To: **UNDP/Ministry of Environment and Physical Planning, Macedonia**

Integrated Ecosystem Management in the Trans-boundary Prespa Region in Albania, Macedonia and Greece (00051409)

From: **PointPro Consulting**, Skopje, Macedonia,
in association with
Blumberg Engineers, Boveden, Germany

PREPARATION OF FEASIBILITY STUDY FOR SMALL-SCALE WASTEWATER TREATMENT FACILITY IN THE VILLAGE OF NAKOLEC

MID-TERM REPORT

August 15, 2007

1. Introduction

This mid-term report is related to implementation the project: Preparation of a Feasibility Study for Small-scale Wastewater Treatment Plant in the Village of Nakolec, Prespa. The project, i.e. the preparation of the Feasibility Study, is funded by GEF/UNDP Macedonia and the Macedonian Ministry of Environment and Physical Planning (MOEPP), within activities the multi-year program: Integrated Ecosystem Management in the Trans-boundary Prespa Lakes Basin of Albania, Macedonia and Greece.

The purpose of report is to provide an insight into the implementation of planned project activities at a mid-point, and to serve as a decision-making tool on behalf of the Project Sponsors related to payment of the first installment according to the Institutional Contract no. 11/2007, signed between the UNDP and PointPro Consulting (Contractor).

2. Background

The Prespa region – Prespa Lakes Basin and National Park – is situated on the Balkan Peninsula and shared among the neighboring countries of Albania, Macedonia and Greece. Above referenced GEF/UNDP-funded project aims at adoption and implementation of ecosystem-based management practices in the region by: mainstreaming ecosystem conservation objectives; reorganization of current production practices that cause adverse environmental impacts; and demonstrating the relevance and introduction of innovative, environmentally-friendly production and environmental management practices by piloting new environmental protection approaches.

Pollution from discharge of untreated wastewater is among the most pressing environmental problems and concerns in the Prespa region. In 2006 the Municipality of Resen has financially supported the preparation of an engineering design for wastewater collection system for the village of Nakolec and three neighboring villages. However, this design does not foresee any wastewater treatment options. In order to mitigate the abovementioned problems, the mentioned GEF/UNDP-funded project intends to pilot one small-scale wastewater treatment facility in the village of Nakolec in order to improve the overall environmental status of Brajcinska River and consequently to reduce the eutrophying inputs to the Prespa Lake. The wastewater treatment facility will be constructed after completion of the wastewater collection system.

Hence, the GEF/UNDP-funded project and the Macedonian Ministry of Environment and Physical Planning have assigned and subcontracted PointPro Consulting (PP), Skopje in association with Blumberg Engineers, Germany to carry out necessary analysis and prepare a Feasibility Study (FS) for a small-scale Wastewater Treatment Plant (WWTP) in the Village of Nakolec.

The purpose of the Nakolec WWTP FS is to:

1. Develop, evaluate and design a wastewater treatment facility for the Nakolec Village, based on identification and comparative analysis of several alternative treatment options against multiple criteria
2. Define an implementing institutional model and project implementation strategy on behalf of the project sponsor

More specifically, the feasibility assessment process should deliver the following outputs:

- Identify, compile and present all the information and data relevant to the project strategic context, and relevant to the current wastewater management practices in the Prespa region, the PE Proleter, and in particular the village of Nakolec
- Identify and develop several alternative systems/technologies for the Nakolec wastewater treatment, and assess their feasibility against multiple criteria (technical, environmental, financial, social and organizational) over the project economic life-cycle
- Identify and determine all project related costs and benefits, for the investment project itself (project incremental analysis)
- Select and structure the best project alternative, based on multiple criteria and analysis and few project performance indicators
- Indicate and define likely changes in the wastewater management policy (such as tariff policy) and organizational arrangements at the project implementing entity
- Identify key risk factors and the relative magnitude of project sensitivity on them
- Determine successful business model and financing plan, and lay out an implementing plan on behalf of the project entity, over the project economic life.

This report refers to the implementation of planned activities and related achievements from the project start-up phase (July 1, 2007) through July 31, 2007.

3. Completed Project Activities and Achievements

Survey and Data Collection

This is the initial phase/activity of the FS preparation, focused on mobilizing the project implementation team and conducting on-site survey and data collection necessary for: (1) determination of the project baseline status (the project strategic context, identification and initial meetings with project stakeholders); (2) analysis of basic wastewater hydraulic and pollution load profile; and (3) identification of alternative wastewater treatment options for the Nakolec village small-scale WWTP. The following tasks were carried out:

- First site visit, conducted on July 5, 2007; separate site visit report has been prepared and submitted on July 9 (Annex 1)

- Second site visit, conducted on July 24, 2007; separate site visit report has been prepared and submitted on July 25 (Annex 2)

- Data collection and analysis; the following basic data/information are collected:

    - Maps of the locality; scale 1:25 000 (in electronic and hard copies)
    - Copy of the wastewater collection system design
    - Water demand, i.e. water measurements/meter readings, for the period June 2004 through July 2007. Water meter readings in the village are performed two times per year; collected date were made available to the consultants.
    - Demographics/population changes and household size in Resen Municipality for the period 1921 – 2002, and Nakolec village from 1994 and 2002 census.

- Meteorological data, including: precipitation (rainfall), air temperatures, wind speed, humidity, fog incidents, etc. (Annex 6).
- Hydrology, i.e. water flows in Brajcinska River for the period 1961 through 2002, and changes in Prespa Lake water level for the period 1951 through 2001.

Based on listed data, the following analysis are prepared:

- Based on statistical data regarding population changes, several potential scenarios related to expected future changes in the village were prepared (Annex 3). The "normal" scenario – yearly population growth of 0.5% -- has been accepted as the most appropriate.
- Based on historical data from water measurements the average, maximum and minimum monthly water demand per household and for several periods (differences from one reading to another; e.g. Sept 2005 through April 2006) have been determined. The average water demand during a winter period has been adopted as the most suitable for the WWTP design input data, since – following the discussions during the site visit to Nakolec – during that period most of the water is used for domestic purposes (watering and cleaning of gardens is avoided). The average unit water demand is 204 liters/capita/daily (Annex 4).
- Calculations regarding water demand forecast, wastewater flow forecast and pollution loading and concentrations forecast for the period 2007 through 2035. The wastewater flow forecast is calculated based on accepted water-demand-to-wastewater-flow ratio of 80%. That is, it is assumed that only 80% of consumed water will end up in the sewer system, which is a common way of calculating wastewater flow in a number of publications and also widely used in Macedonia. The peak daily and hourly wastewater flows are calculated based on accepted peaking factors of 160% (1,6) as hourly peak, and 130% in 2007 to 175% in 2035 as daily peak factor; the daily peak factor accounts for the "summer visitors" in the village, which create increase in wastewater flows during a sustained 2 to 3-month period. Further on, total wastewater pollutant/constituent mass loadings and concentrations are calculated based on unit concentrations provided by you (e.g. BOD = 60 gr/capita/day) and for several wastewater flows (e.g. average dry, average wet (including ground water infiltration into the sewer system), and peak average daily flows) (Annex 5).

In addition to listed analysis, which are part of the principal design considerations and will be used as basic input data in the consequent feasibility analysis phase, the potential micro location of the WWTP – in close proximity of the Nakolec village – has been determined and initially agreed upon with village authorities/representatives during the second site visit.

- Identification of WWTP alternatives. Based on Consultants' previous experience regarding up-to-date both traditional and conventional wastewater treatment technologies and their potential applicability in the case of Nakolec village, the following alternative technologies were initially considered, presented to and discussed with village community representatives during the second site visit: (1) constructed wetland (reed beds); (2) lagoon treatment system; (3) sequencing batch reactor (SBR, in the form of package plant); (4) trickling filter (in the form of package/pre-engineered plant); and (5) biological fixed-bed reactors (also in the form of package/pre-engineered plant).

Based on the discussions, which represented the " WWTP owner's/operator's needs and expectations[1]", but also taking into consideration other criteria such as: (1) environmental/ regulatory requirements, above all required level of treatment prior to discharge of the effluent into Prespa Lake, and also appropriateness for integration of the treatment facility within the local environment/habitat; (2) basic cost considerations, including pre-assessment of capital/ investment and operation costs; and (3) availability of equipment and past experience (institutional capacity) of the community with treatment technologies, the following wastewater treatment options were selected to be further analyzed in the FS:

- Reed bed (constructed wetland)
- Sequencing Batch Reactor
- Fixed-bed reactor.

4. Changes and Modifications

Thus far, there are no changes or modifications neither in the scope of activities nor the initial work plan for implementation of the project.

5. Conclusions and Follow-up Activities

- The project is developing according to the initial work plan. The first activity – Survey and Data Collection, along with the basic calculations – has been completed to a satisfactory level.

- The project consultant team will continue with the subsequent activities:

  - comparative analysis of listed wastewater treatment alternatives, including: comparative multi-criteria analysis; least-cost analysis; and final selection of the best affordable treatment technology.
  - design and detailed planning for the selected alternative, including technical and operational design; environmental, health and safety considerations; stakeholder analysis; tariff affordability analysis; institutional/organizational analysis; financial analysis; implementation plan development; and report writing.

Skopje, August 15, 2007

Danco Uzunov, Project Team Leader
PointPro Consulting

[1] As a specific criterion for technology selection.

ANNEXES

Annex 1:

Site Visit Report (1)

Background and purpose of the site visit

This site visit report is related to implementation the project: Preparation of a Feasibility Study for Small-scale Wastewater Treatment Plant in the Village of Nakolec, Prespa. The project, i.e. the preparation of the Feasibility Study, is funded by GEF/UNDP Macedonia and the Macedonian Ministry of Environment and Physical Planning (MOEPP), within activities the multi-year programme: Integrated Ecosystem Management in the Trans-boundary Prespa Region in Albania, Macedonia and Greece.

In 2006 the Municipality of Resen has financially supported the preparation of an engineering design for wastewater collection system for the village of Nakolec and three neighboring villages. However, this design doesn't foresee any wastewater treatment options. In order to mitigate the abovementioned problems, the mentioned GEF/UNDP-funded project intends to pilot one small-scale wastewater treatment facility in the village of Nakolec in order to improve the overall environmental status of Brajcinska River and consequently to reduce the eutrophying inputs to the Prespa Lake. The wastewater treatment facility will be constructed after completion of the wastewater collection system. Hence, the GEF/UNDP-funded project and the Macedonian Ministry of Environment and Physical Planning have assigned and subcontracted PointPro Consulting (PP), Skopje in association with Blumberg Engineers, Germany to carry out necessary analysis and prepare a Feasibility Study (FS) for a small-scale Wastewater Treatment Plant (WWTP) in the Village of Nakolec.

The purpose of the Nakolec WWTP FS is to:

3. Develop, evaluate and design a wastewater treatment facility for the Nakolec Village, based on identification and comparative analysis of several alternative treatment options against multiple criteria
4. Define an implementing institutional model and project implementation strategy on behalf of the project sponsor

More specifically, the feasibility assessment process should deliver the following outputs:

- Identify, compile and present all the information and data relevant to the project strategic context, and relevant to the current wastewater management practices in the Prespa region, the PE Proleter, and in particular the village of Nakolec
- Identify and develop several alternative systems/technologies for the Nakolec wastewater treatment, and assess their feasibility against multiple criteria (technical, environmental, financial, social and organizational) over the project economic life-cycle
- Identify and determine all project related costs and benefits, for the investment project itself (project incremental analysis)
- Select and structure the best project alternative, based on multiple criteria and analysis and few project performance indicators
- Indicate and define likely changes in the wastewater management policy (such as tariff policy) and organizational arrangements at the project implementing entity

- Identify key risk factors and the relative magnitude of project sensitivity on them
- Determine successful business model and financing plan, and lay out an implementing plan on behalf of the project entity, over the project economic life.

The site visit explained below, according to the previously presented work plan, is among the initial activities for FS preparation – Survey and Data Collection (see PP Technical Proposal). The site visit was conducted on July 5, 2007, by two PP experts – Danco Uzunov (Team Leader) and Simon Avramovski (FS and Project Development Specialist). Main purpose of the visit was initiation of the FS preparation efforts, by:

- Conducting initial meeting the UNDP Project team members and discussing proposed work plan, planned activities and timing
- Conducting initial meetings with representatives of Nakolec village/community
- Initiation of the data collection process

Site visit details

Meetings and discussions

The following meetings took place during the visit:

(1) Meeting with Vasil Jankulovski, a representative of Nakolec village Community Council[2]. Mr. Jankulovski provided:

- overview of the community (rough population figures, main economic activities, etc.)
- overview of the community's viewpoint regarding the development of the planned wastewater management system (wastewater collection system and WWTP);
- details regarding currently applied (inappropriate) wastewater management practices and related ongoing problems
- details regarding the water supply system[3] in the village
- current tariff structure (for water supply only)

(2) Meeting with Risto [family name] (responsible for maintenance of the Nakolec water supply system) and initial visit of the potential WWTP location. Risto provided further information regarding the functioning of the water supply system – system components and functioning, periodic problems, fee collection practices and efficiency, etc. It was agreed that as soon as possible (prior to the next site visit) Risto will compile and hand-over to the consultants data regarding water meter/demand records for the period 2006 and 2007. In addition, Risto joined the consultants during the visit of the WWTP location/site and provided detailed information on all required aspects.

(3) Meeting with Ljupco Stojanovski, Project Manager for the GEF/UNDP Prespa project and Nikola [family name], UNDP Prespa project team member. The discussion during the meeting touched upon the following aspects:

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[2] Mr. Jankulovski was replacing the President of the Community Council (Mesna zaednica – Mr. Gzim Sulejmani), who was not available.
[3] As a starting point for wastewater infrastructure planning.

- Planed activities (according to the PP proposal) and their timing, with reference to the postponed start-up of the FS preparation. It was agreed that the initial FS preparation plan will be followed as regards the scope of activities and planned analysis, however the minor modifications in planned activity implementation timing will be detailed and presented to the Prespa project team at a subsequent site visit and meeting which will include the foreign expert of the PP project team.

- Necessary support in data collection to be provided by the Prespa project team to the consultants. It was agreed that the Prespa project team will provide information regarding: (1) population/demography trends for the Prespa region; (2) water demand (water-meter readings) for Nakolec, based on short questionnaire to be prepared by PP and data compiled by Risto; (3) hydrology of Prespa Lake (if necessary, to be confirmed accordingly); (4) other required information, if deemed necessary and available (also to be confirmed accordingly).

- Organization of community wider stakeholder meeting. It was agreed that the consultants will carefully investigate the possibility for organizing a first meeting with a wider group of Nakolec community stakeholders[4] during the following site visit, and inform the UNDP project team in due time.

Conclusions and follow-up activities

- The PP project team will continue with data collection efforts;

- The UNDP Prespa project team will collect and make available to the consultants the above-listed information;

- The next site visit and meeting is scheduled for July 23 and 24, 2007.

Skopje, July 9, 2007

Danco Uzunov, Project Team Leader
PointPro Consulting

[4] The aim of the wider stakeholder meeting is to present the project to a bigger group of citizens in the village, and gathering critical data for project implementation/construction and sustainability planning.

Annex 2:

Site Visit Report (2)

Background and purpose of the site visit

This site visit report is related to implementation the project: Preparation of a Feasibility Study for Small-scale Wastewater Treatment Plant in the Village of Nakolec, Prespa. The project, i.e. the preparation of the Feasibility Study, is funded by GEF/UNDP Macedonia and the Macedonian Ministry of Environment and Physical Planning (MOEPP), within activities the multi-year programme: Integrated Ecosystem Management in the Trans-boundary Prespa Region in Albania, Macedonia and Greece.

In 2006 the Municipality of Resen has financially supported the preparation of an engineering design for wastewater collection system for the village of Nakolec and three neighboring villages. However, this design doesn't foresee any wastewater treatment options. In order to mitigate the abovementioned problems, the mentioned GEF/UNDP-funded project intends to pilot one small-scale wastewater treatment facility in the village of Nakolec in order to improve the overall environmental status of Brajcinska River and consequently to reduce the eutrophying inputs to the Prespa Lake. The wastewater treatment facility will be constructed after completion of the wastewater collection system. Hence, the GEF/UNDP-funded project and the Macedonian Ministry of Environment and Physical Planning have assigned and subcontracted PointPro Consulting (PP), Skopje in association with Blumberg Engineers, Germany to carry out necessary analysis and prepare a Feasibility Study (FS) for a small-scale Wastewater Treatment Plant (WWTP) in the Village of Nakolec.

The purpose of the Nakolec WWTP FS is to:

5. Develop, evaluate and design a wastewater treatment facility for the Nakolec Village, based on identification and comparative analysis of several alternative treatment options against multiple criteria
6. Define an implementing institutional model and project implementation strategy on behalf of the project sponsor

More specifically, the feasibility assessment process should deliver the following outputs:

- Identify, compile and present all the information and data relevant to the project strategic context, and relevant to the current wastewater management practices in the Prespa region, the PE Proleter, and in particular the village of Nakolec
- Identify and develop several alternative systems/technologies for the Nakolec wastewater treatment, and assess their feasibility against multiple criteria (technical, environmental, financial, social and organizational) over the project economic life-cycle
- Identify and determine all project related costs and benefits, for the investment project itself (project incremental analysis)
- Select and structure the best project alternative, based on multiple criteria and analysis and few project performance indicators
- Indicate and define likely changes in the wastewater management policy (such as tariff policy) and organizational arrangements at the project implementing entity

- Identify key risk factors and the relative magnitude of project sensitivity on them
- Determine successful business model and financing plan, and lay out an implementing plan on behalf of the project entity, over the project economic life.

The site visit explained below, according to the previously presented work plan, is among the initial activities for FS preparation – Survey and Data Collection (see PP Technical Proposal). The site visit was conducted on July 24, 2007, by two PP experts – Danco Uzunov (Team Leader) and Simon Avramovski (FS and Project Development Specialist) – and an international expert on alternative wastewater treatment technologies – Michael Blumberg. Main purpose of the visit was conclusion of the data collection phase and initial discussion regarding pre-identified wastewater treatment alternative technologies.

Site visit details

Meetings and discussions

The following meetings took place during the visit:

(1) Meeting with Ljupco Stojanovski, Project Manager for the GEF/UNDP Prespa project. The discussion during the meeting referred to the latest developments and achievements regarding consultants' work from the last meeting/site visit, that took place on July 5. It was confirmed that the project activities follow the initial plan agreed upon during the previous meeting.

(2) Meeting with Mr. G'zim Sulejmani, President of the Village Council[5], Risto [family name], responsible for maintenance of the Nakolec water supply system, and several other village residents. The following issues were discussed:

- Relevance of the water metering data (water meter readings), provided by Risto during the period from the previous site visit, with specific focus on what volume of the total water consumed per household is likely to inflow into the future sewerage collection and treatment system vs. water used for garden watering and cleaning purposes.

- Expected/planned future growth of the permanent village population and number of short-term visitors, i.e. population that is not permanently settled in the village but resides in it during the summer.

- Availability of publicly owned land in close proximity to the village, to be used as a location/site for the WWTP.

- Brief presentation and detailed discussion regarding possible wastewater treatment technologies for the village WWTP. The following alternative technologies (treatment methods) for small-scale WWT were presented, along with their positive and negative aspects: (1) constructed wetland (reed beds); (2) lagoon treatment system; (3) sequencing batch reactor (SBR, in the form of package plant); (4) trickling filter (in the form of package/pre-engineered plant); and (5) biological fixed film contactors (FFR, also in the form of package/pre-engineered plant). While all listed technologies were regarded as potentially applicable, it was agreed that the consultants will further analyze the reed bed

[5] Mesna zaenica Nakolec

system, SBR and FFR and select and structure the most feasible one based on a number of criteria, as explained in the project proposal and earlier in this report.

- WWT system management issues, such as (1) responsibility requirements for operation and maintenance of the wastewater collection system and the WWTP; (2) capacity of the village council (the project entity) to manage the system; and (3) preferred organizational setup for future management of the system.

- Available data related to geology (soil structure) and ground water variations.

Conclusions and follow-up activities

- The project is developing according to the initial work plan, and the consultants have completed the first activity: Survey and Data Collection.

- The project consultant team will continue with the subsequent activities: Feasibility Analysis – (1) comparative analysis of listed wastewater treatment alternatives; and (2) design and detailed planning for the selected alternative.

- The next site visit and meeting with the UNDP project team and other project stakeholders is scheduled for the second half of August 2007 (after completion of the WWTP comparative analysis, according to agreed work plan).

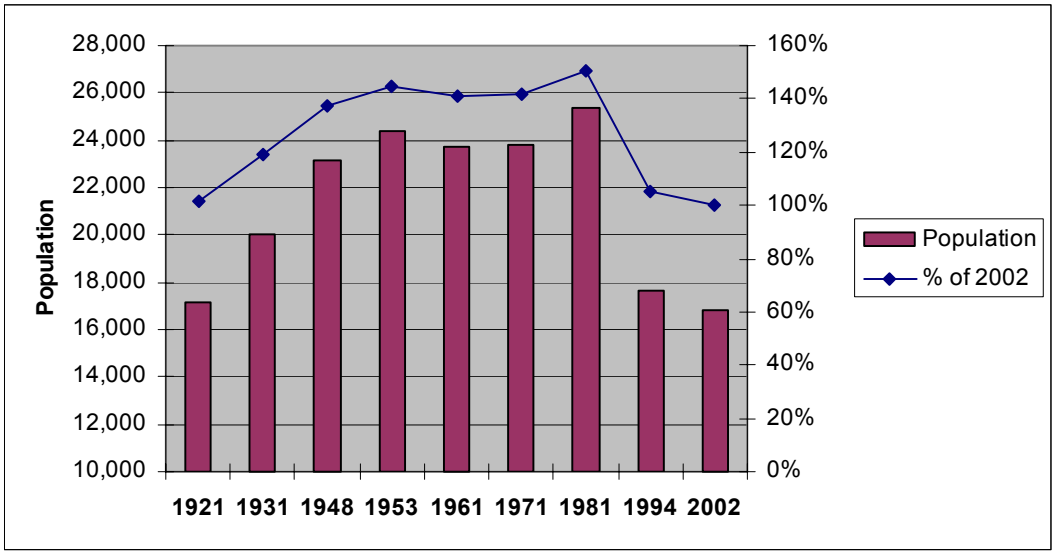
Skopje, July 25, 2007

Danco Uzunov, Project Team Leader
PointPro Consulting

Annex 3: Demography

Resen Municipality: Demographic changes

Year	1921	1931	1948	1953	1961	1971	1981	1994	2002
Population	17,128	20,021	23,137	24,400	23,730	23,840	25,360	17,681	16,825
% of 2002	102%	119%	138%	145%	141%	142%	151%	105%	100%



Resen Municipality: Demographic changes

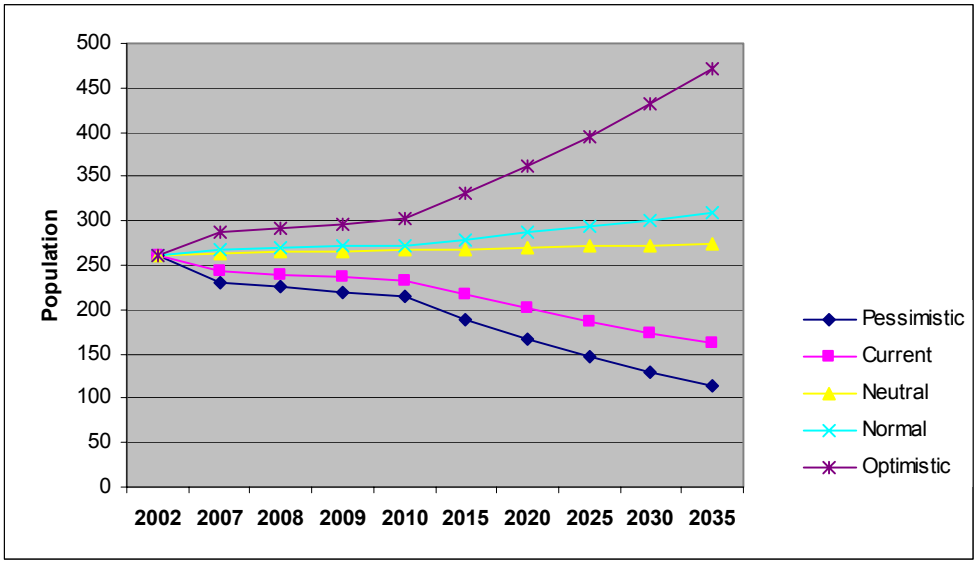
Community	Census 1994		Census 2002		Difference 1994 to 2002		
	Population	Households	Population	Households	Population	% total	%/year
Resen Municipality	17681	4949	16825	4849	-856	-4.8%	-0.62%
Arvati	183	50	137	35	-46	-25.1%	-3.50%
Asamati	195	47	175	45	-20	-10.3%	-1.30%
Bolno	289	79	237	74	-52	-18.0%	-2.37%
Brajcino	212	85	134	61	-78	-36.8%	-5.50%
Volkoderi	102	26	114	30	12	11.8%	1.47%
G.Bela Crkva	215	55	187	44	-28	-13.0%	-1.79%
Gorno Dupeni	104	39	59	25	-45	-43.3%	-6.80%
Gorno Krusje	123	43	107	35	-16	-13.0%	-1.75%
Grncari	476	117	417	107	-59	-12.4%	-1.75%
D.Bela Crkva	249	58	237	59	-12	-4.8%	-0.65%
Dolno Dupeni	260	101	235	89	-25	-9.6%	-1.28%
Dolno Perovo	213	65	175	61	-38	-17.8%	-2.55%
Drmeni	460	141	416	130	-44	-9.6%	-1.25%
Evla	138	47	106	33	-32	-23.2%	-3.25%
Ezereni	217	58	203	55	-14	-6.5%	-0.85%
Zlatari	124	35	118	39	-6	-4.8%	-0.60%
Izbiste	198	51	176	48	-22	-11.1%	-1.55%
Jankovec	1214	321	1169	352	-45	-3.7%	-0.48%
Kozjak	120	27	117	26	-3	-2.5%	-0.35%
Konjsko	4	2	3	2	-1	-25.0%	-4.00%
Krani	529	145	416	112	-113	-21.4%	-2.95%
Kriveni	49	24	27	11	-22	-44.9%	-6.45%
Kurbinovo	122	30	137	33	15	12.3%	1.65%
Lavci	145	39	134	30	-11	-7.6%	-0.95%
Leva Reka	73	25	60	20	-13	-17.8%	-2.50%
Leskoec	13	5	12	4	-1	-7.7%	-0.96%
Ljubojno	238	97	186	86	-52	-21.8%	-2.95%
Nakolec	295	83	262	79	-33	-11.2%	-1.45%
Podmocani	350	101	306	90	-44	-12.6%	-1.65%
Pokrvenik	100	29	65	22	-35	-35.0%	-4.95%
Preljubje	23	10	16	9	-7	-30.4%	-4.25%
Pretor	153	38	142	39	-11	-7.2%	-0.90%
Rajca	72	23	66	18	-6	-8.3%	-1.15%
Resen	8684	2354	8748	2451	64	0.7%	0.09%
Slivnica	166	45	188	48	22	13.3%	1.65%
Sopotsko	246	77	222	73	-24	-9.8%	-1.25%
Stenje	324	94	438	129	114	35.2%	3.85%
Carev Dvor	708	197	605	161	-103	-14.5%	-1.95%
Strbovo	195	57	184	63	-11	-5.6%	-0.75%
Surlenci	100	29	89	21	-11	-11.0%	-1.45%

Max	3.9%
Min	-6.80%
Average	-1.73%
Median	-1.45%

Resen Municipality: Average size of households

Community	Population		Number of households		Average size of households	
	1994	2002	1994	2002	1994	2002
Resen Municipality	17681	16825	4949	4849	3.57	3.47
Arvati	183	137	50	35	3.66	3.91
Asamati	195	175	47	45	4.15	3.89
Bolno	289	237	79	74	3.66	3.20
Brajcino	212	134	85	61	2.49	2.20
Volkoderi	102	114	26	30	3.92	3.80
G.Bela Crkva	215	187	55	44	3.91	4.25
Gorno Dupeni	104	59	39	25	2.67	2.36
Gorno Krusje	123	107	43	35	2.86	3.06
Grncari	476	417	117	107	4.07	3.90
D.Bela Crkva	249	237	58	59	4.29	4.02
Dolno Dupeni	260	235	101	89	2.57	2.64
Dolno Perovo	213	175	65	61	3.28	2.87
Drmeni	460	416	141	130	3.26	3.20
Evla	138	106	47	33	2.94	3.21
Ezereni	217	203	58	55	3.74	3.69
Zlatari	124	118	35	39	3.54	3.03
Izbiste	198	176	51	48	3.88	3.67
Jankovec	1214	1169	321	352	3.78	3.32
Kozjak	120	117	27	26	4.44	4.50
Konjsko	4	3	2	2	2.00	1.50
Krani	529	416	145	112	3.65	3.71
Kriveni	49	27	24	11	2.04	2.45
Kurbinovo	122	137	30	33	4.07	4.15
Lavci	145	134	39	30	3.72	4.47
Leva Reka	73	60	25	20	2.92	3.00
Leskoec	13	12	5	4	2.60	3.00
Ljubojno	238	186	97	86	2.45	2.16
Nakolec	295	262	83	79	3.55	3.32
Podmocani	350	306	101	90	3.47	3.40
Pokrvenik	100	65	29	22	3.45	2.95
Preljubje	23	16	10	9	2.30	1.78
Pretor	153	142	38	39	4.03	3.64
Rajca	72	66	23	18	3.13	3.67
Resen	8684	8748	2354	2451	3.69	3.57
Slivnica	166	188	45	48	3.69	3.92
Sopotsko	246	222	77	73	3.19	3.04
Stenje	324	438	94	129	3.45	3.40
Carev Dvor	708	605	197	161	3.59	3.76
Strbovo	195	184	57	63	3.42	2.92
Surlenci	100	89	29	21	3.45	4.24

Scenario	Change (%/year)	*2002*	2007	2008	2009	2010	2015	2020	2025	2030	2035	% change ('35/'02)
Pessimistic	-2.50	*262*	231	225	219	214	189	166	146	129	114	43%
Current	-1.45	*262*	244	240	237	233	217	201	187	174	162	62%
Neutral	0.10	*262*	263	265	266	267	269	270	271	273	274	105%
Normal	0.50	*262*	269	270	271	273	280	287	294	301	309	118%
Optimistic	1.80	*262*	286	292	297	302	330	361	395	432	472	180%



Annex 4: Historical Water Demand

#	Water meter readings					Difference (m3)						Monthly water demand per household (m3/mo				
	June 2004 (1)	Sept. 2005 (2)	April 2006 (3)	Nov. 2006 (4)	July 2007 (5)	(2) -(1)	Winter (3)-(2)	Summer (4)-(3)	(5)-(4)	14 mon (4)-(2)	3 years (5)-(1)	(2)-(1)/15	Winter (3)-(2)/7	Summer (4)-(3)/7	(5)-(4)/9	14 mon (4)-(2)/14
1	3329	/	3857	/	4225						896					
2	5307	5560	5606	5683	5740	253	46	77	57	123	433	16.9	6.6	11.0	7.1	8.8
3	461	1281	1637	2183	2630	820	356	546	447	902	2169	54.7	50.9	78.0	55.9	64.4
4	0	110	316	585	832	110	206	269	247	475	832	7.3	29.4	38.4	30.9	33.9
5	909	1709	1923	2150	2358	800	214	227	208	441	1449	53.3	30.6	32.4	26.0	31.5
6	7240	7630	7880	8277	8570	390	250	397	293	647	1330	26.0	35.7	56.7	36.6	46.2
7	4702	5202	5317	5516	5669	500	115	199	153	314	967	33.3	16.4	28.4	19.1	22.4
8	5168	5628	5754	6001	6224	460	126	247	223	373	1056	30.7	18.0	35.3	27.9	26.6
9	/	/	1286	/	1331											
10	/	/	1600	/	1660											
11	298	723	1000	1434	1676	425	277	434	242	711	1378	28.3	39.6	62.0	30.3	50.8
12	2440	2990	3200	3400	3600	550	210	200	200	410	1160	36.7	30.0	28.6	25.0	29.3
13	4359	5059	5281	5508	5631	700	222	227	123	449	1272	46.7	31.7	32.4	15.4	32.1
14	776	936	948	/	1100	160	12				324	10.7	1.7			
15	5127	5467	5576	5747	5891	340	109	171	144	280	764	22.7	15.6	24.4	18.0	20.0
16	506	1396	1604	2132	2621	890	208	528	489	736	2115	59.3	29.7	75.4	61.1	52.6
17	0	385	508	711	882	385	123	203	171	326	882	25.7	17.6	29.0	21.4	23.3
18	531	651	720	762	822	120	69	42	60	111	291	8.0	9.9	6.0	7.5	7.9
19	/	180	210	/	350											
20	7072	7632	7774	8337	8721	560	142	563	384	705	1649	37.3	20.3	80.4	48.0	50.4
21	2400	2800	2970	3223	3452	400	170	253	229	423	1052	26.7	24.3	36.1	28.6	30.2
22	3330	/	3570	/	3730						400					
23	5189	5349	5386	5457	5522	160	37	71	65	108	333	10.7	5.3	10.1	8.1	7.7
24	1462	/	1490	/	/											
25	1999	2000	2010	/	2110	1	10				111	0.1	1.4			
26	6601	6801	7334	7477	7631	200	533	143	154	676	1030	13.3	76.1	20.4	19.3	48.3
27	2809	2989	3033	3133	3213	180	44	100	80	144	404	12.0	6.3	14.3	10.0	10.3
28	5182	5260	5427	5734	6006	78	167	307	272	474	824	5.2	23.9	43.9	34.0	33.9
29	3093	3353	3418	3545	3633	260	65	127	88	192	540	17.3	9.3	18.1	11.0	13.7
30	4354	4774	4900	5108	5302	420	126	208	194	334	948	28.0	18.0	29.7	24.3	23.9
31	5931	7000	7230	7555	7850	1069	230	325	295	555	1919	71.3	32.9	46.4	36.9	39.6
32	5220	5690	6040	6263	6453	470	350	223	190	573	1233	31.3	50.0	31.9	23.8	40.9
33	31	191	325	523	632	160	134	198	109	332	601	10.7	19.1	28.3	13.6	23.7
34	0	190	372	724	1024	190	182	352	300	534	1024	12.7	26.0	50.3	37.5	38.1
35	2053	2153	2164	2490	2557	100	11	326	67	337	504	6.7	1.6	46.6	8.4	24.1
36	0	neispravno	100	270	456			170	186		456	0.0		24.3	23.3	
37	1900	2010	2210	2321	2399	110	200	111	78	311	499	7.3	28.6	15.9	9.8	22.2
38	453	573	673	700	700	120	100	27		127		8.0	14.3	3.9	0.0	9.1
39	1491	1631	1676	1723	1743	140	45	47	20	92	252	9.3	6.4	6.7	2.5	6.6
40	3040	3460	3830	3944	4025	420	370	114	81	484	985	28.0	52.9	16.3	10.1	34.6
41	400	/	528	/	726						326					
42	62	112	/	/	/	50						3.3				
43	483	1248	1490	1690	1820	765	242	200	130	442	1337	51.0	34.6	28.6	16.3	31.6
44	753	840	864	/	1013	87	24				260	5.8	3.4			
45	3750	4090	4186	4382	4542	340	96	196	160	292	792	22.7	13.7	28.0	20.0	20.9
46	/	/	724	/	790											
47	4670	5220	5394	5688	5995	550	174	294	307	468	1325	36.7	24.9	42.0	38.4	33.4
48	3313	3413	3663	4223	4290	100	250	560	67	810	977	6.7	35.7	80.0	8.4	57.9
49	5316	6216	6317	6504	6633	900	101	187	129	288	1317	60.0	14.4	26.7	16.1	20.6
50	4185	4982	5046	5532	5851	797	64	486	319	550	1666	53.1	9.1	69.4	39.9	39.3
51	791	911	960	1020	1060	120	49	60	40	109	269	8.0	7.0	8.6	5.0	7.8
52	1330	2020	2260	2750	3120	690	240	490	370	730	1790	46.0	34.3	70.0	46.3	52.1
53	160	400	486	1066	3340	240	86	580	2274	666	3180	16.0	12.3	82.9	284.3	47.6
54	1570	/	1956	/	2150						580					
55	/	/	1677	/	1690											
56	90	470	780	/	1100	380	310				1010	25.3	44.3			
57	2770	3460	3700	3980	4152	690	240	280	172	520	1382	46.0	34.3	40.0	21.5	37.1
58	450	708	908	993	1056	258	200	85	63	285	606	17.2	28.6	12.1	7.9	20.4
59	6787	6857	6983	7305	7452	70	126	322	147	448	665	4.7	18.0	46.0	18.4	32.0
60	1985	2355	2469	2610	2720	370	114	141	110	255	735	24.7	16.3	20.1	13.8	18.2
61	315	395	410	433	445	80	15	23	12	38	130	5.3	2.1	3.3	1.5	2.7
62	959	1140	1140	1226	1260	181	0	86	34	86	301	12.1	0.0	12.3	4.3	6.1
63	57	237	307	/	456	180	70				399	12.0	10.0			
64	4321	/	4557	/	4687						366					
65	995	1093	1097	/	1170	98	4				175	6.5	0.6			
66	/	1080	1170	1309	1410		90	139	101	229			12.9	19.9	12.6	16.4
67	140	/	280	/	400						260					
68	4332	4632	4764	4945	5100	300	132	181	155	313	768	20.0	18.9	25.9	19.4	22.4
69	800	998	1070	neispraven	/	198	72					13.2	10.3			
70	7566	7984	8134	8353	8556	418	150	219	203	369	990	27.9	21.4	31.3	25.4	26.4
71	5750	6130	6246	6427	6555	380	116	181	128	297	805	25.3	16.6	25.9	16.0	21.2

Annex 5: Water Demand, Wastewater Flow and Pollution Loading Forecast

Water Demand Forecast

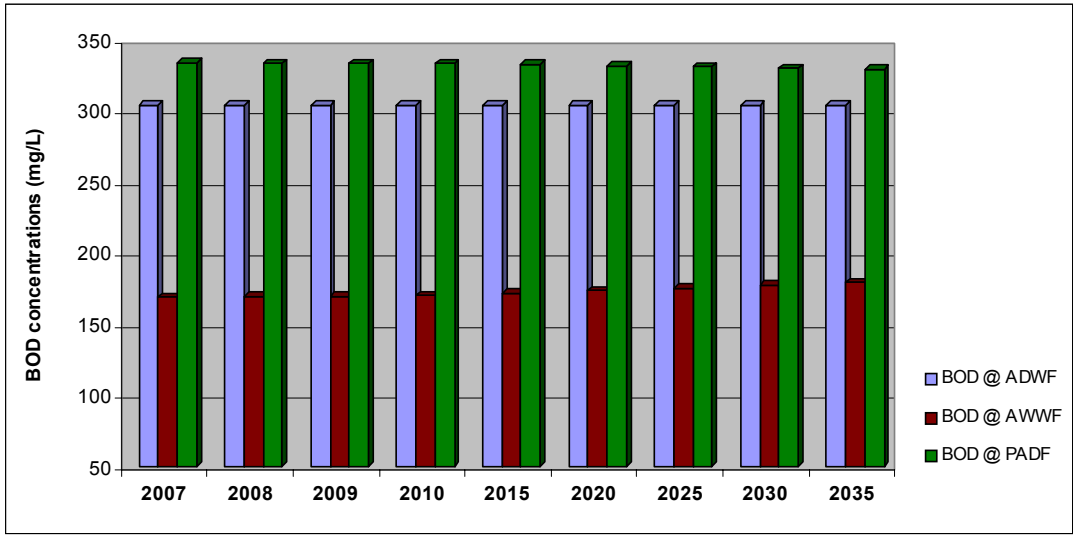
		Unit	2002	2007	2008	2009	2010	2015	2020	2025	2030	2035
1	**I. Population**											
2	Population growth	%/year		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3	Total population	No	*262*	269	270	271	273	280	287	294	301	309
4	Increase in number of connections	%		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5	Number of connections (end of year)	No	*79*	81	81	82	82	84	86	89	91	93
6	Size of household	No	*3.32*	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32
8	**II. Demand**											
9	*II.1 Households*											
10	Per capita consumption	l/cap/day		204	204	204	204	204	204	204	204	204
11	Increase/decrease in per capita/connection consumption	%			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12	Total daily household consumption	m3/day		54.84	55.12	55.39	55.67	57.08	58.52	59.99	61.51	63.06
13	Total monthly household consumption	m3/month		1,645.3	1,653.5	1,661.8	1,670.1	1,712.3	1,755.5	1,799.8	1,845.3	1,891.9
14	Total yearly household consumption	m3/year		20,018	20,118	20,218	20,319	20,833	21,359	21,898	22,451	23,018
16	*II.2 Public sector*											
17	% of household consumption	%		10.0	10.1	10.1	10.2	10.4	10.7	10.9	11.2	11.5
18	Number of connections (end of year)	No										
19	Total daily public consumption	m3/day		5.48	5.54	5.59	5.65	5.94	6.24	6.56	6.90	7.25
20	Total monthly public consumption	m3/month		164.5	166.2	167.8	169.5	178.2	187.3	196.9	207.0	217.5
21	Total yearly public consumption	m3/year		2,002	2,022	2,042	2,063	2,168	2,279	2,395	2,518	2,647
22	*Total Demand*											
23	Total per capita consumption	l/per/day		225	225	225	225	225	226	227	227	228
24	Total average daily consumption	m3/day		60.33	60.66	60.99	61.32	63.02	64.76	66.56	68.41	70.31
25	Total average monthly consumption	m3/month		1,809.8	1,819.7	1,829.6	1,839.6	1,890.5	1,942.8	1,996.7	2,052.2	2,109.4
26	Total average yearly consumption	m3/year		22,019	22,140	22,260	22,382	23,001	23,638	24,293	24,969	25,665
27	*Peaking Factors*											
28	Hourly peak factor	%		160%	160%	160%	160%	160%	160%	160%	160%	160%
29	Daily (seasonal) peak factor	%		130%	130%	132%	135%	145%	155%	165%	170%	175%
30	*Peak Water Demand*											
31	Peak daily water demand	m3/day		78.4	78.9	80.5	82.8	91.4	100.4	109.8	116.3	123.0
32	Peak monthly water demand	m3/month		2,352.8	2,365.6	2,415.1	2,483.5	2,741.2	3,011.4	3,294.6	3,488.8	3,691.5
33	Peak hourly water demand	m3/hour		5.2	5.3	5.4	5.5	6.1	6.7	7.3	7.8	8.2

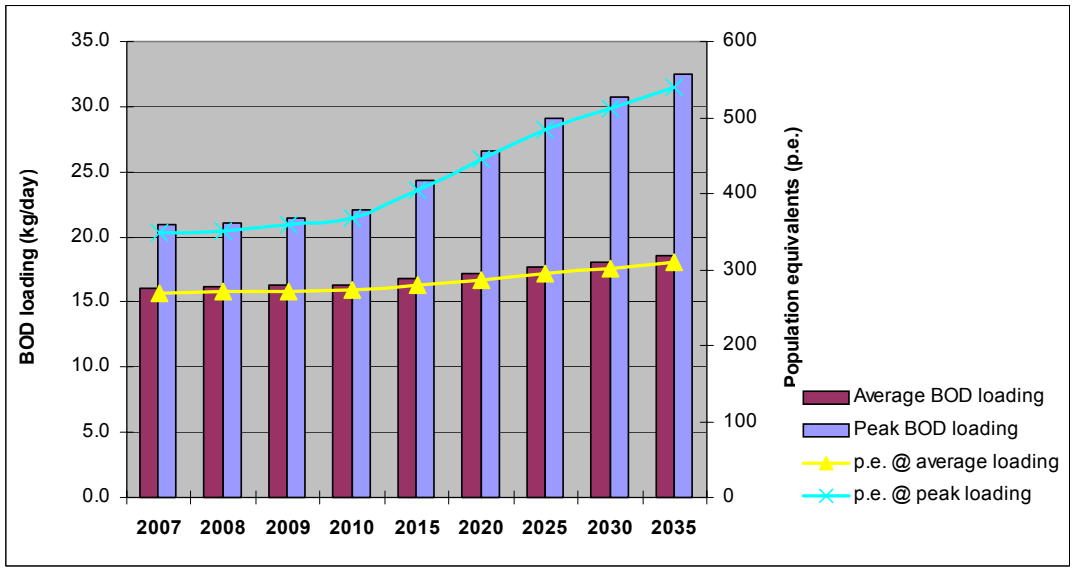
Wastewater Flow Forecast

	Water demand to wastewater flow ratio		80%										
		Unit	Value	**2007**	**2008**	**2009**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
1	*Households*											
2	Total daily household wastewater	m3/day		43.87	44.09	44.31	44.54	45.66	46.81	48.00	49.21	50.45
3	Total monthly household wastewater	m3/month		1,316	1,323	1,329	1,336	1,370	1,404	1,440	1,476	1,513
4	Total yearly household wastewater	m3/year		16,014	16,094	16,175	16,256	16,666	17,087	17,518	17,961	18,414
5	*Public sector*											
6	Total daily public sector wastewater	m3/day		4.39	4.43	4.48	4.52	4.75	4.99	5.25	5.52	5.80
7	Total monthly public sector wastewater	m3/month		132	133	134	136	143	150	158	166	174
8	Total yearly public sector wastewater	m3/year		1,601	1,617	1,634	1,650	1,734	1,823	1,916	2,014	2,117
9	*Groundwater infiltration*											
10	Area covered by collection system	ha	63.0									
11	Unit groundwater infiltration rate	m3/ha.day	0.75									
12	Groundwater inflow	m3/day	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3
13	*Peaking factors*											
14	Hourly peak factor	%	160%									
15	Daily (seasonal) peak factor	%	180%	130%	130%	132%	135%	145%	155%	165%	170%	175%
17	*Total Wastewater Flows*											
18	**Average dry weather flow (ADWF)**	**m3/day**		**53.0**	**53.3**	**53.5**	**53.8**	**55.1**	**56.5**	**58.0**	**59.5**	**61.0**
19	Average wet weather flow (AWWF)	m3/day		95.5	95.8	96.0	96.3	97.7	99.1	100.5	102.0	103.5
20	Average annual daily flow	m3/day		48.3	48.5	48.8	49.1	50.4	51.8	53.2	54.7	56.3
21	Peak hourly flow	m3/hour		8.3	8.3	8.5	8.7	9.4	10.2	11.1	11.6	12.1
22	**Peak average daily flow**	**m3/day**		**62.7**	**63.1**	**64.4**	**66.2**	**73.1**	**80.3**	**87.9**	**93.0**	**98.4**
23	Peak dry weather daily flow	m3/day		68.9	69.2	70.6	72.6	79.9	87.6	95.7	101.1	106.7
24	Peak wet weather daily flow	m3/day		124.2	124.5	126.8	130.0	141.6	153.5	165.8	173.4	181.1
25	Peak average monthly flow	m3/month		2,066	2,077	2,119	2,178	2,398	2,629	2,870	3,032	3,201
26	Minimum average hourly flow	m3/hour		2.0	2.0	2.0	2.0	2.1	2.2	2.2	2.3	2.3
27	Minimum average daily flow	m3/day		48.3	48.5	48.8	49.1	50.4	51.8	53.2	54.7	56.3
28	Minimum average monthly flow	m3/month		1,448	1,456	1,464	1,472	1,512	1,554	1,597	1,642	1,688
29	Sustained yearly flow	m3/year		17,616	17,712	17,808	17,906	18,400	18,910	19,435	19,975	20,532

Wastewater Constituent Concentrations

		Unit	2002	2007	2008	2009	2010	2015	2020	2025	2030	2035
1	**I. Population**											
2	Population growth	%/year		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3	Total population	No	*262*	269	270	271	273	280	287	294	301	309
4	**II. Unit Concentration**											
5	*II.1 Households*											
6	BOD Per capita	gr/cap.day		60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
7	COD Per capita	gr/cap.day		120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
8	TSS Per capita	gr/cap.day		70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
9	N Per capita	gr/cap.day		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
10	P Per capita	gr/cap.day		1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
11	**III. Constituent Discharge (mass loading)**											
12	*III.1 Average loading*											
13	BOD	kg/day		16.1	16.2	16.3	16.4	16.8	17.2	17.6	18.1	18.5
14	COD	kg/day		32.2	32.4	32.6	32.7	33.5	34.4	35.3	36.2	37.1
15	TSS	kg/day		18.8	18.9	19.0	19.1	19.6	20.1	20.6	21.1	21.6
16	N (total)	kg/day		3.0	3.0	3.0	3.0	3.1	3.2	3.2	3.3	3.4
17	P (total)	kg/day		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6
18	*III.2 Peak loading*											
19	BOD	kg/day		21.0	21.1	21.5	22.1	24.3	26.7	29.1	30.7	32.4
20	COD	kg/day		58.0	58.3	58.6	58.9	60.4	61.9	63.5	65.1	66.7
21	TSS	kg/day		33.8	34.0	34.2	34.4	35.2	36.1	37.0	38.0	38.9
22	N (total)	kg/day		5.3	5.3	5.4	5.4	5.5	5.7	5.8	6.0	6.1
23	P (total)	kg/day		0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0
24	**IV. Constituent Concentrations**											
25	*IV.1 Average daily dry weather flow (ADWF)*	m3/day		53.0	53.3	53.5	53.8	55.1	56.5	58.0	59.5	61.0
26	BOD	mg/L		304.2	304.2	304.2	304.2	304.2	304.2	304.1	304.0	303.9
27	COD	mg/L		608.3	608.4	608.4	608.4	608.4	608.4	608.3	608.1	607.9
28	TSS	mg/L		354.9	354.9	354.9	354.9	354.9	354.9	354.8	354.7	354.6
29	N (total)	mg/L		55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.7	55.7
30	P (total)	mg/L		9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
31	*IV.2 Average daily wet weather flow (AWWF)*	m3/day		95.5	95.8	96.0	96.3	97.7	99.1	100.5	102.0	103.5
32	BOD	mg/L		168.7	169.1	169.5	169.9	171.7	173.6	175.4	177.3	179.1
33	COD	mg/L		337.5	338.2	339.0	339.7	343.5	347.2	350.9	354.5	358.1
34	TSS	mg/L		196.9	197.3	197.7	198.2	200.4	202.5	204.7	206.8	208.9
35	N (total)	mg/L		30.9	31.0	31.1	31.1	31.5	31.8	32.2	32.5	32.8
36	P (total)	mg/L		5.1	5.1	5.1	5.1	5.2	5.2	5.3	5.3	5.4
37	*IV.3 Peak average daily flow (PADF)*	m3/day		62.7	63.1	64.4	66.2	73.1	80.3	87.9	93.0	98.4
38	BOD (peak loading)	mg/L		333.9	333.8	333.6	333.5	332.7	331.9	331.1	330.3	329.5
39	COD (peak loading)	mg/L		924.8	924.4	909.9	889.3	826.1	770.9	722.4	699.5	677.7
40	TSS (peak loading)	mg/L		539.5	539.2	530.8	518.8	481.9	449.7	421.4	408.0	395.4
41	N (total) (peak loading)	mg/L		84.8	84.7	83.4	81.5	75.7	70.7	66.2	64.1	62.1
42	P (total) (peak loading)	mg/L		13.9	13.9	13.6	13.3	12.4	11.6	10.8	10.5	10.2
43	**V. Population Equivalents (p.e.)**											
44	p.e. @ average dry weather flow (winter)	(60 gr/cap.d)		269	270	271	273	280	287	294	301	309
45	p.e. @ peak dry weather flow (summer)	(60 gr/cap.d)		349	351	358	368	405	444	485	512	541


BOD concentrations (mg/L)
350
300
250
200
150
100
50
2007
2008
2009
2010
2015
2020
2025
2030
2035
BOD @ ADWF
BOD @ AWWF
BOD @ PADF


BOD loading (kg/day)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
600
500
400
300
200
100
0
Population equivalents (p.e.)
2007
2008
2009
2010
2015
2020
2025
2030
2035
Average BOD loading
Peak BOD loading
p.e. @ average loading
p.e. @ peak loading

Annex 6: Meteorological Data

STATION: PRETOR

Period:1960-1995

Data / Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Av/An/MM
Average monthly and annual air temperatures in °C	1.3	2.3	5.6	8.9	13.4	17.4	20.4	21.0	17.3	13.0	6.4	2.7	**10.8**
Absolute monthly and annual air temperature maximums in °C	13.7	16.5	20.8	22.5	29.5	31.2	33.8	35.4	32.2	28.4	20.9	15.0	**35.4**
Absolute monthly and annual air temperature minimums in °C	-11.4	-16.0	-8.5	-3.8	1.0	4.6	6.0	7.8	5.0	0.0	-7.2	-12.1	**-16.0**
Average monthly and annual air temperature maximums in °C	5.2	6.1	10.8	13.8	18.7	24.6	26.7	27.6	23.7	18.2	10.6	6.4	**16.0**
Average monthly and annual air temperature minimums in °C	-1.9	-1.9	1.4	4.5	8.2	12.1	14.3	14.8	11.7	8.6	3.0	-0.7	**6.2**
Average monthly and annual precipitation sums in mm	57.1	62.1	51.6	50.6	70.7	35.3	28.5	27.5	50.2	82.5	98.9	65.3	**680.2**
Daily and annual precipitation maximums in mm	57.6	60.0	26.4	40.3	57.5	29.8	31.4	60.6	50.4	127.3	80.6	49.2	**127.3**
Average monthly and annual wind speeds (m/sec)	0.9	1.0	0.9	0.9	0.7	0.7	0.6	0.6	0.6	0.8	0.8	0.9	**0.8**
Average monthly sums of duration of sunshine (h/month)	110.1	121.9	177.9	190.7	223.6	262.6	324.0	306.0	238.4	170.7	124.4	83.7	**194.5**
Average number of days with fog by months and at annual level	2	1	0	0	0	0	0	0	0	0	0	0	**4**
RELATIVE HUMIDITY (%)	71.0	68.0	62.0	63.0	63.0	60.0	57.0	55.0	59.0	66.0	70.0	70.0	63.7
MEAN MONTHLY CLOUD (0-10)	4.8	5.2	4.8	5.6	5.1	3.4	3.2	4.5	2.9	4.5	5.7	5.8	4.6

RST285_Brajchino

Total Monthly Rainfall — Units: mm

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	117.1	35.7	45.1	49.3	54.6	46.4	22.7	30.6	52.3	79.1	141.3	115.7
1967	83.2	10.8	-	62.1	86.6	55.8	140.0	1.2	70.6	32.9	30.1	91.8
1968	92.1	61.7	46.9	22.7	105.2	113.3	-	58.9	49.1	10.3	73.0	106.1
1969	78.4	122.3	112.6	55.7	43.9	16.6	6.5	54.8	77.3	-	20.8	191.2
1970	108.8	98.5	48.2	60.2	112.2	36.6	85.7	5.2	22.6	84.7	51.6	52.2
1971	90.6	69.4	106.0	32.2	67.2	24.4	43.2	18.4	128.6	23.4	53.6	22.6
1972	58.8	49.8	35.6	53.4	41.6	9.2	89.2	84.5	76.4	165.0	43.2	8.2
1973	80.2	98.8	88.9	69.9	15.2	32.0	26.4	106.6	-	-	-	-
1974	50.2	139.8	58.9	70.6	125.8	104.4	3.4	53.8	34.0	105.2	71.4	24.4
1975	37.6	8.2	37.4	51.0	87.2	49.4	35.4	39.4	21.6	80.0	59.2	22.6
1976	26.2	32.4	37.2	48.8	101.2	64.4	92.6	38.2	17.0	73.4	-	-
1977	41.4	77.6	55.0	35.2	56.6	27.4	7.6	29.0	77.8	20.0	103.6	26.2
1978	72.4	55.8	55.4	84.2	69.2	62.6	-	6.2	96.2	70.4	14.4	89.6
1979	89.6	39.8	33.6	107.8	124.0	41.6	16.2	61.0	49.8	85.6	164.2	92.2
1980	112.2	16.4	70.2	25.4	134.0	48.6	5.0	37.6	21.8	125.2	61.8	91.6
1981	56.4	89.6	64.8	55.4	39.4	46.0	42.6	54.6	28.6	172.2	46.0	114.6
1982	36.2	16.4	33.8	40.4	46.0	20.0	20.5	41.6	69.6	43.8	93.2	76.2
1983	9.0	65.8	18.0	37.2	75.2	97.0	57.0	40.6	29.2	33.4	95.2	54.0
1984	82.6	91.8	79.8	49.6	9.6	12.6	11.2	106.6	41.6	9.4	53.0	49.4
1985	85.6	58.6	64.6	91.2	86.4	36.0	7.0	6.0	18.0	11.4	187.8	33.0
1986	91.2	-	67.0	39.2	99.5	90.6	72.0	18.0	12.6	40.6	30.0	32.2
1987	-	23.6	90.0	33.6	64.0	22.2	30.0	7.0	9.2	107.2	54.0	61.0
1988	16.0	50.2	56.0	37.0	-	48.0	-	-	23.3	39.0	96.6	46.1
1989	-	49.0	30.0	30.0	80.0	86.0	89.0	28.0	-	49.0	62.0	86.0
1990	-	25.0	12.0	77.0	49.0	7.0	32.0	37.3	33.0	54.0	45.0	150.0
1991	11.0	111.2	32.0	116.0	72.0	16.0	94.0	19.0	53.0	45.0	130.0	18.0
1992	3.8	12.9	28.4	141.0	-	84.0	17.2	-	28.4	92.0	39.0	27.0
1993	22.0	55.0	38.6	22.0	74.0	22.0	5.0	6.0	14.0	42.0	53.0	-
1994	63.0	81.5	7.0	76.0	21.0	31.0	70.0	49.0	18.0	54.0	34.0	34.0
1995	75.0	26.0	47.0	38.0	65.0	18.0	72.0	68.0	90.0	-	60.0	108.0
1996	37.0	97.0	93.0	37.0	76.0	31.0	-	-	-	-	-	-
AVERAGE	61.7	59.0	53.1	56.4	71.8	45.2	44.2	39.5	45.1	64.7	70.3	67.6
STD DEV	33.2	35.7	26.7	28.5	32.1	29.6	36.9	28.6	30.3	43.2	42.7	44.9

RST234_Resen - kl

Total Monthly Rainfall — Units: mm

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	164.1	37.8	24.0	33.3	43.6	38.7	11.5	-	47.8	50.3	216.5	125.0
1967	75.5	17.8	31.7	66.4	72.7	40.6	98.2	3.6	46.1	28.5	30.1	146.0
1968	110.6	66.0	47.0	26.7	102.5	92.7	0.6	41.5	26.1	21.9	87.2	97.1
1969	59.5	108.5	98.6	68.1	25.9	26.5	8.0	49.2	52.3	-	37.1	175.7
1970	86.9	103.1	101.0	68.1	53.3	25.9	32.0	7.7	16.5	95.9	65.5	43.5
1971	116.6	55.6	90.1	30.3	34.0	31.1	47.8	32.1	124.0	31.7	65.6	28.0
1972	88.3	63.5	28.3	61.4	74.0	10.1	60.3	45.1	83.0	163.0	33.5	13.6
1973	62.1	76.5	70.3	42.2	20.4	27.7	21.8	98.0	-	-	-	-
1974	46.1	108.9	57.7	69.2	110.2	54.3	3.4	36.0	48.3	138.5	79.6	40.8
1975	13.1	7.7	23.1	30.8	60.0	38.4	32.5	25.3	23.6	163.4	86.3	50.1
1976	23.8	21.9	35.1	36.7	53.1	56.2	64.0	20.3	26.1	83.4	-	-
1977	41.2	74.4	35.1	24.8	47.5	27.7	0.8	29.3	114.3	12.5	102.7	32.2
1978	84.1	50.5	88.3	93.3	98.3	20.3	-	12.6	100.6	101.9	28.8	97.4
1979	121.4	73.9	27.3	100.2	177.9	4.3	9.8	50.0	37.5	73.7	99.9	65.5
1980	98.7	12.4	68.8	14.7	122.0	34.7	7.7	7.6	2.0	155.2	91.1	112.9
1981	58.0	85.7	46.4	55.3	51.7	47.7	26.7	63.5	70.4	248.9	47.1	105.1
1982	20.5	50.0	40.8	54.7	58.0	14.8	19.6	32.4	53.5	99.8	82.7	110.3
1983	15.2	57.4	11.0	27.4	106.1	67.5	21.3	16.4	78.6	24.8	125.0	48.5
1984	113.7	91.4	65.9	42.0	23.6	8.6	29.9	124.4	47.7	10.4	113.7	57.2
1985	112.1	49.3	72.6	66.6	70.0	30.3	7.4	1.5	25.2	7.6	298.7	16.5
1986	101.5	-	90.3	26.4	141.9	121.5	62.9	6.1	8.8	44.8	16.1	41.4
1987	122.8	30.7	98.9	33.5	60.7	31.4	35.0	6.9	8.3	84.4	84.8	55.0
1988	24.6	41.4	63.1	22.8	6.4	42.5	15.6	8.0	34.4	64.8	132.9	74.0
1989	-	50.2	69.5	22.2	100.4	47.7	56.7	8.7	-	107.8	50.8	54.3
1990	4.2	27.2	9.5	86.7	53.9	15.7	22.2	15.0	37.7	45.8	67.1	161.6
1991	8.0	139.5	19.9	87.4	65.6	31.8	46.2	11.6	44.3	21.4	143.7	6.9
1992	-	-	-	-	75.7	-	-	5.6	-	-	-	-
1993	-	-	-	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-	-	-	-
1995	-	-	-	-	-	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-	-	-	-	-
AVERAGE	70.9	60.1	54.4	49.7	70.7	38.0	29.7	29.2	48.2	78.4	91.1	73.3
STD DEV	44.4	33.4	29.0	24.9	39.2	25.7	24.4	29.8	32.5	61.3	62.7	47.3