Coordinates	N 41°59'41" / E 21°26'50"	
Elevation	239.55	m a.s.l.
River basin area A	4.650,0	km^2
Average precipitation: P_o	788	mm
Average annual discharge Q_{sr}	57,7	m^3/s
Average multiannual runoff module Mo	12,40	$l/s/km^2$
Minimum discharges (1990) Q_{smin}	22,747	m3/s
Maximum discharges (1963) Q_{smax}	122,9	m3/s
Water Volume W_o	1.820.086.378	m3
Module coeff. C_m	10,497	

For the hydrological station Skopje on river Vardar, the linear trends of the annual values of the series of minimal annual discharges, the series of average annual discharges and the series of maximal annual discharges are descending. Minimal amounts for decade discharge is recorded for the decade 1991-2000 for the series of minimal, average and maximal annual discharges.

2.1.8.2 Water Consumption

The legally proscribed water supply norm for Skopje is 400 l/capita/day. However, the figure is not realistic and certainly not invoiced and paid for the population. It is set so

high to accommodate for high losses in the system (up to 40%) and large quantities for unaccounted-for water and free public use (fountains, Vodovod own use etc.).

PHARE Project (1999) estimates the daily consumption per capita at 170 l/cap/day (even though 200 l/cap/day has been used for projections' calculations). The per-day-consumption is expected to drop even further when water saving measures (loss reduction) and incentives are introduced in conjunction with economic measures (price increase for full-cost recovery, tariff system etc.) to reach the level of developed European countries of cca 140 l/cap/day.

The World Bank Report (GIBB, 2000) states that Vodovod provides on an average about 235,000 m3 of water per day. About 30% of this water is consumed by domestic consumers (average consumption of about 155 liters/day/capita) and around 20% is used by institutional and industrial consumption. The remaining 50% is categorized as non-revenue water which includes 10% use for park irrigation and street cleaning. The Vodovod serves water through 53,000 connections and almost all water consumption is metered.

2.1.8.3 Sources of water

The main source of water is the karstic Rasce spring which has an average yield of 3.8 m3/sec (3.0 to 7.0) and provides high quality potable water. In the summer months, the yield from the spring reduces and the groundwater is pumped from certain parts of the city to augment the water supply.

Water supply well fields have been drilled in the Skopje valley to add to the Rasce capacity: Nerezi well field (right side of Vardar river at the foothill of Vodno), and near Lepenec river. Due to good quality the treatment of these waters is merely filtration and chlorination.

The capacity of these existing water sources is around 350 Ml/day, or around 4,000 l/s. This excludes the 1,000 l/s delivered to steel factories. These arrangements have been adequate so far but there is concern that with the population growth in the city and water demand, the supply of water has to be increased.

Besides these, the water supply infrastructure comprises three additional pumping stations, reservoirs, 5 chlorination facilities, pressure boosting pumps and other facilities.

Plans exist to drill number of wells for watering of green areas and parks in the city and for cleaning of the streets, in order to release the high quality water from Rasce for the households and industry.

2.1.8.4 State of infrastructure

The current coverage of the municipal utility Vodovod is estimated at 450,000 citizens (more than 190,000 households), out of which 401,000 in the urban area and around 50,000 in the rural area. Around 150,000 urban inhabitants live on the left side and 250,000 on the right side of Vardar river.

The Vodovod's water network, which dates back to 1936, is about 900 km long. A policy of replacing old pipes has not been implemented fully and as a result physical losses are increasing and is considered to be high.

According to WB (2000), the current physical losses are estimated to be around 30% of the production. The average number of breaks are around 2 breaks/km/year which is a high number compared to an average of around 0.2 breaks/km/year in Western European utilities.

2.1.8.5 Vodovod – brief overview

Vodovod is a municipal company and is treated as a separate financial entity. While the Vodovod is able to meet its operating costs, higher prices of water have been recently introduced to cover for investment costs.

There is a need to increase operational efficiency and increase the available resources in the company for investments. The current revenue is around US$ 12 million on an annual basis with an average tariff of around $ 0.34/m^3. However, revenue collection has been relatively low as a result of which there has been a progressive build-up of arrears in receivables and payables. At the end of 1999, receivables from consumers amounted to US$ 10 million equivalent which includes arrears from a number of years. The institutional and large consumers account for about 40% of the overdue receivables. The Vodovod continues to carry these receivables on its books although prospects for their realization are low.

The current working ratio (total operating expense divided by collected revenues) is around 90%. The current productivity of the Vodovod is not high and staffing costs account for about 50% of the costs.

2.1.8.6 Quality of provided water supply service

In general, most citizens get clean water and about 60% of the consumers are satisfied with the service. However, the water supply is not regular during the summer months, especially in high rise buildings towards the east of the city. Also, in a number of areas in the city there is lack of water pressure during peak demand periods. This is due to inadequate storage capacity to meet peak demands. In customer surveys, consumers have complained about the hardness, and presence of chlorine, sand, and turbidity in the water. Consumers are also not satisfied with the responsiveness of the Vodovod in addressing breaks in service and answering queries from customers.

2.1.9 Ground water

Groundwater below Skopje consists of two main aquifers:

- high yield semi-confined aquifer of superficial sand and gravel with clay horizons and
- low yield aquifer in underlying marls.

The superficial aquifer is in direct continuity with the Vardar river, being within the alluvial plain of the river. The depths of groundwater level vary depending on the local conditions, flowing in general in direction towards the river and downstream.

The upper aquifer stretching along upper part of Skopje valley consists of compacted alluvial sand and gravel on both sides of the river. The thickness varies from 4-5 m in the western part to up to 144 m in Trubarevo. The hydraulic conductivity also varies. Data from existing wells shows K from 1.80 $*10^{-5}$ to as high as 3.60$*10^{-2}$ m/s (Trubarevo). The depths are from -4.0 m in the upper (western) part to -12.0 m from surface in the east industrial area.

Number of boreholes exist in this area supplying industry with water. The yield varies considerably depending on the location and borehole diameter and depth, to up to 60 l/s in the urban part and as high as 225 l/s in the lower part of the valley. At places the drawdowns have been considerable reaching locally up to -10 m.

Monitoring of groundwater abstraction and groundwater levels have been reduced in the later period. In order to have a clear picture the monitoring efforts have to be substantially improved. This is even more significant regarding the water quality monitoring which is insufficient at the moment.

In the lower part of Skopje valley the same aquifer –compacted alluvial sand and gravel- continues with reduced thickness and similar conductivity. The groundwater level is artificially kept bellow the surface of the terrain by drainage network and pumped into Vardar river before Taor gorge. The drainage has been constructed in the 1950s to drain most of the Katlanovo marsh for agricultural expansion. Around 70 ha of the wetland have been protected and preserved in 1956 with a special law.

The proposed boreholes for abstraction of ground water for street cleaning purposes and watering the parks and green areas are planned to be in the superficial aquifer, which also behaves like an underground river. Abstraction of water from the aquifer will reduce the water level and flow but since the intended use of the water is mostly watering of green areas, the water will be immediately reintroduced into the aquifer thus restoring the hydrological balance and without significant negative impact on the water quality. Although it is not expected that flow in the Vardar river will be affected by the proposed abstraction the risk of reduced flow is nevertheless still possible without appropriate monitoring and control on the use of the water abstracted.

Improvements in the sewerage systems are expected to improve the groundwater quality in the superficial aquifer through reduction in the sewage overflows and the number of malfunctioning septic tanks.

2.1.10 Waste Water

The sewerage system in Skopje is built as separated, storm and sanitary sewerage. The waste water from the households and the industry is being collected from the urban areas by the main collectors on the left and the right bank of the river Vardar and are discharged into the river at numerous locations, without treatment.

Figure 6 Drisla Incinerator

The existing (data from the Brief Review prepared by JP "Vodovod i Kanalizacija" in November 2003) left bank collector extends for about 2800 m. The right bank collector has about 12500 m. The Kruger Report has identified approx. fifty existing outlets, waste water, storm water and industrial.

The Master Plan proposed one Central Waste Water Treatment Plant in Trubarevo, one Waster Water Treatment Plant in Saraj and one in Novo Selo. The general view of the proposed two small WWTPs in Saraj and Novo Selo and the Central WWTP for Skopje as well as the fecal outlets have been presented in Figure 7.

The Vodovod also maintains the sewerage (520 km) and storm water (190 km) systems. The Vodovod owns the sewerage assets but the storm water system is owned by Skopje City. About 80% of the population receiving water is connected to the sewerage system. The collected wastewater is not treated and discharged directly in the Vardar river.

The wastewater collection system in Skopje varies from 100 % separate (Karpos 3 and 4, Jane Sandanski) to 100% combined (Centar), with the whole range in between.

It is estimated that around 74 % of the planned sewer network is completed and only 25% of the stormwater network.

PHARE (1999) estimates the current and future[3] wastewater load in the urban part of Skopje as follows in the Table 21.

2.1.10.1 Sanitary wastewater

The sanitary sewer system comprises five catchment areas on the left bank of Vardar (E, C, A, G and D) and two catchment areas on the right bank of the river (B and F) including the area between R. Vardar and R. Lepenec. Most of these areas do not have truly separate sewer systems as the storm water pipes carry rain water only from the main streets. All rain water from minor streets and houses are probably discharged through the

[3] The future load estimate is for year 2020, based on consumption of 200 l/cap/day, population growth of 0.8 % urban and 2.0% rural, following proposed infrastructure improvements and construction of complete collector system on the right and left side of Vardar river. It excludes Saraj, Novo Selo and Dracevo.

sanitary system, which will, during rain, discharge wastewater through normal sanitary outlets and through overflow outlets. Within each area, the % covered by separate system and the % cover by combined system has been estimated and shown in the tables. The data from November 1999 refer to the discharging outlets have been presented into the Table 24 and the map of the sanitary sewage system with outlets has been shown in the Figure 7.

Table 21 Current and future wastewater load in the urban part of Skopje

Area		Households	Industry	Rain in sewer system	Total		
	ha	PE	PE	m^3/day	PE	Excl. rain m^3/day	Incl. rain m^3/day
Present							
Left bank	2394	153,700	76,850	6,257	230,550	46,110	52,367
Right bank	3680	257,000	128,500	130,928	385,500	77,100	93,400
Total Urban	6,074	410,700	205,350	137,185	616,050	123,210	145,763
Future							
Right bank	3690	300,690	167,050	14,802	476,740	93,584	108,350
Left bank	2394	179,829	99,905	39,654	279,734	55,947	60,885
Total Urban	6,084	480,519	266,950	137,185	616,050	123,210	145,763

The Figure 9 shows the location of selected potentially polluting industries with outlets identified within the Kruger Report in 1999. The industries are selected by Vodovod in cooperation with the Ministry of Urban Planning and Construction and based on an industrial survey carried out in August 1999.

2.1.10.2 Industry

The non-domestic water consumption in Skopje has been currently estimated at 17 Mm^3/y. The consumption of the industry served by Vodovod increases steadily, following the minimum of 14 Mm^3/y during the recession in the mid-1990-s. Most of the industries are supplied with water from the municipal water supply network of Vodovod.

Some industries have their own wells and pump groundwater for their needs. Large steelwork companies – originating from state owned Zelezara – Mak Steel, Mittal Steel and others in the same complex receive separately water supply from Rasce spring (approx. 1 m3/s, or more than 30 Mm3/y).

The new Industry Survey conducted by the JICA and national sub-contractor will provide the new information about the potential industry capacities, water consumption, type of industrial waste water pollutants that can occur and other parameters as the input data for the Feasibility Study on Waste Water Treatment Plant design. The data on the quantities of industrial waste water has been given into the Table 24

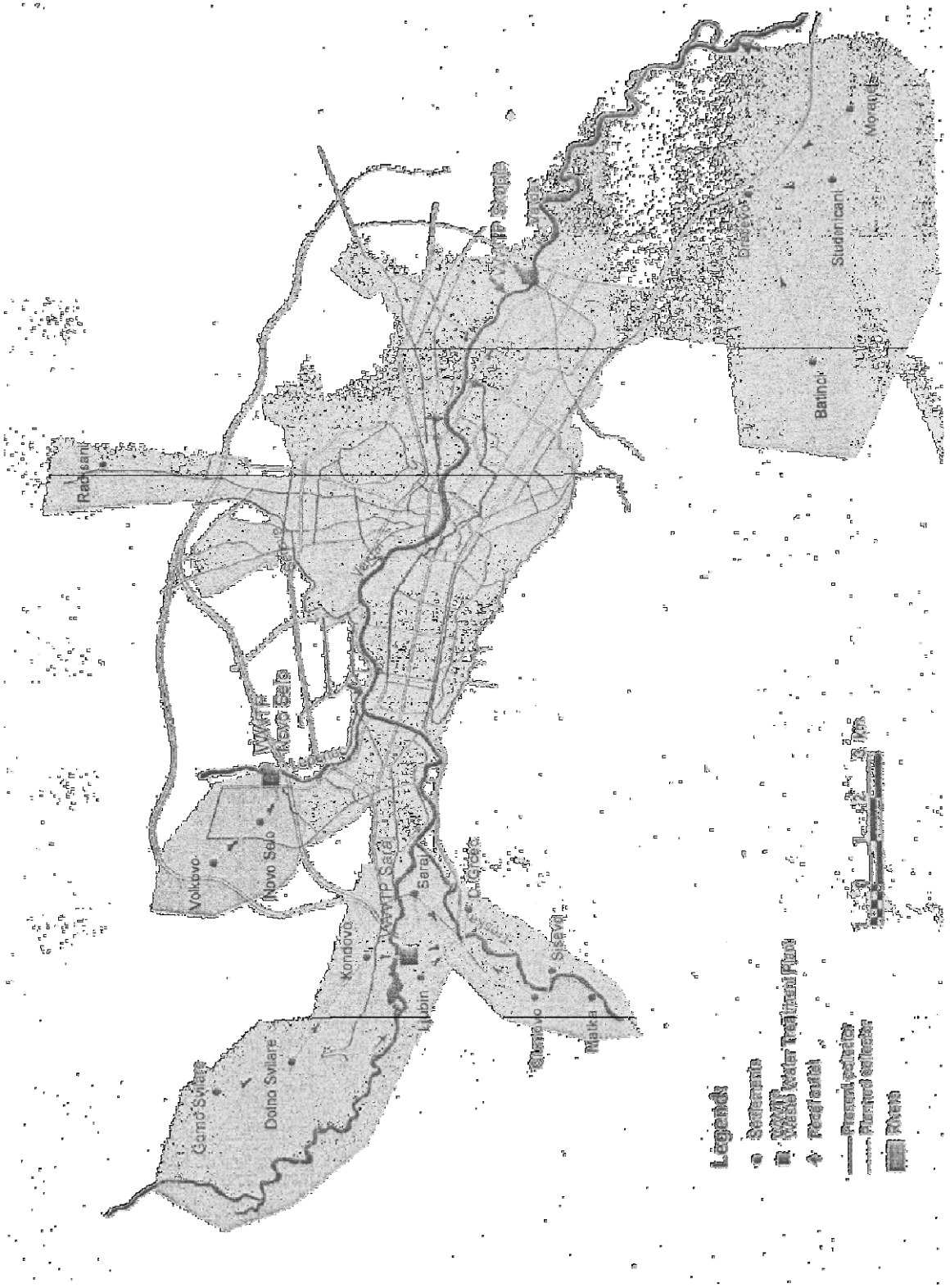

Figure 7 General map of the proposed WWTPs

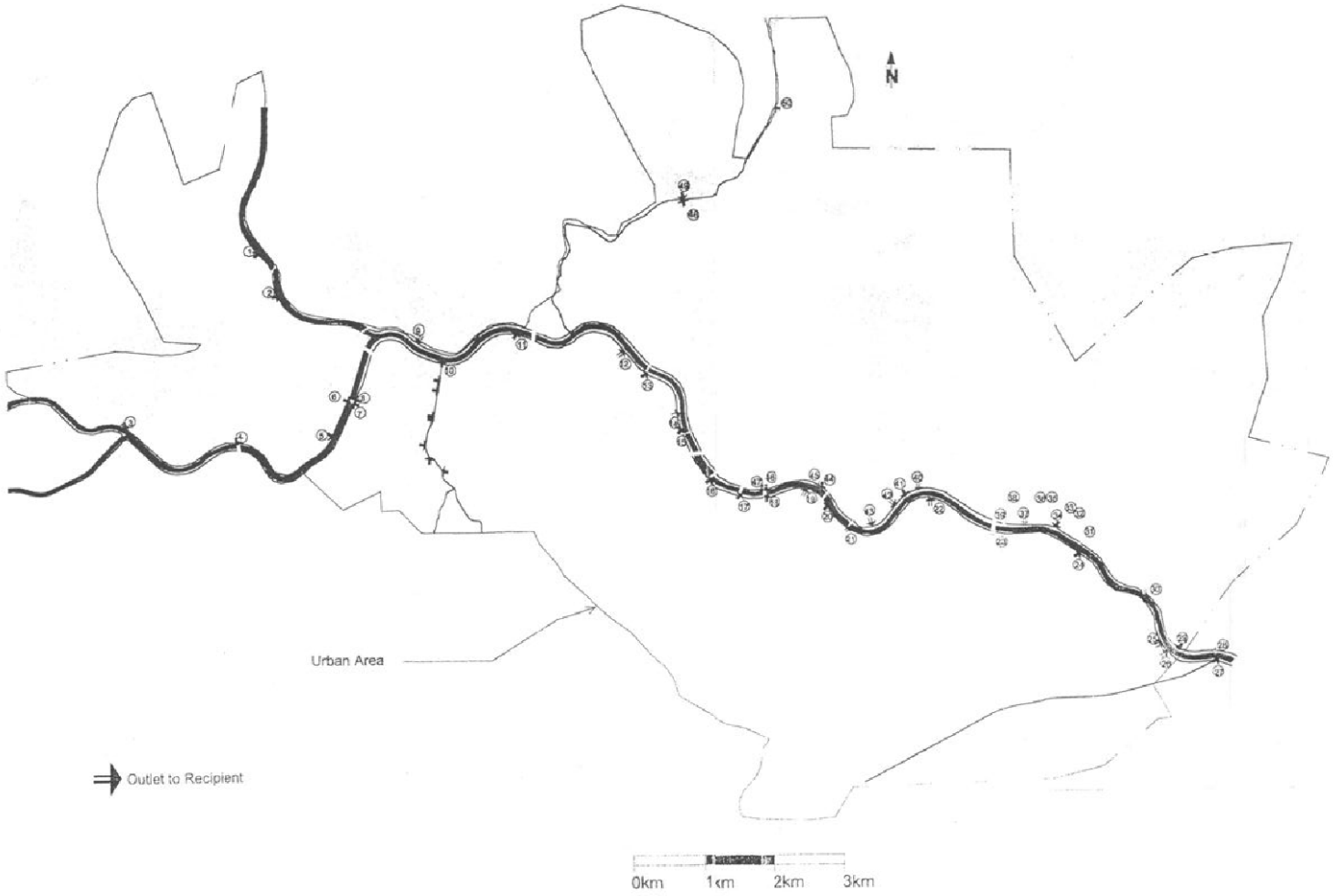

Figure 8 Map of the sewage outlets – sanitary waste water

Table 22 Right collector of the sanitary water, 1999

Area No.	Area covered with the sewage system		Sewage system		Quantity of waste water								Total quantity of waste water		
	Title	Area ha	Separate (%)	Combined (%)	Households			Industry			Storm water in sewage system		P.E.	m^3/day with storm water	m^3/day without storm water
					P.E.	Waste water m^3/day	l/sec	P.E.	m^3/day	l/sec	m^3/day	l/sec			
B-1	Novo Selo	147.00	15	85	7000	1400	38.9	3500	700	24.0	359.4	2886.3	10500	2100.0	2459.4
B-2	Deksion	81.00	10	90	5000	1000	27.8	2500	500	17.0	349.5	2806.7	7500	1500.0	1849.5
B-3	Gjorce Petrov	164.00	55	45	13500	2700	75.0	6750	1350	47.0	353.8	2841.3	20250	4050.0	1403.8
B-4	Vlae2	113.00	15	85	8000	1600	44.4	4000	800	28.0	460.5	3697.9	12000	2400.0	2860.5
B-5	Vlae1	163.00	15	85	4500	900	25.0	2250	450	16.0	398.6	3200.5	6750	1350.0	1748.6
B-6	Karpos 4	6.25	100	0			0.0	0	0	0	0	0	0	0	0
B-7	Karpos4/1	7.25	100	0			0.0	0	0	0	0	0	0	0	0
B-8	Karpos4 kan	236.00	30	70	25000	5000	138.9	12500	2500	87.0	871.9	7001.6	37500	7500.0	8371.9
B-9	Karpos3	142.00	55	45	13000	2600	72.2	6500	1300	45.0	428.9	3444.2	19500	3900.0	4328.9
B-10	Karpos1	324.00	25	75	30000	6000	166.7	15000	3000	104.0	1398.1	11226.6	45000	9000.0	10398.1
B-11	Centar	234.00	25	75	21500	4300	119.4	10750	2150	75.0	1514.6	12162.2	32250	6450.0	7964.6
B-12	Centar1	30.00	0	100	4500	900	25.0	2250	450	16.0	230.1	1848.0	6750	1350.0	1580.1
B-13	Centar2	84.00	20	80	900	1800	50.0	4500	900	31.0	451.0	3622.1	13500	2700.0	3151.1
B-14	Centar3	147.00	20	80	12500	2500	69.4	6250	1250	43.0	676.6	5433.1	18750	3750.0	4426.6
B-15	Centar4	153.00	10	90	17500	3500	97.2	8750	1730	61.0	660.2	5301.5	26250	5250.0	5910.2
B-16	Vardar	633.00	20	80	23500	4700	130.6	11750	2350	82.0	3345.4	26863.8	35250	7050.0	10395.4
B-17	Jane Sandanski	237.00	100	0	28500	5700	158.3	14250	2850	99.0	0.0	0.0	42750	8550	8550.0
B-18	Novo Lisice	102.00	100	0	14000	2800	77.8	7000	1400	49.0	0.0	0.0	21000	4200.0	4300.0
Total B		2917.5	0	0	237000	47400	1316.6	118500	23700	824.0	11498.7	92355.8	355500	71100.0	82598.7
F	Lisice	716			20000	4000	111.1	10000	2000	69.0	4806.0	38592	30000	6000.0	10806.0
Total Right Collector		3693.5	0	0	257000	51400	1427.7	128500	25700	893.0	16304.7	130928	385500	77100.0	93404.7

Table 23 Left collector of the sanitary water, 1999

Area No.	Area covered with the sewage system		Sewage system		Quantity of waste water								Total quantity of waste water		
	Title	Area ha	Separate (%)	Combined (%)	Households			Industry			Storm water in sewage system		P.E.	m^3/day with storm water	m^3/day without storm water
					P.E.	Waste water m^3/day	l/sec	P.E.	m^3/day	l/sec	m^3/day	l/sec			
E-1	½ Madzari	465.00	15	85	7500	1500	41.7	3750	750	26.0	568.5	4565.1	11250	2250.0	2818.5
E-2	1/5 Industrija I	85.60	15	85	3800	760	21.1	1900	380	13.2	209.3	1680.8	5700	1140.0	1349.3
Total E		550.60			11300	2260	62.8	5650	1130	39.2	777.8	6245.9	16950	3390.0	4167.8
C-1	Industrija II	134.00	10	90	9500	1900	52.8	4750	950	33.0	346.9	2785.9	14250	2850.0	3196.9
C-2	1/2 Gazi Baba	122.00	20	80	3750	750	20.8	1875	375	13.0	280.8	2254.6	5625	1125	1405.8
Total C		256.00			13250	2650	73.6	6625	1325	46	627.7	5040.5	19875	3975	4602.7
A-1	Cair	416.00	25	75	61000	12200	338.9	30500	6100	211.8	1495.9	12012.0	91500	18300.0	19795.9
A-2	Stara Carsija	37.00	50	50	2500	500	13.9	1250	250	8.7	53.2	427.4	3750	750.0	803.2
A-3	Kale	124.00	15	85	5500	1100	30.6	2750	550	19.1	303.2	2434.7	8250	1650.0	1953.2
A-4	Butel I	137.00	15	85	6000	1200	33.3	3000	600	20.8	335.0	2690.0	9000	1800.0	2135.0
A-5	Radisani	116.00	15	85	8000	1600	44.4	4000	800	27.8	283.6	2277.7	12000	2400.0	2683.6
A-6	Suto Orizari	154.00	20	80	15000	3000	83.3	7500	1500	52.1	354.4	2845.9	22500	4500.0	4854.4
A-7	1/2 Gazi Baba	122.00	20	80	3750	750	20.8	1875	375	13.0	280.8	2254.6	5625	1125.0	1405.8
Total A		1106.0			101750	20350	565.2	50875	10175	353.3	3106.1	24942.3	152625	30525.0	33631.1
G-1	½ Madzari	232.5	15	85	7500	1500	41.7	3750	750	26.0	568.5	4565.1	11250	2250.0	2818.5
G-2	4/5 Industrija I	342.4	15	85	15200	3040	84.4	7600	1520	52.8	837.2	6723.0	22800	4560.0	5397.2
Total G		574.9			22700	4540	126.1	11350	2270	78.8	1405.7	11288.1	34050	6810.0	8215.7
D	Industrija I I	139.00			4700	9400	26.1	2350	470	16.3	339.9	2729.3	7050	1410	1749.9
Total Left Collector		2394	0	0	153700	30740	854	76850	15370	534	6257	50246	230550	46100	52367

Source: Kruger Study,1999, Waste water, Water quality and Solid Waste Management of Macedonia

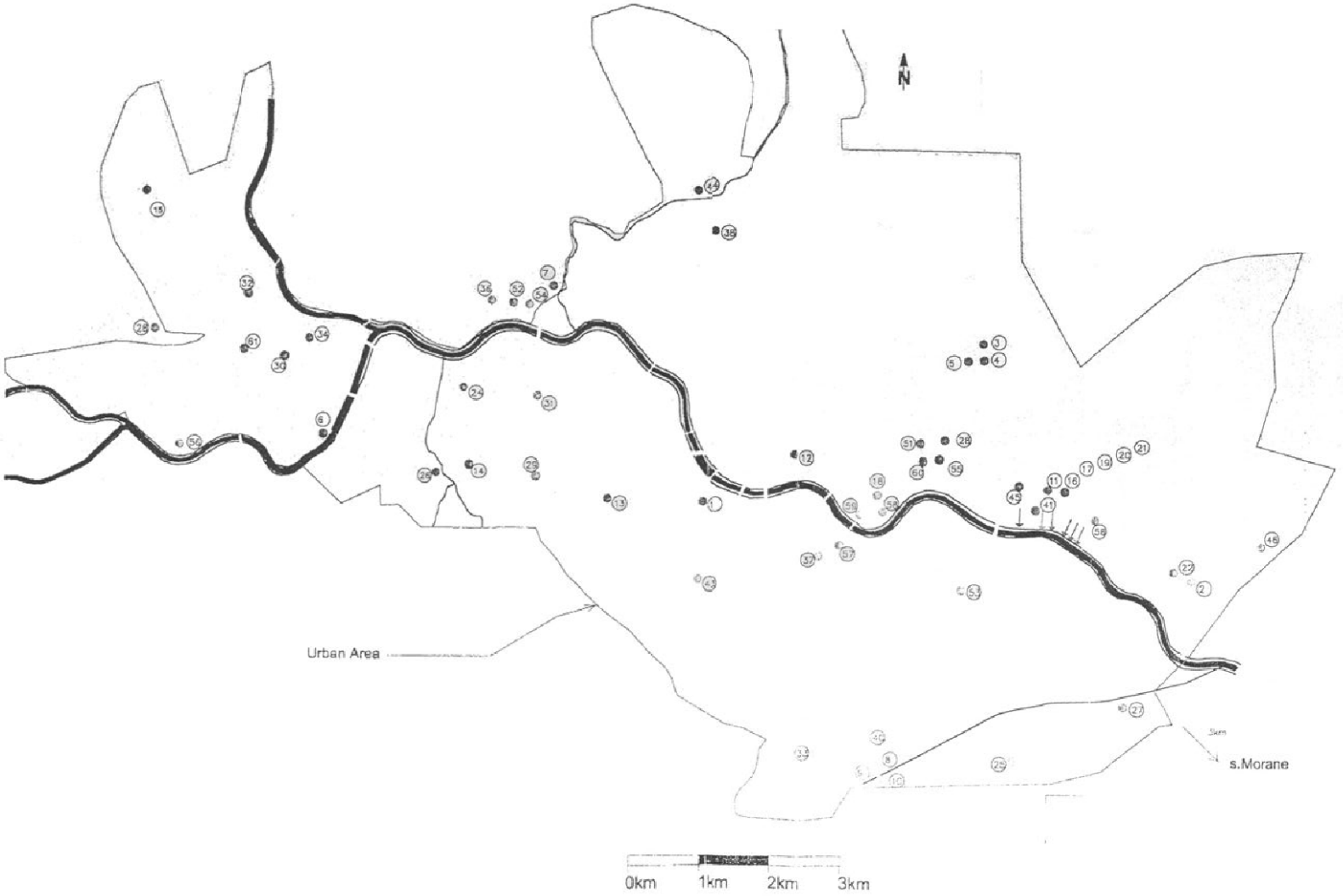

Figure 9 Map of the sewage outlets – industrial waste water

Table 24 Selected Industries with outlets presented on Figure 9

Industry no		Area no.	Water consumption m^3/year	Present recipient	Present Outlet no	Future recipient
3	LADNA VALAVNICA A.D (Rolling mill)	C		Vardar	39	Sewer
4	MAK STIL A.D.	C		Vardar	39	Sewer
5	RZ VALAVNICA ZA LENTI	C		Vardar	39	Sewer
6	KUPRUM	B	16 385	Sewer	23	Sewer
18	FAS 11 OKTOMVRI	D	166 044	Vardar	37	Sewer
16	MZT FAM, doo	G	238 812	Vardar	28	Sewer
9	GLASS AND GLASS WOOL FACTORY	F	3 347	Vardar	26	Sewer
25	OHIS a.d	F	477 684	Vardar	26	River
27	HEMTEKS	F	33 794	Vardar	26	River
28	ALKALOID	B	151 404 + 30792 from own wells	Vardar	23	River
14	ALUMINA A.D.	B	563 184	Sewer	23	Sewer
29	PLASTIKA A.D.	B	19 344 + 12000 from own wells	Sewer	23	Sewer
32	ADING	B	25 704	Sewer	23	Sewer
38	TIPO, a.d.	A	207 996	Sewer	40	Sewer
40	CEMENTARNICA USJE	B	244 932	Vardar	23	Sewer
41	KOZARSKI KOMBINAT GOCE DELCEV A.D GODEL	G	130 022	Vardar	28	Sewer
45	KLANICA NA KOZARSKI KOMBINAT GOCE DELCEV A.D	D	119 498	Vardar	37	Sewer
55	PIVARA a.d.	D	1 083 636	Vardar	37	Sewer
43	ZITO LUKS	A	119 696		40	Sewer
44	ZITO SKOPJE	A	94 306		40	Sewer
46	MLEKARNICA A.D.	G			28	Sewer
47	Dairy ANA	?			?	Sewer
48	Dairy MAKI	?			?	Sewer
49	Dairy MILKA	?			?	Sewer
50	MASKO	?			?	Sewer
51	EVROPA A.D.	D	166 656	Sewer	37	Sewer
53	INO SPEKTAR	B	21 105		23	Sewer
56	SLOVIN JUGOKOKTA	B	44 823		23	Sewer
57	SPEKTAR - LOZAR	B	13 005		23	Sewer
58	KOMUNA a.d KERAMIDNICA	G	43 164	Vardar	28	Sewer
	KOMUNA a.d	A	9000	Vardar	40	Sewer
60	PTE SKOPJE	A	266832 + 9204 from own wells	Vardar	40	Sewer
61	PTE SKOPJE	B		Sewer	23	Sewer

Source: Kruger Study,1999, Waste water, Water quality and Solid Waste Management of Macedonia

2.1.11 Solid Waste

2.1.11.1 Municipal Solid Waste

Municipal solid waste (MSW) includes those wastes which are collected from households, together with street sweepings and park wastes, commercial-institutional waste and wastes generated in industry with household like character. A small proportion of the household waste stream is hazardous:

household batteries containing heavy metals and acids, outdated medicines, residues of packaging of household cleaning materials, garden pesticides, etc.

It is the major stream in the total waste quantities generated in Macedonia. The municipal waste generation broadly follows the pattern in which denser urban areas produce higher volumes of MSW waste than municipalities in predominantly rural areas. Reliable statistical information on MSW generation is not available.

Quantities of municipal waste generated on territory of Skopje and landfilled on Drisla Landfill are presented in the Table 25.

Table 25 Quantities of municipal waste generated in Skopje and landfilled on Drisla Landfill

	Collector	Year 2003 (tones)	Year 2004 (tones)	Year 2005 (tones)
1	Public Communal Enterprise "Communal Hygiene".	124.727	95.794	128.000
2	Private Communal Enterprises	10.442	7.430	11.000
Total		135.169	103.224	139.000

Source: Public Communal Enterprise "Communal Hygiene".

Waste collection services are executed by the Communal Enterprises. Only a small proportion of waste collectors are private companies, typically those dealing with waste in rural areas.

Regular waste collection services are mainly limited to urban areas, with little or no attention paid to rural settlements. In total about around 70% of the total population receive regular waste collection services and only about 20% of the population in rural settlements.

Standardization is absent, since Communal Enterprises using all different types and sizes of collection and/or compaction vehicles and containers. In rural areas the limited collection services, are usually performed by a tractor and trailer, sometimes by a small multi-purpose municipal vehicle.

Most of the MSW and other collected wastes are deposited without any pre-treatment at Landfill Drisla or at wild dump sites.

Separate collection of municipal waste does not exist, except for some separate bulky waste collection.

The financing of the municipal solid waste management systems is to be provided by the user fees paid by the receivers of the waste collection services, e.g. the households. The fees are invoiced and collected by the Communal Enterprises. The base for setting the fees is made by the following charging criteria:

- Charge per m^2 of house and yard (by rule in urban municipalities)
- Flat fee per household / month (mostly being the case in rural and some semi urban municipalities)

In general the revenues obtained from the households and other sources are not sufficient to cover the costs of operating the services.

2.1.11.2 Packaging Wastes

Most of this waste stream was disposed of in the landfill or dumpsites as a constituent of MSW and similar commercial/industrial solid wastes. At present the capacity for recycling, reuse and recovery of packaging is very limited. Some facilities exist for metals, paper & cardboard, PET, PVC and HDPE recycling, but these are not currently operating at full capacity. There are some recycling activities in the informal sector with growing tendency due to the increased interest of numerous small private companies to get involved in the recycling business.

The recovery of the various types of potentially recyclable materials is considered not financially viable under prevailing conditions.

2.1.11.3 Industrial Solid Wastes

Industrial solid wastes consist of all solid waste generated in industries, either from the industrial process or any other source within the industrial premises. Distinction has to be made between industrial non hazardous waste and industrial hazardous waste (all hazardous wastes generated within the industrial premises). Treated industrial wastewaters (e.g. sludge) that comprise hazardous constituents exceeding minimum standards/norms are included in total HZW quantities.

Generally the HZW generators don't separate, but mix the different types of hazardous wastes with the other, non-hazardous wastes. The separation of some HZW streams waste types is primarily driven by market demand i.e. only those types of HZW wastes are separated that can be sold. There aren't any officially licensed collectors and transporters of HZW in the country.

2.1.11.4 Medical Waste

"Medical waste" (MeW) is considered solid wastes generated in medical and health institutions (dispensaries, hospitals, policlinics and outpatient departments, dental clinics etc.), which originated from used items and materials as a result of diagnosing, medical treatment and prevention of diseases in humans and animals;

According to the data obtained from the Sanitary Landfill "Drisla", department of Public Enterprise "Communal Hygiene", quantity of solid medical waste from Health Care Facilities in Skopje they collect, transport and incinerate is about 1.3-1.5 tons/per day (about 360 tons/per year). By the safe management of solid medical waste are covered all Public Health Care Facilities in Skopje and two bigger Private Health Care Institutions. The small private ambulances (more than 300) are not fully covered yet because of their refusal to be involved in this process.

The quantity of veterinary waste in Skopje is estimated to total of 6,524 tons per year: 1,624 tons from animal corpses (cows, pigs, sheep, horses and poultry) and 4,900 tons from slaughter losses. There is no data for handling and treatment with the veterinary waste (Local Environmental Action Plan for the city of Skopje, LEAP; 2004: 65).

2.1.11.5 Special waste streams

Waste streams requiring special consideration are following:

- Waste oils - Presently there is no system in place for collection and processing of used engine oils and components. Most of the waste oils are currently irregularly landfilled, spilled or burnt.
- Oils containing PCB Bigger energetic facilities are still used PCB oil containing transformers. Some of this waste is intended to be collected exported and disposed out of the country. There doesn't exist any capacity at local laboratories in Macedonia to identify PCB and PCT contents in solid wastes.
- End of Live Vehicles (EoLV) - There is no any organized collection of EoLV. The car wrecks are usually picked up by the informal sector. The scrap metals are exported, or delivered to the steel factory in Skopje.
- Car batteries and accumulators - Spent batteries used in home appliances are mainly disposed as a constituent of MSW in landfills.
- Used tires - Part of the annually generated used tyres are collected and used as fuel in not controlled process of tar and lime production, but most used tyres are currently landfilled. Energy recovery is not applied presently.

2.1.11.6 Waste Infrastructure and Facilities

The solid waste generated in Macedonia is mostly disposed of by landfilling.

The landfill Drisla, serving the Skopje region, is the only landfill in Macedonia which is relatively well managed.

2.1.11.7 Drisla Landfill

Location of the Drisla Landfill is in the Markova Reka Watershed, on the contrary declivity of the village Batinci, 14 km southeastern of the center of Skopje. It spreads on surface of 76 ha, but it's foreseen its maximum capacity to be 56 ha and exploitation period of 30 years. It capacity corresponds to value of 16 Mt of waste, and around 6% of its designated capacity has been utilized.

As a result of good infrastructure connection and physical separateness from the near settlements, the landfill site location is assessed as acceptable. However, no special construction measures have been taken to prevent possible percolation of leachate into the upper and lower aquifers.

Collected municipal waste quantities of approximately 500 tons per day are landfilled on Drisla Landfill. Filling of the landfill is performed in layers, each 2,5 m high. The available mechanization at Drisla landfill is relatively old and insufficient. However, the environmental management of the Drisla landfill needs further improvements. Plans to install impermeable lining to prevent

possible groundwater contamination and collection of landfill gas have not yet been realized;

Figure 6: Drisla Landfil

2.1.11.8 Drisla Incinerator

Drisla incinerator has a capacity of 200 kg/hr and it does not have a separate air treatment system. The incinerator works in two shifts, 2 employees (in one shift), In total, they have 7 employees working only to cover the above mentioned activities.

After burning of solid infectious waste, the remaining ash finally is disposed on the Drisla Landfill, near to the incinerator.

Medical waste incinerator has been installed and started operation in the year 2000. Main characteristics of the incinerator are presented in Table 26.

Table 26 Characteristics of the incinerator

Item	Specification
Actual waste input (year)	2001: 230 ton, 2002: 240 t on (estimate)
Incineration temperature	Chamber 1: 800°C, Chamber 2: 1000 °C
Flue gas cleaning system	Non additional cleaning system beside secondary chamber
Capacity (hour)	200 kg/hour, approx 1 ton/ shift
Emission Data	Inspection by Inspectorate of the Ministry of Environment
Ash disposal	Land filling

2.1.12 Biological Environment

In relation to the biogeographically characteristics the territory of the city Skopje has distinctive number of plants and animals. The vegetation is represented with 3 basic regions: the plain part, the forest part and the part of high mountain land. The vegetation is presented with bushes of pine and pine-scrub, firtree forests with blueberries. The most representative tree is the tumult than maple-tree, ash-tree, hazel-tree and others. In the lower parts is represented with the white oak and the oak "blagun". These forests were more represented and occupied large part of the lower areas. The wild briar and the rest of the oak blagun – white oak forests are found extending along the lower part of the flow of the Markova River and the river Vardar.

The vegetation and the animal world are quite distinctive and exuberant. In the past the presence of the trout was large while today this kind is gone. Another species present are the carp, the vardaric "mrena", the spring "mrena". In the riverbeds of these rivers and in the close coastal parts there are frogs and representatives of the other water animals.

From the reptiles there are the lizards and snakes. The most representative snakes are the "poskok" and the "sharka". There are turtles, hedgehog, filed mice, moles and others.

The birds are present in large number. The most numerous are the sparrows, magpie, doves, ravens, crows, alpine crows, swallows, hawks and owls.

The mammals are represented with numerous species. Some of them are before extinction such as the deer, the wild goat, and the lynx has long disappeared. In the group of existing representatives the most characteristic are: wolf, fox, wild pig, rabbit, squirrel, marten, groundhog, the mole and others. The extreme forest falling and reuse of the pasture fields have limited the existence of these and other animals. That is the reason for reduction of certain species and why other has permanently disappeared.

The analysis has been made in accordance with the contemporary ecological approaches and has been presented by an up-to-date ecological terminology. The ecosystems have been reviewed as an integral part of the landscape, taking into consideration the interactions of the anthropogenic activities, the social metabolism and the anthropogenic biotopes in a natural environment.

The text gives a description of the biotopes being met in the area of interest, i.e. their most important characteristics have been covered, such as spreading, surface, description of the plant community, the flora content and some more significant animal species. Within this scope a complete composition of the avifauna has been given, along with a list of all species of significance for the preservation of the biodiversity in accordance with all conventions and laws of the European Union. As for the other animal species, only some more important groups have been studied, such as mammals, ground-beetles or some particularly significant species, i.e. those significant from biodiversity aspect.

2.1.12.1 Landscape characteristics

From a biogeographic standpoint, this area is located in the zonobiom of the sub-Mediterranean Balkans forests according to Matvejev (1995), while according to the climate-vegetation-soil classification, Macedonia is in the continental-subMediterranian region characterized by climate zonal community of the Bubescent oak *(Quercus pubescens) and oriental hornbeam (Carpinus orientalis),* (Filipovski et al. 1996).

According to the classification of the European landscapes, this zonobiom belongs to landscape types – Mediterranean open surfaces (Stanners and Bordeau 1995).

2.1.12.2 Description of biotopes

This chapter describes the biotopes found around the Skopje. For each biotope a short description is given about the vegetation community that determines the biotope. Within this chapter are listed the more significant species of plants and animals, the distribution of that community in Macedonia (out of which, the significance and this community on the biodiversity in Macedonia, may be defined).

Community of Oriental hornbeam and Pubescent oak

This biotope belongs to the zonobiom of the sub-Mediterranean Balkan forests. Characteristic association is Querco-Carpinetum orientalis mecedonicum Rud. 39 apud Ht. 1946. This thermophilic community is developed on skeleton soils (silicate and carbonate ones). The edifactor in the community is *Quercus pubescens* and very common is also the *Carpinus orientalis.* Apart from these two dominant tree-like plants, may be found *Fraxinus ormus, Pistacia terebinthus, Colutea arborescens, Coronilla emeroides, Acer monspessulanum, A. tataricum, Crataegus monogyna, Ulmus campestris, Sorbus torminalis, Rhamnus rhodopaea, Ruscus aculeatus, Hedera helix.* In the group of grassy plants, the following taxons are developed: *Cyclamen neapolitanum, Lathyrus ventus, Anemone apenina ssp. blanda, A. purpureoviolacea, A. ranunculoides, Lithospermum purpureocoeruleum, Cardamine graeca, Carex halleriana.*

The mammals are represented by species, such as: *Vulpes vulpes, Felis sylvestris, Canis lupus, Canis aureus, Meles meles, Martes foina, Mustela nivalis, Lepus europaeus, Apodemus flavicollis, Apodemus sylvicollis, Glis glis, etc.*

For biodiversity preservation are the following species: *Canis lupus, Canis aureus, Testudo hermanni, Testudo graeca, Rana dalmatina, Bufo viridis, Elaphe longissima, Meles meles, Martes foina, Mustela nivalis.* They are listed in the appendices of the Bern Convention and the EU Directove for preservation of the wild species and their domiciles as strictly protected species (Appendix II) or as protected species (Appendix III).

Most characteristic types of insects are: Carbus violaceus, Carabus intricatus, Molops rufipes, Myas chalybaeus, Cymindis lineata, Cymindis axillaris. Brachinus explodens, Brachinus crepitans, Calathus fuscipes, Calathus melanocephalus, Pterostichus melas depressus, etc.

Lands under cultivation

- *Fields, plowed fields and gardens*

The lands under cultivation are represented mostly by wheat cultures.

Cultivation of garden plants is also a common practice, especially in the vicinity of inhabited places.

There are many species of birds that feed themselves from the lands under cultivation. Most common of them are: *Ciconia ciconia, Melanocorypna calandra, Miliaria calandra, Corvus cornix, Coloeus monedula, Pca pica, Passes domesticus* and many others. The birds of prey constantly fly over the area in search of prey *(Buteo buteo, Buteo rufinus, Falco tinnunculus).*

The insects of the ground – beetle family (Carabidae), some characteristic species are met that feed themselves with cultivated plants, such as *Harpalus rufipes, H. autumnalis, H. serripes, Chlaenus vestitus, Chlaenius skopljensis,Dixus obscurus* and *Dixus eremita.*

As a more significant insect may be pointed out *Chlaenius skopljensis*, which is an endemic species, characteristic of the Skopje Valley, and is mostly found in the surroundings of Katlanovo.

Ruderal communities

The ruderal grassy biotopes develop in smaller strips around the roads,

railroads, and seldom around the fields, or in the villages in form of small areas. In regard to their small and diffusely distributed area, it is not possible to show them on the biotopes' map.

They are presented in plant communities found everywhere in the man's settlements or by the roads, i.e. the existence of the human activities conditions the existence of such communities. Hence the species forming these communities are widely spread (cosmopolitan species), and therefore is not of special interest for the biodiversity protection.

Katlanovsko Blato (wetland)

Katlanovsko Blato is located on the extreme south of the area of interest, at 222 a.s.l. present surface is about 20 ha, and thus its significance for the biodiversity nowadays is highly reduced (compared to the former big Lake Katlanovo). This small area is recovered by the community of reed (*Phragmites communis*) and there is not water on this area throughout the whole year. It dries up during summer period, and in addition to the small surface, it is an additional cause for the small number of animal species found there.

The plant community which is being developed is the association Scirpeto-Phragmitetum W. Koch 1926 is most widely spread mud community in Macedonia.

We have noted a small number of birds typical for water habitats, such as *Ergetta garzetta, Ciconia ciconia, Acrocephalus arundinaceus, Ardea cinerea, Circus cyaneus, Gallinula chloropus,*

The most common insects are the ground-beetles, such as *Chlaenius vestitus, Agonum sp., Natiophilus sp, Pterostichus nigrita, Elaphrus cupreus, Amara aenea, Bembidion spp., Tachyura diabrachys bisbimaculatus, Badister bipustulatus,* and a great number of other species.

As far as the plans for revitalization of Katlanovsko Blato are realized, then it would be a biotope with huge species richness and specially a great diversity of birds, since it is located on the established migration routes for numerous birds, which could find in the mud a passing- by stop for rest and food).

2.1.13 Review of sensitive areas in and around Skopje City

According to the Spatial Plan of the Republic of Macedonia, on the territory of Skopje and its surrounding there are 9 location designated as protected areas.

The main ecosystem locations are given in ANNEX 4a (Google view on ecosystem at Trubarevo location) and ANNEX 4b (Topography map with protected areas.

Classification of each location is made according to the provisions of the World Conservation Union (IUCN - Union for the Conservation of Nature and Natural Resources). In that respect protected areas in Skopje are classified in categories III, IV and V, where:

Category III (*Natural monument) is : protected area managed mainly for conservation of specific natural features* – area containing specific natural or natural/cultural feature(s) of outstanding or unique value because of their inherent rarity, representativeness or aesthetic qualities or cultural significance.

Category IV(*Habitat/Species Management Area) is protected area managed mainly for conservation through management intervention* – area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats to meet the requirements of specific species.

Category V: *Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation or recreation* – area of land, with coast or sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.

Protected areas in and around Skopje City are given on Table 27 to

Table 29.

Table 27 Natural Monuments (IUCN Category III)

No.	Name	Region	Area (ha)	Protected since year	Description	Features
1.	Trubarevo	Skopje	3.3	1965	Arboretum	Dendrologic/forestry features
2.	Ostrovo	Skopje	13	1976	Unique bird resort in the Skopje region	Faunal features
3.	Skopje fortress	Skopje	0.68	1987	Paleontolo{ki lokalitet	Geologic-paleontological, mineralogical- petrografic features
4.	Katlanovo region	Skopje	5442	1991	Tectonic rift 350 m long, mineral resources	Surface geomorfologic features Hydrologic features, Geologic-paleontological, mineralogical- petrografic features Floristc features
5.	Matka Canyon	Skopje	5442	1993	Penetrance canyon, number of caves, important refuge for significant number of flora and fauna species	Surface geomorfologic features Subterranian geomorfologic features Hydrologic features Faunal features

Table 28 Sites of Special Natural Character (IUCN Category IV)

No.	Name	Region	Area (ha)	Protected since year	Description	Features
1.	Vodno	Skopje	1953	19 70	On higher parts of Vodno hill are preserved several hundred trees of chestnut, oak and ash. Mastodon anquistideus are found on paleontologic locality miocen age, northeast of Nerezi village.	Dendrologic/forestry features
2.	Kožle	Skopje	85	1985	The northern position of Juniperus excelsa on Balkan Peninsular	Dendrologic/forestry features

Table 29 Areas outside Nature Reserves containing certain Plant and Animal Species (IUCN Category V)

No.	Name	Region	Area (ha)	Protected since year	Description	Features
1.	Katlanovo Wetland	Skopje	70.0	1965	Botanical-ihtiologic-ornitological reserve	Faunal features
2.	Rucica	Skopje	1785	1969	Reserve of pine (Pinus mugo) (1500-2000 m)	Dendrologic/forestry features

2.2 Socio-economic analysis

The City of Skopje is administrative, economic cultural and educational centre of the Republic of Macedonia. It is a major centre for the metal-processing, chemical, timber, textile, leather, and printing industries in the country. Industrial development of the city has been accompanied by developments of the trade and banking sectors, as well as an emphasis on the fields of culture and sport.

The organisation of Skopje, like a distinct unit of the local-selfgovernment is defined by the Law of Skopje

2.2.1 Population

According to the official data from the state statistical office of R. Macedonia and the last census in 2002, the population of Skopje was 506,926 people

Table 30 Skopje Population; Breakdown by ethnic background

Municipality	Total	Macedonians	Albanians	Turks	Romas	Vlahs	Serbs	Bosnians	Others
Aerodrom	72009	64391	1014	430	580	501	3085	538	1470
Butel	36154	22506	9107	1304	561	120	1033	970	553
Gazi Baba	72617	53497	12502	606	2082	236	2097	710	887
Gjorce Petrov	41634	35455	1597	368	1249	109	1730	489	637
Karpos	59666	52810	1952	334	615	407	2184	98	1266
Kisela Voda	57236	52478	250	460	716	647	1426	425	834
Centar	45412	38778	1465	492	974	459	2037	108	1099
Chair	64773	15628	36921	4500	3083	78	621	2950	992
Shuto Orizari	22017	1438	6675	56	13342	-	67	177	262
Saraj	35408	1377	32,408	45	273	-	18	1,120	167
TOTAL	506926	338358	103891	8595	23475	2557	14298	7585	8167

Source: State Statistical office , 2006

Presented data show that Skopje is a multiethnic community, where the following ethnic groups are represented, Macedonians 64.2%, Albanians 25.2%, Turks 3.9%, Romas 2.7%, Vlahs 0.5%, Serbs 1.8%, Bosnians 0.8% and 1%Others

The population density strongly varies in various urban parts of the city. The total urban service area is around 6,100 hectares, yielding average density of 65 inh/ha.

The growth rates of 0.8% for the urban part of Skopje and 2.0% for the rural settlements within the service extent of Vodovod have been proscribed by the Statistical Institute of Macedonia.

2.2.2 Work force and employment

The work force and the active part of the population are considered as most important categories in the demographical and economical structure of the population.

The working force is the drive behind all the activities, its being recruited from particular groups among the population, men between 15-64 years old and women between 15-59 years old. The size of the work force population is defined by the dynamic of the population growth rate, mortality and the age structure of a particular population group.

The Table 31 reflects the statistical data drawn from the population census in 2002 in Macedonia.

Table 31 Working force, and unemployment rate in Skopje

Municipality	Working force	Employed	Unemployed	Unemploy-ment rate	Employ-ment rate
Aerodrom	35484	28310	7174	20.22%	79.78%
Butel	13821	9824	3997	28.92%	71.08%
Gazi Baba	29326	19766	9560	32.60%	67.40%
Gjorce Petrov	18584	13586	4998	26.84%	73.11%
Karpos	26212	21784	4428	16.89%	83.11%
Kisela Voda	25068	18582	6486	25.87%	74.13%
Saraj	7661	2891	4770	62.26%	37.73%
Centar	19967	16662	3305	16.55%	83.45%
Chair	19179	10433	8746	45.60%	54.40%
Shuto Orizari	5635	1970	3728	65.04%	34.96%
TOTAL for Skopje	200937	143745	57192	28.46%	71.54%

Source: Employment agency of Republic of Macedonia

2.2.3 Households and accommodation

While analyzing the accommodation conditions in Skopje an important indicator is the bigger percentage of individual houses in rural and sub-urban areas.

The Table 32 reflects the situation of the total population and households as well as the types of accommodations/residences in each of the municipalities in Skopje.

Table 32 Total population, households, flats and capacity of surface occupied

Municipality	Total population	Number of households	Number of dwellings	Surface occupied by flats (m^2)	Average floor surface by member of household (m^2)
Aerodrom	72009	21495	23741	1636724	20.44
Butel	36154	10056	11058	847644	20.07
Gazi Baba	72617	20336	22739	1521629	18.27
Gjorce Petrov	41634	11886	13928	1015762	20.60
Karpos	59666	19680	22838	1590358	22.76
Kisela Voda	57236	17577	20221	1390968	21.03
Saraj	35408	7972	7828	567092	14.58
Centar	45412	15355	18853	1371812	24.71
Chair	64773	17107	17122	1052052	14.92
Shuto Orizari	22017	5102	5251	320988	13.19
Total in Skopje	506926	146566	163745	11315029	190.57

Source: State statistical office (census 2002)

Connection rate to the municipal water supplying system is estimated at 96.1% and the rest of 3.9 % have own water supply boreholes.

2.2.4 Education

The education of the population is organized through the system of educational institutions-schools (for elementary, secondary, high and university education). The general attributes of the educational system is conditioned first of all by the needs of the society-community and the level of the development of the educational needs

Out of all listed levels of education, only the elementary (primary) education, covering the children between 6-14 years old is obligatory and requires a compete integration of all the children at this age, while in the remaining levels of education the beneficiaries participate based on preferences and possibilities. The elementary education is composed of two parts; lower and higher. The lower elementary education starts at grade 0 and ends at grade 4, the higher elementary education starts at grade 5 and ends at grade 8.

Table 33 Level of education

Municipality	Without education	Incomplete primary education	Primary school	Secondary school	High school	Faculty /Academy	Master degree / doctorate
Aerodrom	488	2264	9254	35078	2535	10603	294
Butel	733	1964	8037	14603	991	2244	118
Gazi Baba	2069	5098	16112	30010	1296	3197	124
Gjorce Petrov	587	2264	7435	19461	1231	2911	117
Karpos	620	2259	6481	25444	2740	11595	981
Kisela Voda	714	3122	9425	27049	1755	4924	231
Saraj	1252	2319	17139	3563	190	360	12
Centar	351	1434	4900	18313	2194	11080	1080
Chair	2576	4933	20533	17293	1203	2542	102
Shuto Orizari	1869	2635	8092	2611	59	98	3
Total in Skopje	11259	28292	107408	193425	14194	49554	3459

Source: State statistical office (census 2002)

2.2.5 Health

Health protection in the Republic of Macedonia is organized in three levels as primary, secondary and tertiary health protection institutions. On the territory of Skopje there are both public and private health protection organization.

The Table 34 presents bed's fund in Skopje region:

Table 34 Bed's fund in hospital-stationeries institutions on secondary level in the Republic of Macedonia, in year 2000

Health regions	General hospitals	Specialized hospitals	Centres for therapy and rehabilitation	Hospital for therapy with natural factor	Total
Republic of Macedonia	4164	1615	495	180	6454
Skopje	/	275	100	180	555

Source: Health Fund of R. Macedonia

2.2.6 Economic parameters

2.2.6.1 Income of the Population

The following information has been extracted from a social survey carried out within the Project. Bearing in mind the sensitivity of the income issue, the survey tried to overcome problems of inappropriately presented household revenues by including further means of evaluating the respondents' wealth, e.g. by evaluating cross reference to each respondent's self assessment of their household's purchasing power and types of expenditures made recently. In any case, it is generally accepted that nominal income values within Macedonia should be considered taking into account the impact of the shadow economy, but it is difficult to assess exact figures.

The responses on the households' income for the Skopje region are presented in Table 35.

Table 35: Number of households for each income groups

Income groups (MKD/month/HH)	No of HH	% of total
up to 8,000	57	14.1%
8,001-14,000	76	18.9%
14,001-18,000	66	16.4%
18,001-24,000	81	20.1%
24,001-35,000	58	14.4%
35,001-50,000	32	7.9%
over 50,000	16	4.0%
Did not answer	17	4.2%
Total	*403*	100.0%

The results show that a considerable number of HH belong to the middle income group (14.000 to 35.000 MKD/month/HH) whereas only few can be considered as below poverty level.

The reliability of those HH having been classified as very poor is difficult to assess as outlined above. It is often discussed how honestly households answer questions on their income due to the fact that most of them receive social benefits, which would be lost if any additional and not registered source of income would be presented. Apart from this, the estimation of the demand levels differed strongly among the households, because the "demand" is subject to very broad scale of basic and other kind of expenditures.

2.2.6.2 Fee Collection

The method of billing and the price level for water supplying and waste water collection is regulated at City level which on the recommendation of the Management Board of the Public Enterprise for water supplying is approved by the City of Skopje council. The water supplying and waste water collection bill for households is on the same bill for the waste collection services. Industries and bussiness facilities have separate bills for water supplying/waste water collection and waste management services.

Table 36 shows current costs per m^3 for households and industry/commercial entities

Table 36 Current costs for water supplying and wastewater collection

Service	Fees per m^3

	Household		Industry/ bussiness entities	
	MKD denars	Euros	MKD denars	Euros
water supplying and wastewater collection	29.39	0.479	65.80	1.073
water supplying	17.25	0.281	46.63	0.761
wastewater collection	12.12*	0.198	19.17	0.312

Source: "Vodovod" – Skopje

There is no household receiving only wastewater collection service.

According to Water supplying enterprise "Vodovod"-Skopje, collection rate vary between 60% from the households and 70% in industry/business entities.

2.2.6.3 Land use and acquisition

Information about land use in the area determinate as route for collector system is relevant in order to perform both environmental impact assessment and to approximate costs for expropriation. Due to the fact that detailed study on expropriation of land for construction of collector system has not been prepared since preparation period of this report, data form the Ministry of transport and communication are used as source of information.

Due to the data from Ministry of transport and communication route of collector system pass trough five cadastre areas as follows: City of Skopje, Kisela Voda 2, Madzari, Gazi Baba and Trubarevo. Bearing in mind that Cadastre of the City of Skopje is currently under the process of upgrading, some data given in following tables might slightly vary after its finalization.

Total area of the parcels that are subject of expropriation is 2.349.762 sq. meters. Data about surface of land that should be expropriated per parcel are not available. Table 37 presents total surface of the parcels per cadastre area:

Table 37 Surface of parcels per Cadastre area

Cadastre area	Kisela Voda 2	Madzari	Gazi Baba	City of Skopje	Trubarevo	Total
Surface (m^2)	687.410	479.978	84.147	444.260	653.967	2.349.762
%	29,3	20,4	3,6	18,9	27,8	100

Ownership of the parcels varies between cadastre areas. Some of the parcels are under process of privatization both through denationalization or buying the state owned property. In some cadastre areas there are few parcels with unknown ownership.

Review of the ownership of the parcels is given in Table 38.

Table 38 Ownership of parcels per Cadastre area

Owner / Cadastre area	Republic of Macedonia	Legal entities		Private property		Unknown owner	
	Surface (m^2)	Surface (m^2)	No. of companies	Surface (m^2)	No. of owners	Surface (m^2)	No. of parcels
Kisela Voda 2	448968	124197	3	79723	63	21154	2
Madzari	188636	201528	5	89814	33		
Trubarevo	304121	34447	1	5373	4		
City of Skopje	163647	269959	3	10654	18		
Gazi Baba	61508	4142	12	14396	56	4101	2

Current land use of the parcels which are subject of expropriation is presented on Figure 10 to Figure 14. Presentation of land use is made per Cadastre area.

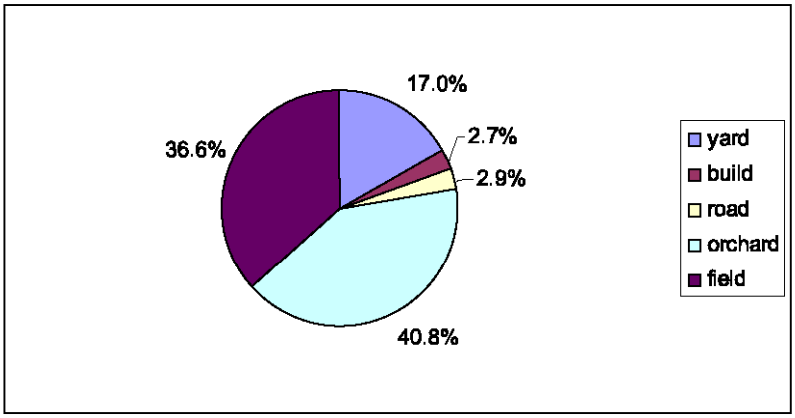

Figure 10 Current land use in the Cadastre area Kisela Voda 2

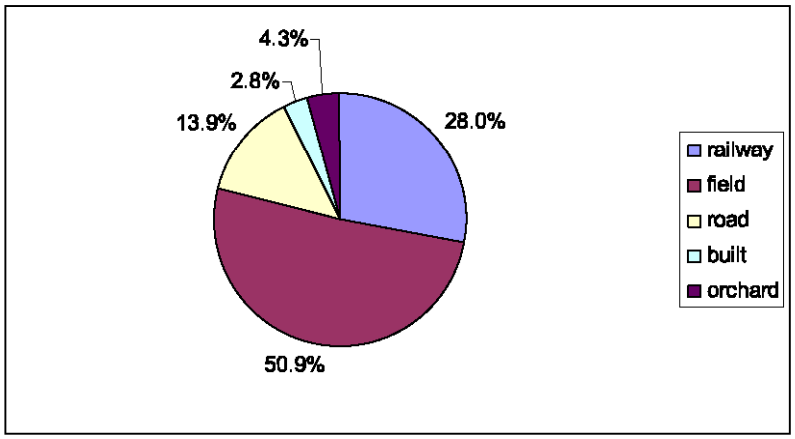

Figure 11 Current land use in the Cadastre area Gazi Baba

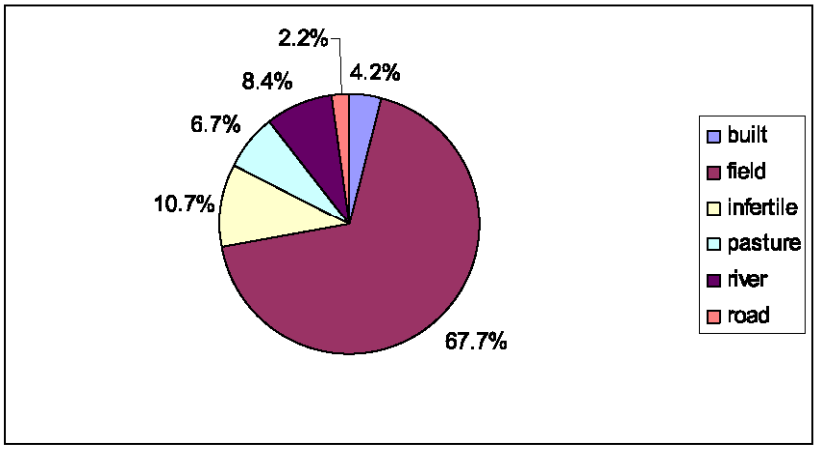

Figure 12 Current land use in the Cadastre area Madzari

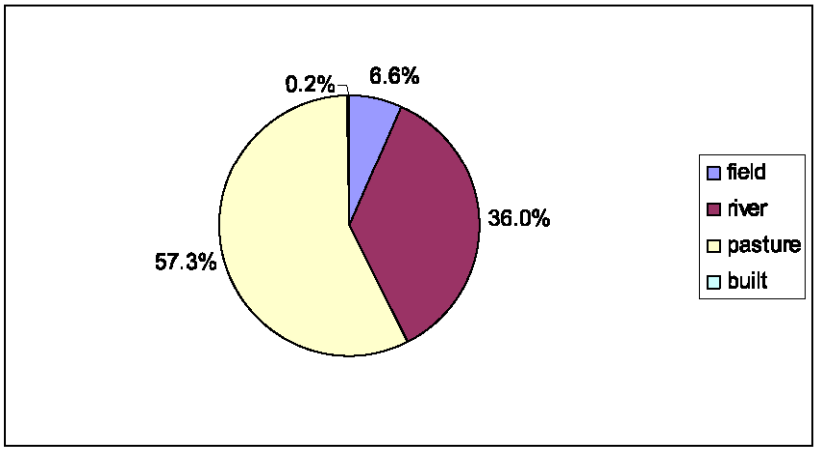

Figure 13 Current land use in the Cadastre area City of Skopje

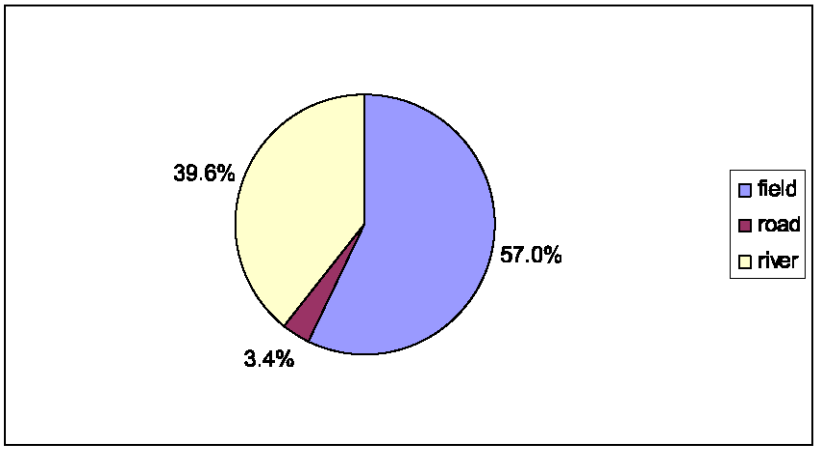

Figure 14 Current land use in the Cadastre area Trubarevo

3 ASSESSMENT OF ENVIRONMENTAL IMPACTS AND ANALYSIS OF ALTERNATIVES

The proposed project - Waste water Treatment Plant for Skopje City belongs to the Annex I type of projects according the "Decree determining projects for which and criteria on the basis of which the screening for an environmental impact assessment should be carried out" (Official Gazette of R. of Macedonia No. 74/2005) as the capacity of the WWTP is for more than 10 000 e.p.

This means that for the proposed project the full Environmental Impact Assessment procedure should be carried out by the investor according the Law on Environment (Official Gazette of R. of Macedonia No. 53/2005) in order to identify the interactions between project activities/actions and different characteristics of the project environment as well as to determine the significance of the environmental impact during the all phases of the project life cycle (pre-investigations, construction phase, operation and decommissioning).

Within the process of preparation the Feasibility Study-Basic Plan for WWTP for Skopje City, the Initial Environmental Examination (IEE) level study has been prepared including analysis of alternative plans, assessment of environmental impacts, mitigation measures and monitoring plan with institutional arrangements on the basic of secondary data and simple field surveys. This so called "preliminary EIA" study addresses the effect of the project activities during construction and operational phase on the main three groups of environmental elements (social and economic elements, natural environmental elements and public hazardous elements).

The Consultant Team has used already known and well accepted methodology and different tools (scoping check lists and Leopold Matrix) in order to answer the three primary questions:

- What effects could the WWTP and collector system have on the environment?
- Which of these effects are likely to be significant and need particular attention in the full EIA Study?
- Which alternatives and mitigation measures can be considered in developing the WWTP Feasibility Study?

The fulfilled Scoping Check List given in Table 39 show that the WWTP project will involve actions like permanent or temporary change in land use, clearance of existing land, vegetation and buildings, pre-construction investigations, construction of facilities for storage of goods and materials, underground works, construction of new access roads to Trubarevo location, stream crossings, etc. that will affect the different environmental characteristics (land use, air quality, noise, ground water, traffic, need for energy and water supply, generation of waste).

The construction and operational traffic, operation of the equipment like engines, pumping stations with electromotor drives, diffusers, ventilation fans will cause noise and vibration.

The project will use hazardous chemicals needed for the technology process as well as for the on-site laboratory for waste water quality control and quality of activated sludge, but the impact is not so significant . The good laboratory practice with elements of the environmental management will ensure the health and safety chemicals storage and usage.

There is a risk of contamination of land, air and water from spillage of hazardous materials due to handling, storage of chemicals, generation of sludge from the communal and industrial waste water containing different pollutants and disposal of the sludge on the Drisla Landfill.

According the national legislation there are different type of wastes according the source of origin and type of waste and the List of wastes has been adopted as a secondary legislation (Official Gazette no. 100/2005). The waste from the screen and grease trap belong to the non-hazardous waste with identification labels 19 08 01 and 19 08 02. The sewage sludge from the communal waste water treatment plants belongs also into the non-hazardous waste with identification label 19 08 05. The sludge which contains the dangerous hazardous substances from the biological treatment of the industrial waste water belongs into the hazardous waste group with identification label 19 08 11. In the group of hazardous waste is also the sludge from other treatment of industrial waste waters which contain dangerous substances and the identification of that waste is 19 08 13.

According the Law on Waste Management (Official Gaz. no. 68/2004, 71/04) the final disposal of the hazardous waste should be done only on the Landfill for hazardous waste Only the hazardous waste which not react with the other waste after the physical and chemical treatment could be disposed on the separate part of the communal Landfill with agreement of the governmental institutions.

At this moment there is no information about the possible hazardous nature of the sewage sludge that will be generated from the WWTP in Trubarevo due to the mix of the communal and industrial waters.

The issue related to the final sludge disposal should be investigate in more details within the full EIA Study due to the fact that at this moment there is no any information about the quality of effluents from the industrial facilities with outlets into collector system, the existing pre-treatment processes within the industry installations. All these information are essential for identification of the hazardous type of the sludge in order to allow or ban the final disposal on Drisla Landfill. According the Law on Environment and Law on Waste Management, it is forbidden to mix the communal and hazardous waste in order to dispose on the communal landfill.

The different processes within the operational phase of the WWTP (the screen, grease trap, grit chamber, clarifiers, and sludge dewatering units) will generate wastes like screening material –wood, rocks, dead animals, grease, oils and sewage sludge after digester and sludge dewatering unit.

The project will result in social changes as well as changes into the traditional lifestyles of the citizens in Skopje City. The land expropriation should be done for the land owned by private persons and according the baseline data examination there are only 4 private properties at the proposed location for WWTP at Trubarevo settlement and 84 private properties through which the collector system should passed. The construction and operation phases of the project will result with new jobs opportunity and it will have a positive impact due to the very high unemployment rate. The improvement of the water quality will decrease the impact of water borne diseases and at the same time directly will decrease the health care costs.

Table 39 Initial Environment Examination Study on Feasibility Study on Waste water treatment plant for Skopje City

SCOPING CHECKLIST: QUESTIONS ON PROJECT CHARACTERISTICS

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
1. Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in water bodies, etc)?				
1.1	Permanent or temporary change in land use, landcover or topography including increases in intensity of land use?	YES	Land use - The project will require intensive land use for WWTplant and possible for new landfill for sludge disposal. The proposed project will not impact on the topography of the area.	YES- Impact on land ownership Significant locally- change in land use, increased traffic, noise, reduction of vegetation. Positive: improved local water quality in Vardar River
1.2	Clearance of existing land, vegetation and buildings?	YES	Land use – The project will change the purposes of the land use refer to the vegetation that already exists.	Not significant- The surrounding land is used almost (?) exclusively for industrial purpose with no intermixing among other companies located there. Not significant – the area affected is not significant for biodiversity or richness of vegetation.
1.3	Creation of new land uses?	YES	Land use, vegetation	Not significant – the area affected is not significant for biodiversity or richness of vegetation.
1.4	Pre-construction investigations e.g. boreholes, soil testing?	YES	Land on the WWTP location site – soil testing investigations The project is in close vicinity to River Vardar. Underground water connections should be tested to prevent any leakage to River Vardar.	Not significant – There is a proper analytical method that needs small quantities of soil and water for analytical analysis.
1.5	Construction works?	YES	Land use – The construction (both for collection system and WWTPlant itself) activities will influent the land use especially the WWTplant location. Noise-The construction machinery will cause noise both during the construction of the collection system and WWTplant. Air emissions-The construction activities will initiate exhaust gases emissions of dust (PM_{10}), emissions of mobile sources (vehicles and tracks) of CO_2, NO_x,PAH, SO_2; Waste – Creation of the inert waste from the construction works, communal waste from the temporary houses for workers (if they are not citizens of Skopje City); Traffic and access – The project will	YES – The ownership of the land is very important. YES – There is exceedance of the noise level into the Skopje City, so the additional noise caused by the project activities (construction phase only) will increase noise level. YES Not significant

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
			increase the number and frequency of vehicles in the several Skopje City municipalities-Karpos, Gazi Baba, Kisela Voda and Aerodrom. Existing access roads will be utilised and the additional infrastructure will be required only for the new WWT plant. Energy and water supply – The machinery used for the project will need the new energy infrastructure if the already existing in not enough. The water supply is also essential for construction works and accommodated workers into the temporary houses. Sensitive Area-The proposed land for WWTP location with all services facility (around 37 ha) is a State Hunting Area. The 21 ha are under the management of the Faculty of Forest and around 3.3 ha are dedicated to the ARBORETUM . The Arboretum has been established at "60-ties with planting more than 720 different trees from the whole world for educational and research purposes. After the Skopje earthquake in 1963 the ground water level decrease and the dry periods cause the reduction of the trees in around 100. The Faculty of Forest use this ARORETUM for students visits and there are projects for re-cultivation of the ARBORETUM. The other areas are dedicated to the forest and lake as well as the land for cultivating the planting trees and selling them. There are different species-birds and foxes for hunting.	YES Not significant YES, significant
1.6	Demolition works?	NO	Not expected (if needed very limited)	No
1.7	Temporary sites used for construction works or housing of construction workers?	YES	Land use-The project will cause the construction of the temporary houses for accommodation of the construction workers(if they are not citizens from Skopje City). Waste – The temporary accommodated workers will create communal waste that should be take to the Drisla Landfill. Energy and water supply – The temporary sites will required new energy and water infrastructure	Not significant – temporary with conditions regulated by law Not significant Not significant
1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations?	YES	*Earthworks:* pipe trenches along all new and reconstructed/rehabilitated pipelines/collectors; River & street crossings; Excavations at the WWTP site for structures with deep foundations, etc *Above ground structures/objects*: WWTP objects, as well as other structures for the WW collection network & collectors. *Below ground structures/objects*: Pipelines and structures for the WW collection network & collectors.	Construction phase: significant traffic congestion, land- use changes (outside of urban boundary), noise, temporary service problems, air pollution etc.. Operation: WWTP – change in land use, noise, smell, temporary storage areas etc…
1.9	Underground works including mining or tunneling?	YES	Land use – The project will require intensive underground activities for construction of collector system	Construction Phase: significant impact – along collector lines
1.10	Reclamation works?	NO		
1.11	Dredging?	NO		

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
1.12	Coastal structures *e.g.* seawalls, piers?	NO		
1.13	Offshore structures?	NO		
1.14	Production and manufacturing processes?	NO		
1.15	Facilities for storage of goods or materials?	YES	Land use-The project will require construction of the facilities for storage of chemicals, materials and tools for the maintenance of the technology equipment, large pipes, excavated material and machinery During the operational phase the storage facilities will be within the WWTP site boundaries.	Construction Phase: significant impact – along collector lines Operation: Not significant – contained within WWTP limits. However, might become significant if storage/transport of sand & sludge needs large temporary storage facilities.
1.16	Facilities for treatment or disposal of solid wastes or liquid effluents?	YES	Land use-The project will involve construction of the facilities for disposal of solid/liquid waste from the screen, grit chamber and after sludge dewatering equipment. Construction Phase: possible temporary spills of storm water and WW during construction into the recipient river	Operation WWTP: Not significant Sand & sludge disposal shall be organized in special landfill location. Landfill: Significant local effect to overall environment: change in land-use, vegetation cover, increased traffic and associated effects; Construction Phase: not significant- temporary spills not expected often.
1.17	Facilities for long term housing of operational workers?	YES/NO	Land use – There is a need for new temporary buildings for operational workers as well as the service facilities (if they are not citizens of Skopje City).	Not significant
1.18	New road, rail or sea traffic during construction or operation?	YES	The new access roads will be needed for WWT plant location+inner. No new roads expected within the urban area	Not significant: short access road lines are needed as the main roads exist
1.19	New road, rail, air, waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	YES	The new access roads will be needed for WWT plant location+inner. No new roads expected within the urban area	Not significant: short access road lines are needed as the main roads exist
1.20	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	YES	Traffic and access – The project will increase the number and frequency of vehicles in the several Skopje City municipalities-Karpos, Gazi Baba, Kisela Voda and Aerodrom. Existing access roads will be utilised and the additional infrastructure will be required only for the new WWT plant. Construction phase: Temporary closing of streets during excavation works, laying of the pipelines and refilling of trenches & asphalting is expected – creating local diversion of traffic	Slightly significant: Short duration if well organized, however, may cause traffic congestions (air pollution increase)
1.21	New or diverted transmission lines or pipelines?	YES	Separation of storm water and WW networks: New pipelines construction Reconstruction of structures/objects	Construction phase: Slightly significant
1.22	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	YES	RIVER Construction phase: large siphon structure to be constructed across Vardar River (Right hand side collector connection to WWTP). Cofferdams to be constructed during construction shall constrict water bed and flow. No permanent changes in watercourse and river beds expected. Expected overall improvement of water quality of river Vardar	Construction phase: Slightly significant: Cofferdams & constrict water flow – may cause spills and floods locally. Increased sediment load in river Vardar – not significant; All above - temporary
1.23	Stream crossings?	YES	RIVER Construction phase: large siphon	Construction phase: Slightly significant: Cofferdams &

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
			structure to be constructed across Vardar River (Right hand side collector connection to WWTP). Cofferdams to be constructed during construction shall constrict water bed and flow. No permanent changes in watercourse and river beds expected. Expected overall improvement of water quality of river Vardar	constrict water flow – may cause spills and floods locally. Increased sediment load in river Vardar – not significant; All above - temporary
1.24	Abstraction or transfers of water from ground or surface waters?	YES	GROUNDWATER Positive Impact:	Reduced seepage from rehabilitated wastewater network –reduced pollution of groundwater
1.25	Changes in water bodies or the land surface affecting drainage or run-off?	NO		
1.26	Transport of personnel or materials for construction, operation or decommissioning?	YES	The project will involve intensive transport of personnel, tools and materials for all phases.	Not significant impact
1.27	Long term dismantling or decommissioning or restoration works?	NO		
1.28	Ongoing activity during decommissioning which could have an impact on the environment?	YES	The decommissioning process will have an impact on the environment especially during the demolition works, waste disposal and transport of used equipment	Not significant impact
1.29	Influx of people to an area in either temporarily or permanently?	YES	There is an influx of people expected as staff engaged for the construction and operation of the WWTP	Not significant impact
1.30	Introduction of alien species?	NO		
1.31	Loss of native species or genetic diversity?	NO		
1.32	Any other actions?	NO		

2. Will construction or operation of the Project use natural resources such as land, water, materials or energy,

Especially any resources which are non-renewable or short supply

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
2.1	Land especially undeveloped or agricultural land?	YES/NO	The project location will include the parcels as an agricultural land and the future usage has been propose as an industrial one.	YES- Significant local land use change
2.2	Water?	YES	The project will use the water natural resources for operation of WWTP + sanitary water from WS network.	Not significant quantities pf water.
2.3	Minerals?	NO		
2.4	Aggregates?	YES	Construction phase: Aggregate for concrete works & structures – both pipelines and WWTP	Not significant
2.5	Forests and timber?	NO		
2.6	Energy including electricity and fuels?	YES	The project activities with a large number of vehicles and equipment will involve extensive energy – electricity and fuels consumption. Construction phase: FUEL: Transport & installation both pipelines and WWTP Operation: FUEL: Transport of sludge & Operation: ELECTRICITY: Consumption increase	FUEL: Slightly significant- Temporary during construction; During operation – depending on sludge quantities & water content, as well as the transporting distance to landfill site Electricity: Significant – large quantities of electricity for treatment at WWTP
2.7	Any other resources?	NO		

3. Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
3.1	Will the project involve use of substances or materials which are hazardous or toxic to human health or the environment (flora, fauna, and water supplies)?	YES	The project will use hazardous chemicals needed for the technology process as well as for the on-site laboratory. Process: Chlorine, hypochlorious acid and hydrochloric acid.	Not significant
3.2	Will the project result in changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)?	YES	The sludge will cause adverse impact in the environment-foul odours, development of insects, health hazards and if it is generated in large quantities may cause ground water contamination in cases of uncontrolled disposal into environment On other hand the waste water treatment facility will have a positive impact on the improvement of Vardar River water quality and consequently will decrease water borne diseases.	YES, if not treated according the strict provisions from the Law on Environment, Law on Water and Law on Waste Management YES positive impact
3.3	Will the project affect the welfare of people e.g. by changing living conditions?	YES	The project will positively affect the welfare of people through the new employments, decreasing the health costs for water borne diseases and improvement of the agriculture with clean ground water for irrigation. Surface and groundwater: Decreased leakage from sewage pipes, elimination of sewage discharges into recipients and decrease in number of sewage pits The higher communal and water supply collection fees will affect the household budget.	YES YES YES significant negative economic effect
3.4	Are there especially vulnerable groups of people who could be affected by the project e.g. hospital patients, the elderly?	NO		
3.5	Any other causes?	NO		

4. Will the Project produce solid wastes during construction or operation or decommissioning?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
4.1	Spoil, overburden or mine wastes?	NO		
4.2	Municipal waste (household and or commercial wastes)?	YES	The project activities (construction phase) with temporary accommodation of workers will cause municipal waste (communal and commercial wastes) that should be disposed on Drisla Landfill.	Not significant impact
4.3	Hazardous or toxic wastes (including radioactive wastes)?	YES	The mixing of the communal waste water and un-treated industrial waste waters will cause the appearance of the hazardous sludge.	YES – The issue related to the final sludge disposal should be investigate in more details within the EIA preparation phase. The information about the industrial facilities with outlets into Vardar River, existing pre-treatment facilities, concentrations of the pollutant substances into the industrial waste water streams are essential information about the hazardous type of sludge.
4.4	Other industrial process wastes?	YES	The different processes within the WWT Plant will create the different	YES – the oils and waste chemicals belong to the

			wastes like screening material, material from the grit chamber, oils and waste chemicals from the laboratory.	hazardous waste and there should be specific (according the legislation) management of this type of waste.
4.5	Surplus product?	YES	Methane gas from the digester	YES if not treated
4.6	Sewage sludge or other sludge from effluent treatment?	YES	The WWT Plant with the technology used will create sewage sludge after digester and the sludge dewatering unit.	YES – the sewage sludge treatment and final disposal seems to be the most important issue within the EIA Study
4.7	Construction or demolition wastes?	YES	The construction activities will generate inert waste.	Not significant impact
4.8	Redundant machinery or equipment?	YES	The redundant machinery or equipment can create the end-of-life equipment waste.	Not significant impact
4.9	Contaminated soils or other material?	YES	There is possibility for soil contamination due to the seepage of material from vehicles or facility for chemicals storage. Also waste water seepage into the soil at the plant may occur at connecting points of cannels and tanks and other locations due to the cracks on structures.	YES – The contamination can be expected if there is not a good management procedure for chemicals handling and construction procedure
4.10	Agricultural wastes?	NO		
4.11	Any other solid wastes?	NO		

5. Will the Project release pollutants or any hazardous, toxic or noxious substances to air?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources?	YES	The project activities will include the usage of vehicles for transportation and the combustion of fossil fuels will cause emissions into the air.	Not significant impact
5.2	Emissions from production processes?	YES	The technology process will cause emissions into the air (emissions from screen, grit chamber, primary, secondary clarifiers, digesters and sludge dewatering unit (especially methane gas).	Not significant impact
5.3	Emissions from materials handling including storage or transport?	YES	There is possibility for emissions from storage and transport of materials and chemicals.	Not significant impact
5.4	Emissions from construction activities including plant and equipment?	YES	The emissions of dust and suspended particules can occur during the construction and operating activities.	Not significant impact
5.5	Dust or odors from handling of materials including construction materials, sewage and waste?	YES	During the construction phase as well as on day-by-day operational activities the dust, odours can occur. Especially odorous substances due to the composition and concentration of waste substances in waste water in sewage sludge.	YES
5.6	Emissions from incineration of waste?	NO		
5.7	Emissions from burning of waste in open air (e.g. slash material, construction debris)?	NO		
5.8	Emissions from any other sources?	NO		

6. Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
6.1	From operation of equipment e.g. engines, ventilation plant, crushers?	YES	The project activities and technological process will involve great number of equipment that will cause the noise and vibration (pump stations with electromotor drives, ventilators, diffusers, etc).	Not significant – limited within the plant – the mitigation measures may apply on that impact
6.2	From industrial or similar processes?	NO		

6.3	From construction or demolition?	YES	The construction activities will cause noise due to the machinery for digging of the collector system and dredging for WWT Plant construction. Noise, vibration, dust – Construction phase of WW network & collector The construction works will affect the spices within the Arbetrum and the Hunting Area in surrounding the WWTP location at Trubarevo.	YES YES, significant impact
6.4	From blasting or piling?	NO		
6.5	From construction or operational traffic?	YES	The project involve intensive vehicle fleet that will cause noise during the transportation. Noise, vibration – Construction phase of WW network & collectors Noise, vibration – Operation: transport of residues & sludge	 Partly significant – with limited duration Partly significant –limited to transport routes only
6.6	From lighting or cooling systems?	NO		
6.7	From sources of electromagnetic radiation (consider effects on nearby sensitive equipment as well as people)?	NO		
6.8	From any other sources?	NO		

7. Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into sewers, surface waters, groundwater, coastal waters or the sea?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
7.1	From handling, storage, use or spillage of hazardous or toxic materials?	YES	The spillage of hazardous materials and release of pollutants onto the ground or underground may occur.	YES
7.2	From discharge of sewage or other effluents (whether treated or untreated) to water or the land?	YES	The industrial waste water sewage untreated will be discharged into the municipal waste water and mixed waste water will enter the WWT Plant.	YES
7.3	By deposition of pollutants emitted to air, onto the land or into water?	YES	The air, land and water quality will be changed due to the deposition of pollutants emitted.	YES
7.4	From any other sources?			
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	YES	generated sludge and gases can be a cause for long term build up. Example: the WWTP in Struga-Vraniste	YES

8. Will there be any risk of accidents during construction or operation of the Project which could affect human health or the environment?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous or toxic substances?	YES	The WWT Plant will have the facilities with dangerous chemicals and one of the products – sludge can contain the hazardous waste. The traffic safety, public health provided for project personnel including workers as well as health and safety education are essential.	NO - the Risk and Emergency Management Plan will ensure the minimization of risk
8.2	From events beyond the limits of normal environmental protection e.g. failures of pollution control systems?	YES	There is possible risk of failures into the laboratory equipment and on-line instruments for water quality analysis, flow, temp. measurements and emissions of pollutant substances into the water effluent.	NO - the Risk and Emergency Management Plan will ensure the minimization of risk
8.3	From any other causes?	NO		
8.4	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslip, etc)?	YES	There are always unpredictable situation for natural disasters that can affected the project causing the environmental changes. The flood	NO-The Floodplan will ensure the minimization of risk

			will directly affect the water quantity and has been elaborated into the Feasibility Study. For sure the development should be done within the Floodplan.	

9. Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
9.1	Changes in population size, age, structure, social groups etc?	NO		
9.2	By resettlement of people or demolition of homes or communities or community facilities e.g. schools, hospitals, social facilities?	YES	The closest residential area to the proposed WWTP site is the village Trubarevo. The public complaints can be expected for the odours and noise during the construction and operation phases , so this can cause the movement of the people to other places.	Not significant impact. The settlement is far away from the WWTP
9.3	Through in-migration of new residents or creation of new communities?	NO		
9.4	By placing increased demands on local facilities or services e.g. housing, education, health?	YES	The new WWT Plant will impose new higher water and wastewater taxes for all Skopje City citizens	YES
9.5	By creating jobs during construction or operation or causing the loss of jobs with effects on unemployment and the economy?	YES	The construction and operation phases of the project will create new jobs and will directly effect the unemployment and the economy.	YES - Positive impact as the unemployment is very high (almost 36%)
9.6	Any other causes?			

10. Are there any other factors which should be considered such as consequential development which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality?

10.1	Will the project lead to pressure for consequential development which could have significant impact on the environment e.g. more housing, new roads, new supporting industries or utilities, etc?	NO		
10.2	Will the project lead to development of supporting facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: • supporting infrastructure (roads, power supply, waste or waste water treatment, etc) • housing development • extractive industries • supply industries • Other?	YES	WWTP: Supporting Infrastructure-roads & power supply	Partly significant – energy consumption
10.3	Will the project lead to after-use of the site which could have an impact on the environment?	NO		
10.4	Will the project set a precedent for later developments?	YES	The project will be a precedent for other large scale WWT plants that are needed to be constructed in Macedonia according the EU Directives.	YES, There is necessity for additional large scale waste water treatment plants for bigger sities in Macedonia (Bitola, Kumanovo) that can use the lessons learned from construction and operation of the WWT Plant in Skopje City.
10.5	Will the project have cumulative effects due to proximity to other existing or planned projects with similar effects?	NO		

PART 2 OF THE SCOPING CHECKLIST: CHARACTERISTICS OF THE PROJECT ENVIRONMENT

For each project characteristic identified in Part 1 consider whether any of the following environmental components could be affected.

Question - Are there features of the local environment on or around the Project location which could be affected by the Project?		
Areas which are protected under international or national or local legislation for their ecological, landscape, cultural or other value, which could be affected by the project?	No	
Other areas which are important or sensitive for reasons of their ecology e.g.		
• Wetlands,	Yes	Katlanovo marsh – positive impact – improved river Vardar WQ
• Watercourses or other waterbodies,	Yes	Improved river Vardar WQ
• the coastal zone,	No	
• mountains,	No	
• forests or woodlands	YES	ARBORETUM, Hunting Area near by the WWTP location
Areas used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, overwintering, migration, which could be affected by the project?	YES	ARBORETUM, Hunting Area near by the WWTP location
Inland, coastal, marine or underground waters?	No	
Areas or features of high landscape or scenic value?	No	
Routes or facilities used by the public for access to recreation or other facilities?	No	
Transport routes which are susceptible to congestion or which cause environmental problems?	No	
Areas or features of historic or cultural importance?	No	
Question - Is the Project in a location where it is likely to be highly visible to many people?		
No		
Question - Is the Project located in a previously undeveloped area where there will be loss of greenfield land?		
Yes – however, not of great environmental, socio-historical or economic significance		
Question - Are there existing land uses on or around the Project location which could be affected by the Project? For example:		
Homes, gardens, other private property,	No	
Industry,	No	
Commerce,	No	
Recreation,	Yes	Potential due to vicinity to river, presently undeveloped
public open space,	No	
community facilities,	No	
agriculture,	Yes	
forestry,	No	
tourism,	No	
mining or quarrying	No	
Question - Are there any plans for future land uses on or around the location which could be affected by the Project?		
No		
Question - Are there any areas on or around the location which are densely populated or built-up, which could be affected by the Project?		
No		
Question - Are there any areas on or around the location which are occupied by sensitive land uses which could be affected by the Project?		
hospitals,	No	
schools,	Yes	Not in the vicinity
places of worship,	No	
community facilities	No	
Question - Are there any areas on or around the location which contain important, high quality or scarce resources which could be affected by the Project? For example:		
groundwater resources,	No	
surface waters,	No	
forestry,	No	
agriculture,	No	Not significant: Agriculture exists but the

		resources (land) are neither scarce or high quality
fisheries,	No	
tourism,	No	
minerals.	No	
Question - Are there any areas on or around the location of the Project which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project?		
Yes. – Vardar river is currently classified as III or IV class (polluted). The project will positively affect WQ in the river.		
Question - Is the Project location susceptible to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions e.g. temperature inversions, fogs, severe winds, which could cause the project to present environmental problems?		
Earthquakes – in zone 9 Fogs – often in winter -not significant for the Project		
Question - Is the Project likely to affect the physical condition of any environmental media?		
The atmospheric environment including microclimate and local and larger scale climatic conditions?	No	
Water - eg quantities, flows or levels of rivers, lakes, groundwater. Estuaries, coastal waters or the sea?	No	
Soils - eg quantities, depths, humidity, stability or erdodibility of soils?	No	
Geological and ground conditions?	No	
Question - Are releases from the Project likely to have effects on the quality of any environmental media?		
Local air quality?	Yes	Odor
Global air quality including climate change and ozone depletion	Yes	Methane emissions
Water quality - rivers, lakes, groundwater. Estuaries, coastal waters or the sea?	Yes	Improvement of water quality-Vardar
Nutrient status and eutrophication of waters?	Yes	Tertiary treatment (nutrient removal of total N and Total P) not planned in this phase
Acidification of soils or waters?	No	
Soils	Yes	Improvement of GW quality in urban area covered by WW collection network
Noise?	Yes	Locally in the vicinity of the WWTP, and due to sludge transport
Temperature, light or electromagnetic radiation including electrical interference?	No	
Productivity of natural or agricultural systems?	No	
Question - Is the Project likely to affect the availability or scarcity of any resources either locally or globally?		
Fossil fuels?	Yes	Increased electricity consumption (produced from coal in Thermal Power Plant)
Water?	No	
Minerals and aggregates?	No	
Timber?	No	
Other non-renewable resources?		
Infrastructure capacity in the locality - water, sewerage, power generation and transmission, telecommunications, waste disposal roads, rail?	Yes	Power infrastructure to be constructed – however it is not expected to affect nearby settlements/installations
Question - Is the Project likely to affect human or community health or welfare?		
The quality or toxicity of air, water, foodstuffs and other products consumed by humans?	Yes	Improved water quality – Vardar river
Morbidity or mortality of individuals, communities or populations by exposure to pollution?	Yes	Potential positive effect – result of better sanitation
Occurrence or distribution of disease vectors including insects?	No	
Vulnerability of individuals, communities or populations to disease?	No	
Individuals' sense of personal security?	No	
Community cohesion and identity?	No	
Cultural identity and associations?	No	
Minority rights?	No	
Housing conditions?	Yes	Positive effect
Employment and quality of employment?	No/Yes	
Economic conditions?	Yes	Increased service prices might affect businesses with high water consumption
Social institutions?	No	

The identification of the potential interactions between the WWTP project activities and different environmental elements (natural/physical environment, public hazardous elements and social-economic elements) was done using the Leopold Impact Matrix designed by the Consultant Team. The fulfilled Leopold Impact Matrix has been given into the Table 40.