Trans-Boundary River Management Phase II for the Kura River – Armenia, Georgia, Azerbaijan

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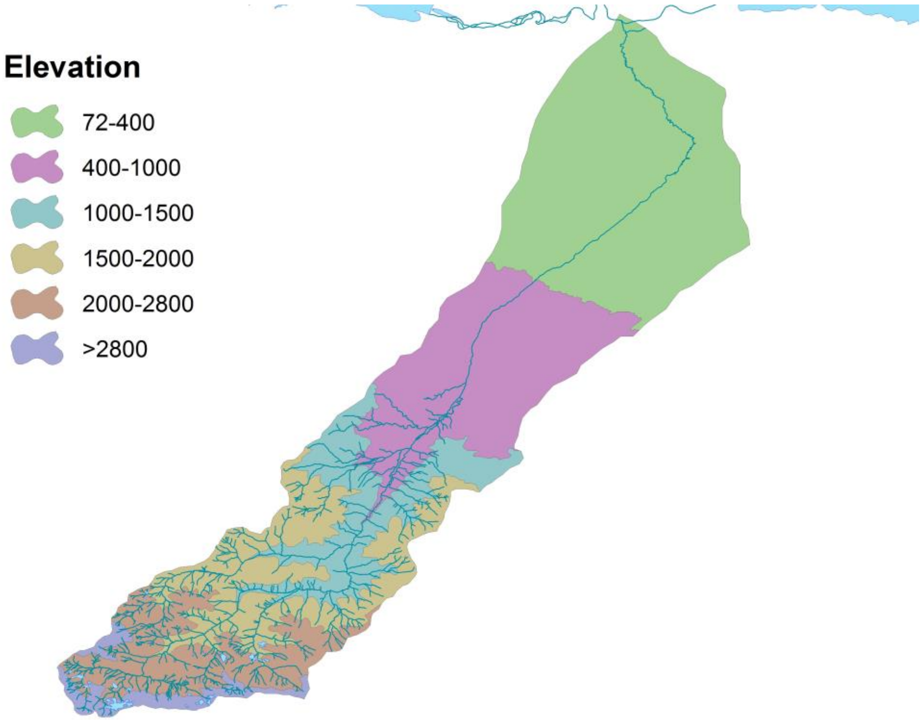

Pilot River Basin Management Plan for the Ganjachay River basin, Azerbaijan

Prepared by:
Jesper Ansbaek, Anatoly Pichugin, Peter Roncak,
Vafadar Ismailov, Farda Imanov, Rafig Vediyev

EPTISA Servicios de Ingenieria S.L. (Spain) & Grontmij Carl Bro A.S. (Denmark)

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LIST OF ABBREVIATIONS

AWB	Artificial Water Body
Azersu	The Republic of Azerbaijan's national water company
BOD	Biological Oxygen Demand
CIS	WFD Common Implementation Strategy (Documents[1])
DPSIR	Driver Pressure State Impact Response
ELV	Emission Limit Value
EQR	Ecological Quality Ratio
EQS	Environmental Quality Standard
GIS	Geographic Information System
EU	European Union
HMWB	Heavily Modified Water Body
HPP	Hydro Power Plant
IFI	International Financing Institution
IMPRESS	CIS Guidance for the analysis of Pressures and Impacts In accordance with the Water Framework Directive.
IPPC	Integrated Pollution, Preventing and Control
IWRM	Integrated Water Resource Management
MAC	Maximum Allowable Concentration
MS	EU Member State
PoM	Programme of Measures
RB	River Basin
RBMP	River Basin Management Plan
WB	Water Body
WBR	Water Bodies at Risk
UWWTD	EU - Urban Wastewater Treatment Directive
WFD	Water Framework Directive, 2000/60/EC
WWTP	Waste water treatment plant
WTP	Waste water treatment plant

[1] Available from http://ec.europa.eu/environment/water/water-framework/objectives/implementation_en.htm

IMPORTANT WATER MANAGEMENT DEFINITIONS

Additional measures (WFD)	"additional measures" is needed where monitoring or other data indicate that the objectives set under the WFD Article 4 for the body of water are unlikely to be achieved and the water body is not already addressed in the PoM.
Agglomeration (UWWTD)	According the Urban Waste Water Directive 'agglomeration' means an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point
Artificial Water Body (WFD)	"Artificial water body" means a body of surface water created by human activity.
Bad status	Large portions of biological communities normally associated with the surface water type under undisturbed conditions are absent. [Severe alteration of structure and function of the ecosystem]
Basic measures	Basic measures includes: - technical interventions as a minimum needed to reach good status in a water body - measures deemed appropriate for the purposes of achievement of other WFD articles - measures required to implement other EU legislation for the protection of water
Baseflow	Baseflow is the usual, reliable, background level of flow in a river, maintained generally by seepage from groundwater storage.
Characterisation (WFD)	For each River Basin District carry out: – an analysis of its characteristics, – a review of the impact of human activity on the status of surface waters and on groundwater, and – an economic analysis of water use. Based upon existing data.
Classification	Addressing water bodies to high, good, moderate, poor or bad status based on monitoring data.
Competent authority (WFD)	The authority or authorities identified by the Member States for the application of the rules of the Water Framework Directive within each River Basin District lying within their territory.
Driver (IMPRESS)	An anthropogenic activity that may have an environmental effect (e.g. agriculture, industry)
Ecological Quality Ratio (EQR)	Ratio representing the relationship between the values of the biological parameters observed for a given body of surface water and values for these parameters in the reference conditions applicable to that body. The ratio shall be represented as a numerical value between zero and one, with high ecological status represented by values close to one and bad ecological status by values close to zero.
Good Status	Slight changes compared to the natural condition: The values of the

(WFD)	biological quality elements for the surface water body type show low levels of distortion resulting from human activity, but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions. [Some replacement of sensitive/rare species; ecosystem functions fully maintained]
Heavily modified water body (WFD)	"Heavily modified water body" means a body of surface water which as a result of physical alterations by human activity is substantially changed in character
High status	Little or no sign of anthropogenic disturbance. [No loss of species, small density changes may occur]
Impact (IMPRESS)	The environmental effect of the pressure (e.g. fish killed, ecosystem modified)
International River Basin Management Plan (WFD)	In the case of an international River Basin District falling entirely within the EU, Member States shall ensure coordination with the aim of producing a single International River Basin Management Plan.
Integrated Water Resource Management (GWP)	IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems
Measures (WFD)	Actions to ensure protection and sustainable use of water and achieve the objectives of the water bodies in the framework of the river basin.
Moderate status	Moderate changes compared to the natural condition. [Many sensitive species disappeared; ecosystem functions largely maintained]
Monitoring	The purpose of monitoring is to provide information on the status of the environments to authorities, organisations and for the public and to provide the information needed for the authorities to decide upon measures to protect and improve the status of the environment
Operational monitoring	– assess status of water bodies at risk, – assess any changes in the status of water bodies at risk resulting from the programmes of measures.
Poor status	Biological communities deviate substantially from those normally associated with the surface water type under undisturbed conditions. [Tolerant species dominate; sensitive species are rare; ecosystem functions altered]
Population Equivalent (UWWTD)	'1 p.e. (population equivalent)' means the organic biodegradable load having a five-day biochemical oxygen demand (BOD_5) of 60 g of oxygen per day
Pressure (IMPRESS)	The direct effect of the driver for example, an effect that causes a change in flow or a change in the water chemistry.
Reference condition (WFD)	Type specific biological reference conditions represent the values of the biological quality elements at high ecological status for each surface water body type. The values of the biological quality elements for the surface water body reflect those normally associated with that type under undisturbed conditions and show no or only very minor, evidence of distortion.
Response (IMPRESS)	The measures taken to improve the state of the water body (e.g. restricting abstraction, limiting point source discharges, developing best

	practice Guidance for agriculture)
River basin (WFD)	The area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta
River Basin District (WFD)	The area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters.
River Basin Management Plan	The River Basin Management Plan summarise and present the analysis, characterisation, monitoring results and programme of measures in one document, which can be used for the dialogue with the stakeholders (including the public information and consultation)
State (IMPRESS)	The condition of the water body resulting from both natural and anthropogenic factors (i.e. physical, chemical and biological characteristics)
Status (WFD)	The biological or ecological behaviour of a water body supported by hydromorphological and chemical data from the water body.
Significant Pressure (IMPRESS)	Any pressure that on its own, or in combination with other pressures, may lead to a failure to achieve the specified objective
Supplementary measures	Supplementary measures includes: Institutional, awareness, legislation, research, economic instruments, education, demonstration projects etc
Surface Water Body (WFD)	"Body of surface water" means a discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water.
Surface water categories (WFD)	Rivers, lakes, transitional waters or coastal waters
Surveillance monitoring (WFD)	- Check results of characterisation. - Input to the design of future monitoring programmes. - To assess long term changes in natural conditions and long term changes resulting from widespread anthropogenic activity.
Typology (WFD)	For each surface water category, the relevant surface water bodies within the river basin district shall be differentiated according to type
Water Body	A coherent sub-unit in the river basin (district) to which the environmental objectives of the directive must apply. Hence, the main purpose of identifying “water bodies” is to enable the status to be accurately described and compared to environmental objectives.
Water body at risk	A water body that is identified as being at risk of failing the environmental quality objectives based upon the characterisation as specified in article 5 of the WFD and results of operational monitoring as specified in article 8 of the WFD.

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INTRODUCTION

Gəncəçay çay hövzəsinin dağlıq hissəsinə düşən yağıntının miqdarı çoxdur, lakin alluvial düzənliyinin təbii bitki örtüyü çöl olduğundan bitkilərin inkişafı üçün suvarmaya ehtiyac var. Əhalinin sıx məskunlaşdığı alluvial düzənlik ərazilərdə su çatışmamazlığı və suyun keyfiyyəti ilə bağlı problemlərin yaranma səbəblərindən biri yağıntının az düşməsidir, lakin əsasən su itkiləri və suyun yalnış idarə edilməsinə üstdən aşağı sektorial yanaşmadır

Azərbaycan Respublikası Avropa Qonşuluq və Tərəfdaşlıq Alətləri (AQTA) çərçivəsində Avropa Birliyi tərəfindən texniki yardım alır. Avropa komissiyası və Azərbaycan Hökuməti tərəfindən razılaşdırılmış AQTA Fəaliyyət planına əsasən Azərbaycan Respublikası Avropa İttifaqının suyun idarə edilməsinə inteqrasiyalı yanaşma xətti boyunca özünün su idarə etmə üsullarını və təcrübəsini tarazlaşdırmağa calışır.

Avropa Birliyinin Su Çərçivə Direktivinin su ehtiyatlarının qiymətləndirilməsində qanunvericiliyin əsas hissəsi çay hövzəsi prinsiplərinə əsaslanır və AB üzv dövlətləri üçün Direktivin tələblərinə uyğun çay hövzəsi planlarının hazırlanması məcburidir

Bu pilot Çay Hövzəsinin İdarə edilməsi Planı Su Çərçivə Direktivinin metodologiyasına uyğun hazırlanmışdır.

Pilot Çay Hövzəsinin idarə edilməsi planın əsas hissəsini su obyektlərinin SÇD-i terminalogiyasındakı "yaxşı status"na nail olmaq üçün görülən lazımi fəaliyyətlərdir. Bu faəliyyətlər Tədbirlər Proqramı adlanır

TP-nın yaradılmasında əsas kimi hövzələrin vəziyyəti və çaylara insan təsirinin təhlil edilməsi götürülür.

Belə ki, Gəncəçay çay hövzəsinin ümumi fiziki-coğrafi vəziyyəti və çay üzərində insan fəaliyyəti barədə mövcud bilik, o cümlədən su, bitki, torpaqdan istifadə, çay axımı və səth sularının keyfiyyəti barədə mövcud biliklər toplanmışdır.

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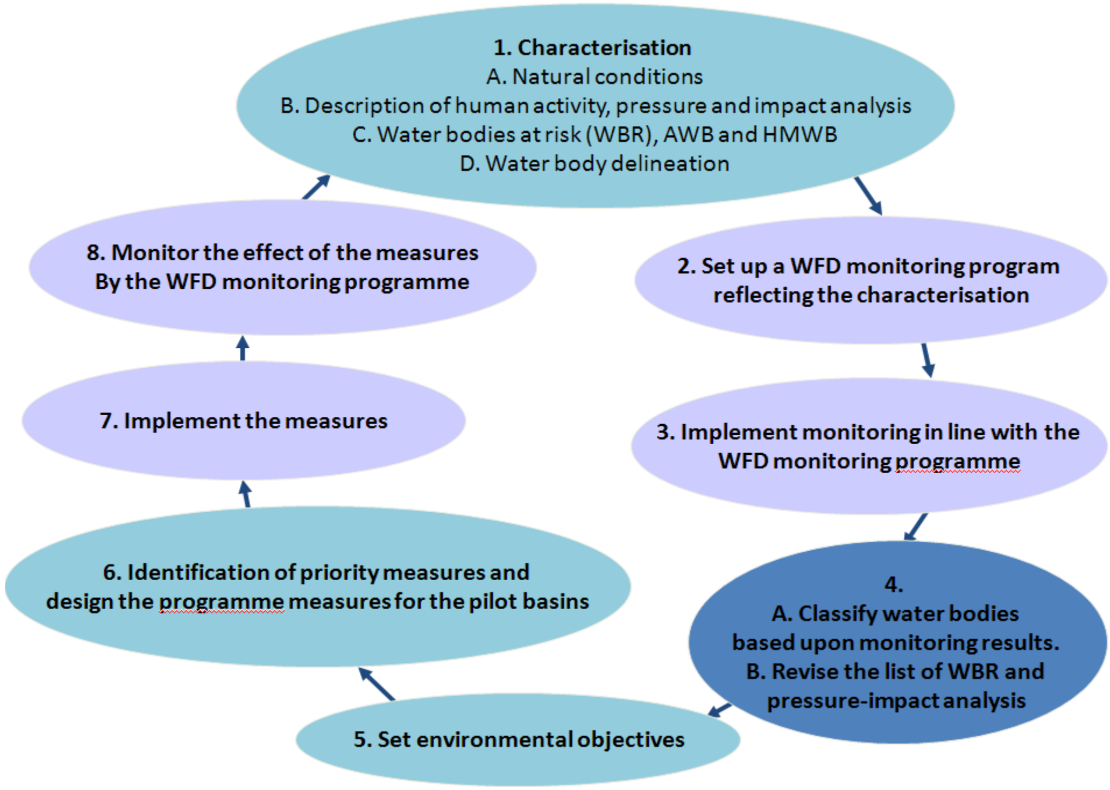
İşin əsas hissəsi su ekosistemində insan fəaliyyəti ilə onun göstərdiyi təsiri birləşdirir (SÇD-nin terminologiyasında təzyiq-təsir təhlili). Təzyiq-təsirin təhlilinə xüsusi baxılmalıdır və nəticədə mühüm problemlər və onların yaranma səbəbləri aydınlaşdırılmalıdır.

Hər bir RSO üçün Tədbirlər Proqramı yerinə yetirilməlidir, TP hər iki xüsusi sahə və xüsusi təsiri bildirir.
Aşağıda biz SÇD-nin planlanma tsiklinin diaqramını vermişik, hansını ki, Direktivə görə AB Üzv Dövlətləri hər 6 ildən bir təkrar etməlidirlər



The information provided in this document is illustrated by the corresponding graphs, maps and tables.

The aim of this draft pilot basin River Basin Management Plan is to help the authorities responsible for water management, the administration and the politicians in the Ganjachay River basin and the public in general to learn and understand the WFD methodology to be able to adopt the better means of water resources management and protection.

As the purpose of the report is to pilot the WFD approach in Azerbaijan by preparing the pilot River Basin Management Plans, we have used the following proactive approach in relation to the characterisation of river basins in line with the WFD methodology: "Lack of data is not an excuse for doing nothing, demonstrate that you tried".

Biz ÇHİP üçün SÇD-də göstərilmiş əsas başlığı rəhbər göturərək Gəncəçay hövzəsinin pilot layihəsini hazırlamışıq. Biz pilot ÇHİP-nı hazırlayarkən mövcud biliklərdə olan boşluqları müəyyən etmişik və boşluqları doldurmaq üçün öz müvafiq tövsiyyələrimizi vermişik.
The gaps in the knowledge identified in the course of the preparation of RBMPs in line with the WFD methodology include lack of basic education, weak "knowledge infrastructure", lack of technical expertise, a fragmented approach to analysing environmental and technical issues (where the WFD requires integration), serious lack of meaningful data about the human activities impacting water quality and quantity, and plus an inadequate monitoring providing only limited amount of meaningful information on the actual water quality and water quantity required for the preparation of RBMP.

SUMMARY

The present draft final river basin management plan is intended to be:

- A basis for the discussions among the key stakeholders on the present situation in the basin, where water quality problems are and what needs to be done to improve the situation,
- A basis for the design and update of the monitoring programmes
- A guidance to better understanding of what kind of data on human pressures are needed in order to establish a targeted and cost-effective programme of measures.

Gəncəçay Çay Hövzəsi

Gəncəçayı öz mənbəyini Kiçik Qafqaz sıra dağlarının təxminən 3400 m hündürlüyündən götürür və şimal-şimalşərq istiqamətində axaraq Kür çayı ilə qovuşur.

Gəncəçayın uzunluğu təqribən 99 km-dir və bu nisbətən kiçik hövzənin sahəsi 725km^2-dir (bu Azərbaycanın az bir faizini təşkil edir). Hövzənin forması elədi ki, onun uzunluğu enindən bir neçə dəfə artıqdır - xəritədə o cənubdan şimala uzanan dar və uzun hövzə kimi görünür.

Hövzə boyu temperatur rejiminin fərqliliyi və hündürlükdə düşən yağıntının böyük fərlilik təşkil etməsi ilə əlaqədar təbii şərait nisbətən qısa məsafədən cənubdan (yüksək dağlar) şimala (düzənlik)doğru cənubda yerləşən bol yağıntılı alp çəmənliklərdən şimalda yerləşən az yağıntılı quru çöl və yarımsəhra çöllərinə qədər uzanır.

İqtisadi Fəaliyyələr

Gəncəçay Çay hövzəsinin əhali sayı təqribən 300,000 nəfərdir. Əhalinin əsas hissəsi Gəncə şəhərində yaşayır.

Sənayenin əsasını Gəncə şəhərində mərkəzləşmiş kiçik və orta miqsaylı müəssisələr təşkil edir (ticarət, qida emalı, xalçaçılıq,toxuçuluq və tekstil daxil olmaq) . Kənd təsərrüfatı - əkinçilik və heyvandarlıq hır ikisi hövzənin qalan hissəsində əsas məşğuliyyət sahələridir. Gəncənin şimal hissəsinin düzənliklərində (Samux rayonu) kənd təsərrüfatı tamamilə suvarmadan asılıdır. Burada əsas əkinçilik məhsulları taxıl, tərəvəzlər, yemiş, meyvə və üzümdü.

Təzyiqlər

Suvarmaya ən böyük tələbat Gəncənin şimalındadır və bu məqsədlə Gəncəçay çayının suyundan istifadə edilir, nəticəsində isə yay aylarında bütün Gəncə şəhəri boyunca çay qur olur.

Şəhər və kəndlərdə bərk tullantıları və tullantı sularını idarə etmək üçün müasir sistem çatışmamazlığı mövcuddur. Şəhərlərdə tullantı sularını təmizləyən qurğular yoxdur. Kəndlərdə bərk tullantılar onlara rahat gələn yerlərə (adətən çay sahilləri və ya çaya atılır) və ya yaşayış ərazilərinə yaxın yerlərdə qazılmış quyulara atılır

The present agricultural practices in the basin are not very advanced in terms of effective and safe application of pesticides and use of the nutrients in chemical fertiliser and manure for crop production.

Hövzə üzrə kənd təsərrüfatı təcrübəsində pestisidlərin səmərəli və təhlükəsiz baxımdan tətbiqi və məhsul istehsalı üçün qidalandırıcı gübrə və peyindən istifadə bir o qədərdə qabaqcıl deyil .

Təsirlər

A crucial step in the WFD water planning procedure is to evaluate where the impacts from human activities have consequences that are so negative (significant impacts) for rivers or other water bodies that something needs to be done to reduce the impact.
SÇD-nin sudan istifadənin planlaşdırılması üsulunda əsas addım çaylarda insan fəaliyyəti zamanı yaranan mənfi təsirləri (əhəmiyyətli təsirlər) və ya başqa su obyektlərinə təsiri azaltmaq üçün lazımi işin görülməsini qiymətləndirməkdir.

Our analysis has shown that such significant impacts on the river ecosystem is resulting from the following human activities in the Ganjachay basin:

1. Water abstraction for irrigation and household use (both river water and subsoil water);
2. Household wastewater - water pollution by household waste waters by people living along the river
3. Car washing in rivers
4. Solid waste disposal
5. Deforestation
6. Hydromorphological changes to the river bed

We have identified the above activities as the activities making significant impacts using informed expert judgment based on the analysis of the data available, as well as on the data obtained during the field surveys.
Biz yuxarıdakı fəaliyyətləri mövcud məlumatlara , həmçinin sahə tədqiqatları zamanı əldə olunan məlumatların təhlilinə əsaslanan ekspert qərarlarından istifadə edərək mühüm təsirlər yaradan fəaliyyət kimi təyin etmişik.

Where the problems are Problemlər haradadır

3 river sections (water bodies) have been identified on the main river, where the ecosystem is not healthy due to the impact (pollution etc.) from the above mentioned human activities.
Əsas çay üzərində yuxarıda göstərilən insan fəaliyyəti zamanı yaranan təsirlərə görə sağlam ekosistemin olmadığı 3 çay bölməsi müəyyən edilib.

Aşağıdakı cədvəldə insan təsirinə məruz qalan risk altında 3 su obyektinin qısa xülasəsi verilmişdir:

	Risk altında olan Su obyekti	***Riskin səbəbləri***
1	Gəncəçay, Zurnabaddan Gəncə	*1. Suvarma və məişətdə istifadə üçün suburaxan(çay suyu və yeraltı sular)* *2.Məişət tullantı suları – çay boyu yaşayan əhali tərəfindən çirklənmiş tullantı suları ilə suyun çirklənməsi*

	Risk altında olan Su obyekti	***Riskin səbəbləri***
	kəndinə qədər	*3.Çaylarda maşınların yuyulması* *4.Bərk tullantıların yerləşdirilməsi* *5.Meşələrin qırılması* *6.Çay yatağında dəyişikliklər (bəndlər, beton divarlar)*
2	Gəncəçay, Tophəsənlidən Göy-gölə qədər	*1. Suvarma və məişətdə istifadə üçün suburaxan(çay suyu və yeraltı sular)* *2.Məişət tullantı suları – çay boyu yaşayan əhali tərəfindən çirklənmiş tullantı suları ilə suyun çirklənməsi* *3.Çaylarda maşınların yuyulması* *4.Bərk tullantıların yerləşdirilməsi* *5.Meşələrin qırılması*
3	*Gəncəçay, Göy-göldən mənsəbə qədər*	*1. Suvarma və məişətdə istifadə üçün suburaxan(çay suyu və yeraltı sular)* *2.Məişət tullantı suları – çay boyu yaşayan əhali tərəfindən çirklənmiş tullantı suları ilə suyun çirklənməsi* *3.Çaylarda maşınların yuyulması* *4.Bərk tullantıların yerləşdirilməsi*

How to address problems

Water abstraction for irrigation

The process of designing measures to secure good status in the water bodies at risk due to water abstraction for irrigation and household use goes through five steps;

1. Setting separate requirements for minimum flow for all WBRs;
2. Detailed analysis of the present use of water and identification of possibilities to optimise the use;
3. Designing measures to meet the minimum flow requirement for al WBRs;
4. Socioeconomic evaluation of the measures;
5. Revision of objectives for WBRs if it is considered disproportionately costly or socially unacceptable to implement the measures (political evaluation).

There are too many gaps in the present data and information available on flow regime and water use to make it possible to make the analysis outlined above within the Kura project.

Wastewater

The measure to reduce pollution from untreated sewage is to collect the sewage in a sewerage system and lead it to a Waste Water Treatment Plant (WWTP).

Gəncə şəhərinin əsas kollektoru tullantı sularını şəhərdən qonşu çay hövzəsinə daşıyır və bunu idarə etmək üçün tədbirlər ÇHİP-na daxil edilməmişdir.
Biz təklif edirik ki, Göy-gölün şimal-qərbində(Xanlarda) TSTQ tikilsin, hansı ki, həmçinin Mirzik, Gəncə və Topalhəsənli kəndlərinə xidmət göstərə bilər.

Solid waste
The EU policy on solid waste emphasise the need to reduce, reuse (e.g. reusable bottles) and recycle (e.g. metal, glass, plastic). The aim of the EU waste policy is to extract the maximum practical benefits from products and to generate the minimum amount of waste.

The rest fraction of the waste should be disposed in a sanitary landfill. As the construction of a sanitary landfill is very expensive we propose that one central sanitary landfill is constructed covering the whole basin. The sanitary landfill has to fulfil four main conditions:

- no water percolating the waste enters surface or groundwater, all percolate has to collected and treated,
- the design should consider local geological conditions,
- trained staff shall run the landfill,
- waste should be handled in a way (coved etc.), that minimise the loss by wind and the accessibility to pests.

Polluter pays
In the EU the main principle to cover the costs of an improved environment is that the polluter pays. E.g. the households and industries discharging their sewerage to the sewerage system shall pay the construction and maintenance of the pipes and the WWTP.

International financing institutions are often willing to provide soft loans for the construction of sewage systems, WWTPs and sanitary landfills.

Many pollution problems are a result of inefficient practices in industries and agriculture resulting in waste of raw materials and energy. Often reducing the environmental impact of an enterprise or a farm will result in an improved economic performance.

The data and information problem
Our work has clarified that many of the data, that are needed to produce the River Basin Management plan are not available. The lack of data and information to support the “expert judgement” (which is always needed during the elaboration of a RBMP) means that the present plan should be considered as a very first iteration of a RBMP for the Ganjachay basin piloting the WFD methodology.

The gaps in data and information include very little information on the economic activities in the basin, and very few of data from the monitoring of the environmental situation.

Also there is a crucial lack of knowledge infrastructure (technical experts in all involved sectors with knowledge of the EU approach to water management and trained in integrated planning) needed to set up River Basin Management Plans in Azerbaijan.

1.Təbii şərait, hövzənin ümumi təqdimatı

Bu fəsildə hövzənin vəziyyətini başa düşmək üçün qısa məlumat verilmişdir(heç bir insane fəaliyyəti və təsiri olmadan). Hövzənin təbii vəziyyəti haqqında bilik insane təsirinin qiymətləndirilməsini və növbəti fəsillərdə göstərildiyi kimi səth su obyektlərinin yaxşı statusuna nail olmaq üçün tədbirlərin hazırlanmasını tələb edir.

Gəncəçayı Kiçik Qafqaz sıra dağlarından başlayır və şimal-şimalşərq istiqamətində axaraq kür çayına birləşir.
The length of Ganjachay is 99 kilometres and the area of this relatively small basin is 752 km^2 (less than one percent of the total area of Azerbaijan). The length of the basin exceeds several times its width. The narrow and long basin stretches from south to northeast.
Gəncəçayın uzunluğu 99 km-dir və bu nisbətən kiçik hövzənin sahəsi 725km^2-dir (bu Azərbaycanın az bir faizini təşkil edir). Hövzənin uzunluğu enindən bir neçə dəfə artıqdır. Dar və uzun hövzə cənubdan şimala qədər uzanır.

1.1 Hövzənin hündürlüyü
Hövzənin ən hündür yeri 3400 m yaxındır və çay mənsəbində ən aşağı yer 72 km-dir. Hövzənin orta hündürlüyü 1119 m-dir. Rəqəmli hündürlük xəritəsi şəkil 1.1 göstərilmişdir.
Figure 1.1: **Digital elevation map of Ganjachay river basin, with river network**

1.2. Çay şəbəkəsi
Gəncəçay öz mənbəyini 2814m hündürlükdə bulaqlardan götürür. Çayın 5 əsas qolu var: bunlardan 1-i sağ qalan 4-ü sol qollardır (cədvəl 1.1).

Cədvəl 1.1:The main tributaries of Ganjachay Gəncəçayın əsas qolları

Qolun adı	Hansı tərəfdən Gəncəçaya birləşir	Gəncəçayın mənbəyindən olan məsafə	Uzunluq, km	Hövzə, km^2
Zincirliçay (Zincirli)	Sol	91	11	29
Zivlançay	Sağ	75	15	48
Dəstəfurçay (Dəstəfurçay)	Sol	66	28	69
Dərəmirzəçay (Dərə Mirzik)	Sol	56	12	46

The Ganjachay river network is shown in figure 1.1. In the mountains (high mountains and middle mountains) there is a high density of river network reflecting a high precipitation and low evaporation, while in the lower part of the basin (low mountains and alluvial plain) there are no tributaries, reflecting low precipitation and high evaporation.

Gəncəçay çay şəbəkəsi şəkil 1.1-də göstərilmişdir. Dağlıq ərazidə (yüksək dağlar və orta yüksəkli dağlar) çay şəbəkəsinin yüksək sıxlığı özündə bol yağıntı və az buxarlanma əks etdirir, baxmayaraq ki, hövzənin aşağı hissəsində (alçaq dağlar, alluvial düzənliklər) az yağıntı və yüksək buxarlanma əks heç bir qol yoxdur.

1.3. İqlim və bitki örtüyüThe big differences in elevation, temperature and precipitation from the high mountains in the south to the lowlands in the north are reflected in similar big differences in the natural vegetation in the Ganjachay basin. From south (high mountains) to north (lowland) the natural vegetation changes from mountain tundra via alpine meadows, oak and hornbeam forests, dry steppe to semi-desert, see figure 1.2 and 1.3.
Cənubdakı yüksək dağlardan şimaldakı düzənliklərə qədər yüksəklik, temperatur, yağntının böyük fərqliliyi Gəncəçay hövzəsində özünü oxşar böyük fərqliliklə təbii bitki örtüyündə əks etdirir. Cənubdan (yüksək dağlar) şimala (düzənliklər) təbii bitki örtüyünün dəyişikliyi dağ tundradan alp çəmənliklərinə, palıd və vələs meşələrinə, quru çöldən yarımsəhraya keçir. Bunu şəkil 1.2. və 1.3-də görmək olar.

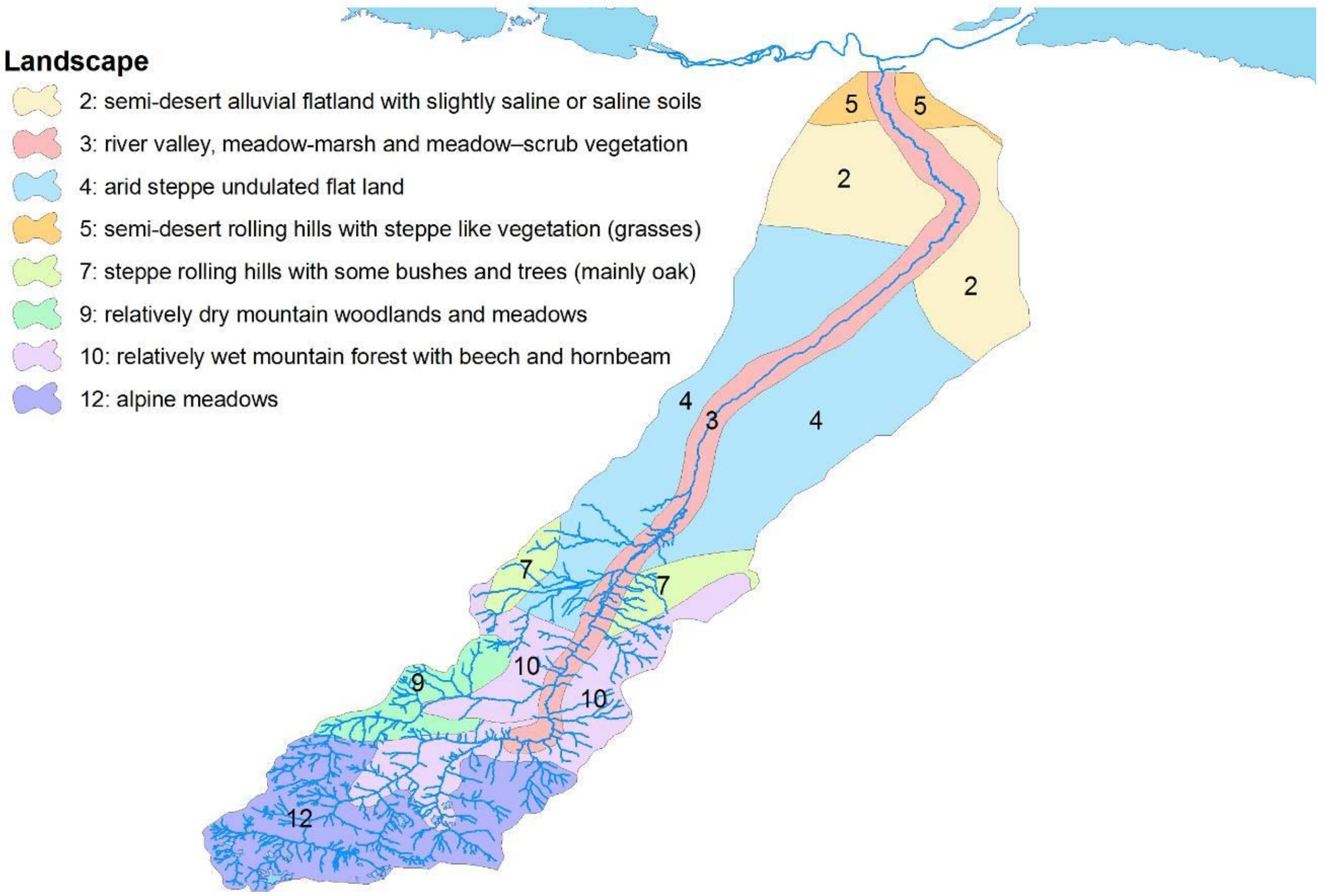
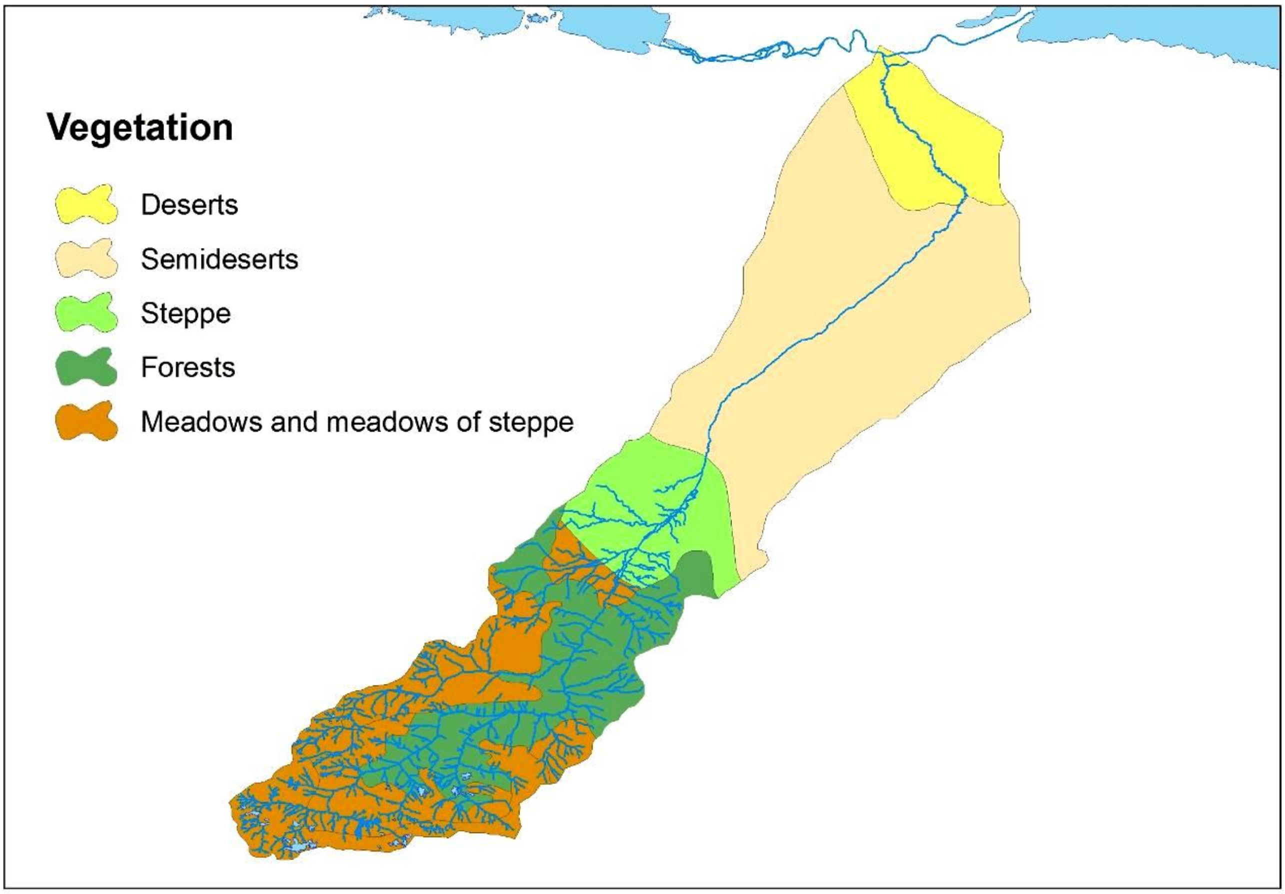


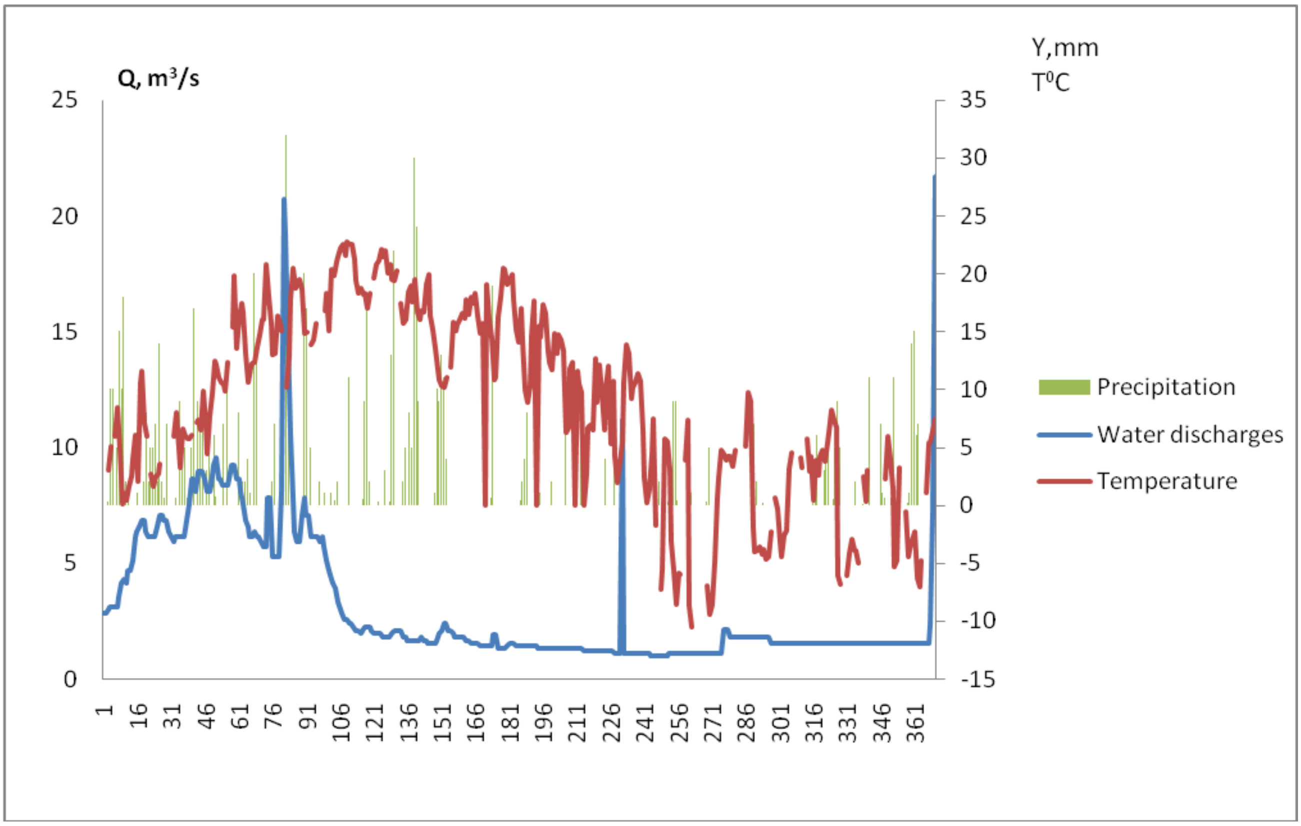
Figure 1.2: **The landscape types of the Ganjachay basin (based on a landscape type map for the whole of Azerbaijan from 1975, elaborated by A.V. Paevola and M.A. Rasmadse).** .



Şəkil1.3: Gəncəçay hövzəsinin bitki növləri (Azərbaycan Dövlət Torpaq və Xəritə çəkmə Komitəsinin atlasından,2010)

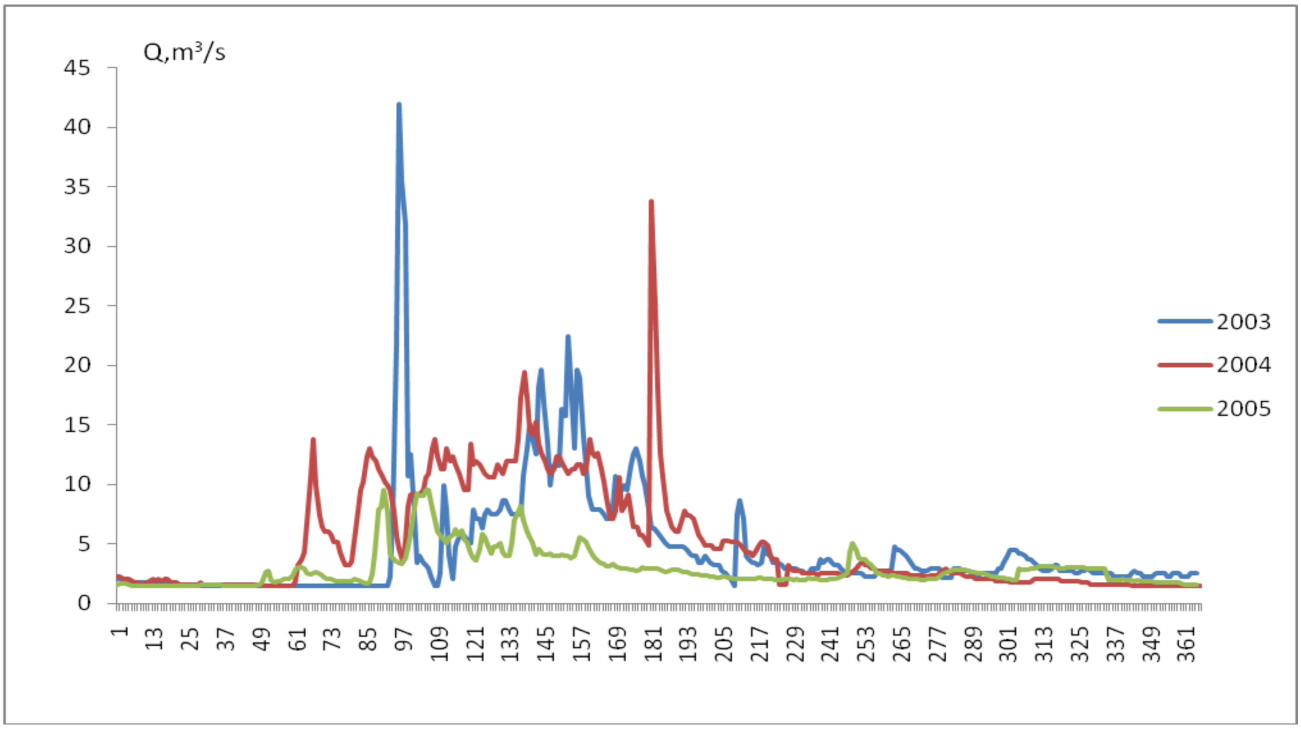
1.4. Çay axını

869 m hündürlükdə yerləşən Zurnabad stansiyasının 2002-ci il üçün temperatur, yağıntı və çay axını şəkil 1.4-də göstərilmişdir.



Şəkil 1.4: Gəncəçay çayının Hidroqrafı, Zurnabad meteoroloji stansiyasında hava temperaturu və yağıntı (869 m hündürlükdə), 2002.

Dağların orta hissəsində Zurnabad meteoroloji stansiyasında orta illik yağıntının miqdarı 657 mm-dir. Yüksək dağlıq ərazilərdə yağıntı miqdarı təqribən 850 mm, orta dağlıq ərazilərdə yağıntı miqdarı təqribən 700 mm, alçaq dağlıq ərazilərdə yağıntı miqdarı təqribən 500mm, düzənliklərdə yağıntı miqdarı təqribən 410 mm, ən şimal təpəlik ərazilərdə isə 300 mm-dir.
Gəncəçayın Zurnabad stansiyasında 3 il (2003,2004,2005) üçün müxtəlif yağıntı və axma rejimi şəkil 1.5-də verilmişdir.



Şəkil 1.5: Gəncəçayının (Zurnabad stansiyası) 3 il üçün müxtəlif axma rejimi və illik axımı, yüksək (2004), orta(2003) və aşağı axım hidroqrafı

Gəncəçayın Zurnabad stansiyasında illik su həcmi 2004-cü ildə 0.17 km^3, 2003-cü ildə 0.14 km^3, 2005-ci ildə 0.09 km^3 olmuşdur.
Baza axımı əsasən yeraltı suların süzülməsi nəticəsində formalaşır. Uzun quraqlıq zamanı baza axımı özü azalmağa başlayır. Gəncəçayın yüksək baza axımı illik axımın təqribən 40% -ni təşkil edir. Yüksək baza axımı göstərir ki, yağıntı miqdarının çox hissəsi (yağış və qar) torpaqdan yeraltı su rezervuarlina süzülür və oradan da çaylara qovuşur.
Azərbaycandakı digər dağ çayları kimi Gəncəçay çayının maksimal su sərfi erkən yazda, fevral və may ayları ərzində müşahidə olunur. Yazda və yayın birinci hissəsində temperaturun artması ilə qar əriməyə başlayır və intensiv yağışlar zamanı (həmçinin qarın əriməsi) yüksək axım yaranır.
In the winter there are long periods with base-flow.

In the winter much of the precipitation will be stored as snow, and there will be long periods with baseflow.
Qışda baza axımıı uzun müddətli olur. Qışda yağıntının çoxu qar şəklində toplandığı üçün baza axımı uzun müddətli olacaqdır.

1.4. Xülasə

Due to the big differences in first and foremost precipitation and temperature associated with the big differences in height, the ecological situation is very different from the south (high mountains) to the north. In figure 1.6 the catchment is divided into 5 sections based on elevation. Each section has a different temperature regime, precipitation and vegetation.
İlk növbədə böyük fərqliliyə görə yağıntı və temperature yüksəkliklərdəki böyük fərqliliklə əlaqəlidir, ekoloji vəziyyət cənubdan (yüksək dağlar) şərqə doğru müxtəlifdir. Şəkil 1.6 –da

yüksəkliyə əsasən hövzə 5 bölməyə bölünüb. Hər bir bölmənin müxtəlif temperature rejimi, yağıntı miqdarı və bitki örtüyü var.

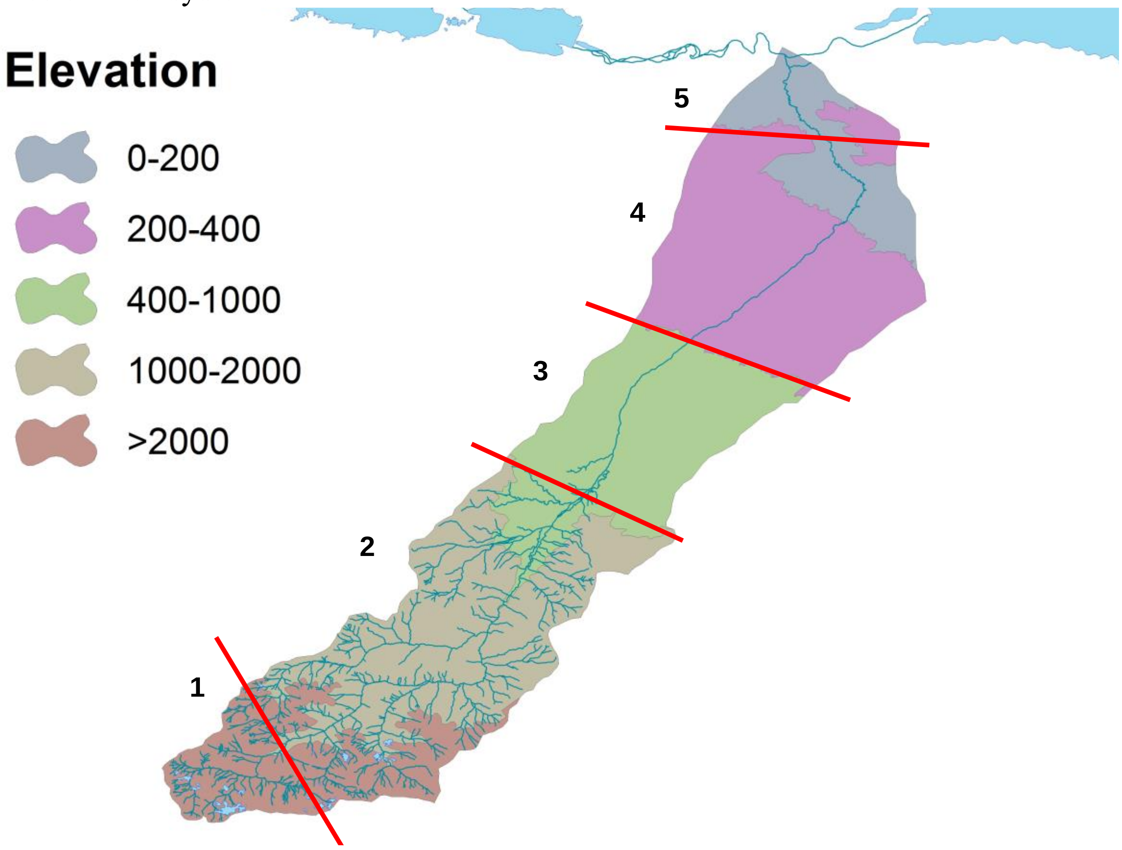


Figure 1.5**: 5 sections of the basin with different temperature regime, precipitation and natural vegetation**
Şəkil1.5: Müxtəlif temperature rejimi, yağıntı miqdarı və təbii bitki ötüklü hövzənin 5 bölməsi
5 bölmənin iqlimi, bitki örtüyü və relyefinin böyük fərqliliyi cəmlənmişdir.

Cədvəl 1.2:Different natural conditions in the Ganjachay river basin

Hövzənin bölməsi	***1***	***2***	***3***	***4***	**5**
	Yüksək dağlıq	**Orta dağlıq**	**Alçaq dağlıq**	**Düzənlik**	**Hilly, ravines Təpəlik, Dərələr**
Yüksəklik	Təxminən 3400-2000 m	Təxminən 2000-1500 m	Təxminən 1500-400 m	Təxminən 400-200 m	72 m-dən yuxarı
Temperatur, yay	Təxminən 10-25^0C	Təxminən 25-35^0C	Təxminən25 – 40^0C	Ca. 30 – 40^0C Təxminən 30-40^0C	Ca. 30 – 45^0C Təxminən 30 – 45^0C
Temperature, Winter	Down to -25^0C 25^0C-dən aşağı	Təxminən	Təxminən	Təxminən	Təxminən

Hövzənin bölməsi	***1*** **Yüksək dağlıq**	***2*** **Orta dağlıq**	***3*** **Alçaq dağlıq**	***4*** **Düzənlik**	**5** **Hilly, ravines Təpəlik, Dərələr**
Temperatur, qış		+5-dən - 10^0-dək	+5-dən -10^0-dək	+11-dən -4^0-dək	+10-dən -5^0-dək
Yağıntı Mm/il	Yüksək (təxminən 850)	Orta (təxminən 700)	Orta/aşağı (təxminən 500)	Aşağı (təxminən 400)	Aşağı (təxminən 300)
Relyef	Dağlıq yaylaq	Dağlıq çay dərələri	Dağlıq çay dərələri	Düzənlik	Təpəlik, Çay dərələri
Bitki örtüyü	Subalp və alp çəmənliyi	Palıd və vələs meşələri	Palıd və vələs meşələri	Subtropik quru çöl	Yarımsəhra

Düzənliklər çox düzdür və hövzənin bu bölməsində çay hövzəsinin sərhədləri yaxşı təyin edilməmişdir.

2. Human activities

In this chapter we describe the present human activities in the basin as a basis for the evaluation in chapter 3 of their impact on surface waters.

2.1 Administrative units

The Ganjachay basin includes parts of 5 districts (rayons), from south to north: Kalbajar (very small area), Dashkesan, Goygol, Goranboy (small area) and Samukh rayons. Ganja city is a separate administrative unit between Goygol and Samukh rayons.

The borders between the administrative regions are shown in figure 2.1

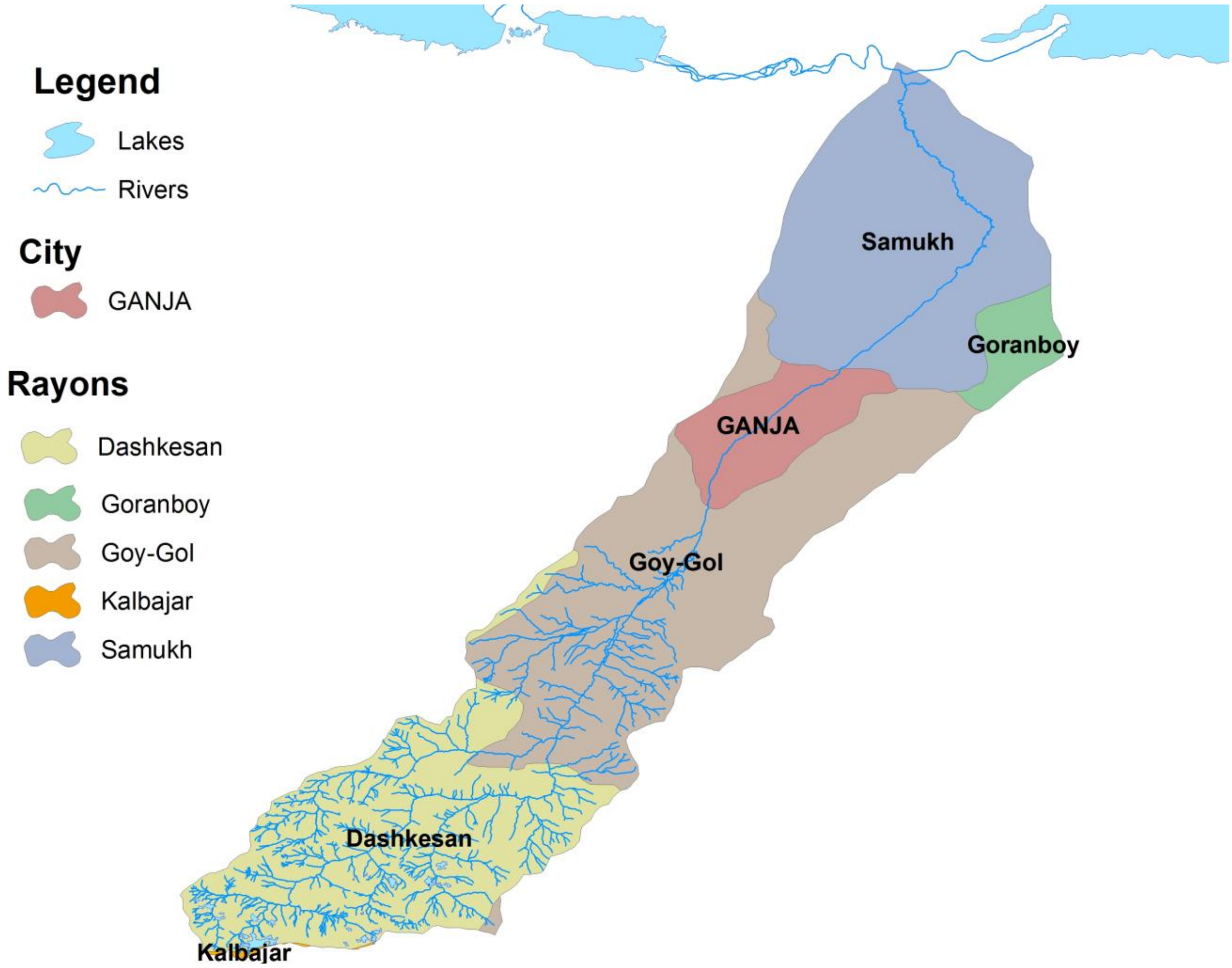


Figure 2.1: **Administrative division of the Ganjachay river basin**

2.2 Population

Average density of population is 31 people per square kilometre in Dashkesan rayon, 55 people in Goy- Gol rayon, 36 people in Samukh rayon and 2815 people in Ganja city.

Table 2.1shows the number of people in each administrative unit (Kalbajar and Goranboy rayons are not included because they only include a small area in the basin).

Table 2.1:
Number of people of the rayons in Ganjachay basin

Rayons/city	*Number of population in Ganjachay basin*	*%*
Dashkesan rayon	1,520	0.5
Goy-gol rayon	3,006	1.0
Ganja city	287,536	94.9
Samukh rayon	11,077	3.7

Total	***303,139***	***100***

In the XIX and XX century the population increased substantially in the basin, both in Ganja and in the villages in the plain area.

Figure 2.2 gives an overview of population density in the basin.

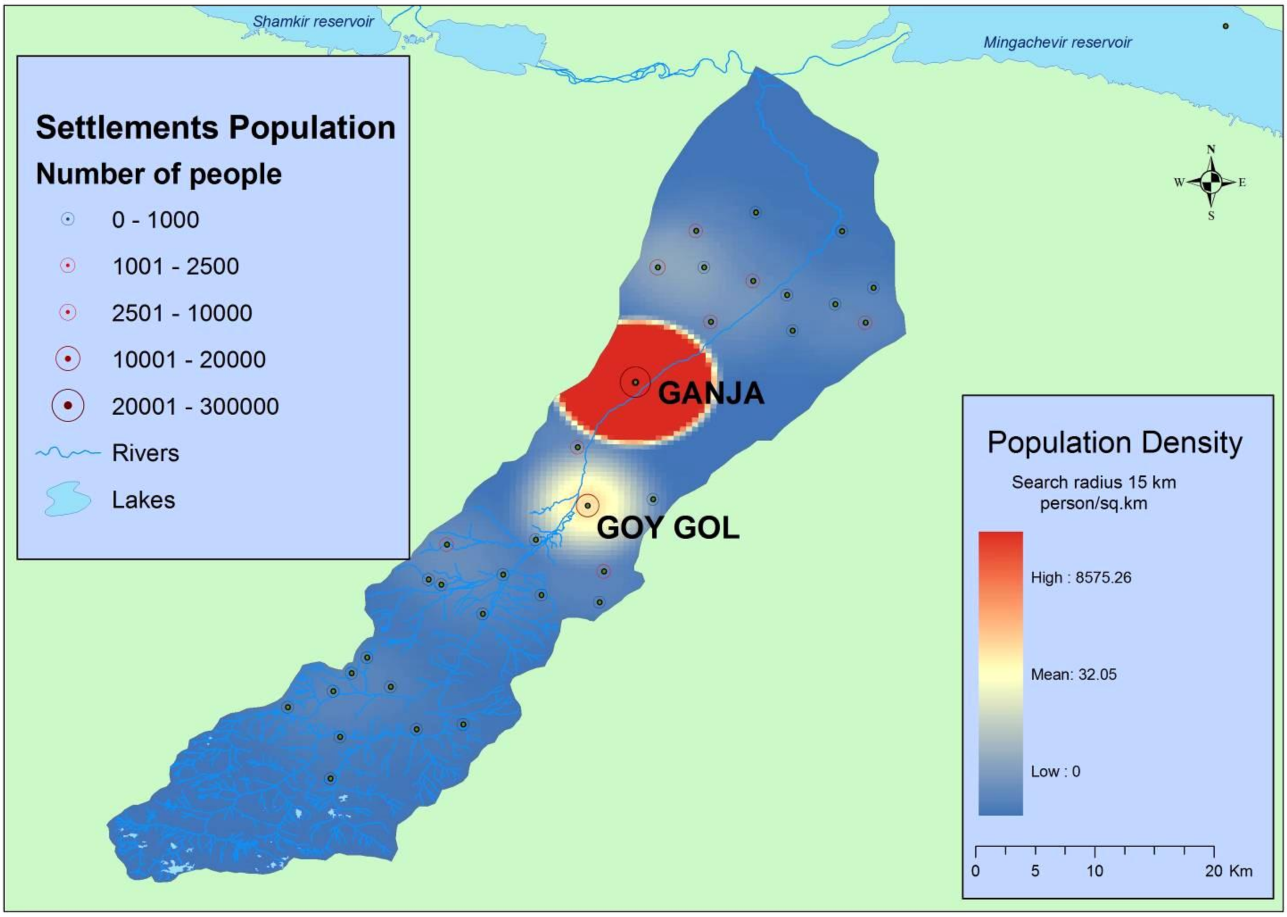


Figure 2.2: **Population density map of Ganjachay river basin**

The Population density map illustrates the dominating role of Ganja city (the second largest city in Azerbaijan), where approximately 95% of the population in the basin lives.

The other areas, with high population densities in comparison to the basin in general, are:
- The area which around Goygol city (administrative center of the Goygol rayon).
- The plain area north of Ganja with intensive agriculture and several villages.
- The area around Mirzik in the lower part of the middle mountainous section of the basin.
- The area around Garagullar in the upper part of the middle mountainous part of the basin.

The population in the basin is increasing, see table 2.2.

Table 2.2:
Population growth in % (2007)

Rayons	City

	Dashkesan	Goygol	Samukh	Ganja
Population growth, %	1.12	0.92	0.88	0.68

2.3. Agriculture, crop production

The natural conditions for agriculture are very different from the mountainous areas (south) to the plain (north) of the basin as illustrated in table 2.3.

Table 2.3
Agricultural activity in different sections of the Ganjachay river basin

Section of basin	**1** **High mountains**	**2** **Middle mountains**	**3** **Low mountains**	**4** **Plain**	***5*** **Hilly, ravines (badlands)**
Elevation	Ca. 2800 – 2000 m	Ca. 2000 - 1500 m	Ca.1500 – 400 m	Ca. 200-400 m	-
Agriculture - general	Limited agricultural activity	In valleys, extensive	In valleys, intensive	Al area, intensive	Very limited agricultural activity
Livestock and bee-keeping, importance	Cattle, sheep (summer grazing)	High, Cattle, sheep, bee-keeping	Medium Cattle, sheep, bee-keeping	Low	-
Crops	-	Potatoes, fruit, vegetables.	Cereals (especially wheat and barley), leguminous (bean), potato, berry and vine	Fruit, vegetables, cereals (especially corn), leguminous (bean) and sunflower, fruit and vine	-
Irrigation	-	Some	Important	Agriculture fully dependent on irrigation	-

From the high mountains in the southernmost part of the basin with alpine meadows down to the badlands in the northernmost part of the basin (Samukh Rayon) there is a big difference in the natural condition which impact on the character of the agricultural activities. In Dashkesan rayon (middle mountains) focus is on livestock production. In Goygol rayon (low mountains) focus is on both livestock and crop production, and in Samukh rayon (plain) focus is on crop production.

The middle mountainous area is used for cattle and sheep grazing, bee-keeping, potato and vegetables growing, and fruit trees.

In the lower mountains (Goygol rayon) grain growing increase in importance and irrigation of crops is widely used. Goygol rayon in Ganjachay basin is also the main vine-growing rayon in Azerbaijan.

In the plains north of Ganja (Samukh Rayon), agriculture is fully dependent on irrigation. Important crops here are corn, vegetables, water-melon, fruit and vine.

The size of the cultivated areas in the rayons is given in the Table 2.4.

Table 2.4:
Total area with crops, Ganjachay basin, hectare

	Year					
Rayon/city	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Dashkesan	1,692	1,213	1,290	1,486	1,531	1,533
Goygol	8,126	8,312	9,310	9,979	10,898	11,038
Samukh	13,075	15,064	14,702	15,076	14,529	13,182
Total	*24,979*	*26,852*	*27,511*	*28,785*	*29,288*	*27,999*

There seems to be a tendency to an increase the area with crops. This could reflect the increase in population.

2.4. Agriculture, livestock production

There are no large cattle production farms and livestock mainly belong to small farms and individual persons. The number of cattle is ca. 30,000 units, the number of sheep, goats etc. 82,800 Farms mainly are located in the villages of Dashkesan rayon (middle mountains) and Goygol rayon (lower mountains) but also in the Samukh rayon (alluvial plain area) livestock are common.

Manure is normally used locally as fertilizer in agricultural fields, and, as far as information is available, it is handled in a way that results in a limited loss of nutrients to the rivers.

The number of cattle in the basin is shown in table 2.5.

Table 2.5:
Number of cattle in the basin

	Year					
Names of rayons	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Dashkesan	27,800	27,995	28,419	29,161	30,588	25,999
Goygol	15,277	16,109	18,342	18,751	18,893	19,266
Samukh	14,933	15,668	16,090	16,947	17,459	18,128
Total for basin	**60,011**	**61,774**	**64,854**	**66,863**	**68,945**	**65,399**
Azerbaijan total:	*2,097,860*	*2,178,572*	*2,241,781*	*2,315,757*	*2,379,976*	*2,445,020*
% of AZ tot	2.9	2.8	2.9	2.9	2.9	2.7

As for crops there seems to be a tendency to an increase in the number of cattle.

2.5. Industry

In Soviet times the industry in Ganja included aluminium, porcelain, instrument making, furniture, textile and other factories. These industrial enterprises have now mostly stopped their production. New investments are slowly bringing new industrial enterprises to Ganja, usually as small scale companies.

The economy of Ganja is partially agricultural, partially tourist based, with some industries in operation. Ore minerals extracted from nearby mines supply Ganja's metallurgical industries, which produces copper and alumina. There are porcelain, silk and footwear industries. Other industries process food, grapes and cotton from the surrounding farmlands. The city has one of the largest textile conglomerates in Azerbaijan and is famous for a fabric named Ganja silk, which received the highest marks in the markets of neighbouring countries and the Middle East.[2]

At present in Dashkesan rayon a whole chain steel plant working on the base of iron-ore is being built. Production 1mln ton steel is taking into consideration. Side by side with it a whole turnover aluminium plant is being built. In this industrial enterprise in a year the production of 100 thousand aluminium production is planned.

Food industry is mainly represented by grinding flour, cooking bread, Goygol and Ganja wine-brandy enterprises.

The light industry consists mainly of carpet-making, weaving and sewing enterprises. Ganja is the most developed carpet-making city in Azerbaijan.

2.6. Mining and raw material abstraction

At present no mining activities for metals take place in the basin. Some sand and gravel abstraction from the river bed takes place.

Building material industry is represented by the production of building materials, especially with building stone, marble, sand, clay, gravel, gyps tree productions (door, window etc). In Dashkesan there is marble production.

2.7. Hydropower and damming

Ganjachay Zurnabad HPP with a capacity of 2760 kvt/hour was built in 1927, 10 km upstream from Goygol (Figures 2.2 and 2.3).

[2] http://en.wikipedia.org/wiki/Ganja,_Azerbaijan

Figure 2.3: **Building at Zurnabad HPP**

Figure 2.4: **Water intake facility in Zurnabad HPP**

Zurnabad HPP does not work since 2002. The remaining facilities, including the building of the plant, are in very bad condition and a large investments are necessary to restore it.

2.8. Waste disposal

There are centralized waste disposals in the three main cities (Goygol, Ganja and Samukh). Only Goygol city has waste a disposal site in the Ganjachay basin. The dumpsite is 1.8 km far from the right side of the river, near Mollaxalilli village. Its area is approximately 1 hectare.

The dumpsite of Ganja is 10 km east from the city in the neighbouring Kurakchay basin.

In the villages along the river it is a normal procedure to throw wastes into the river valley and the river.

The waste disposal of administrative centre of Samukh Rayon (Nabiagali) is located outside the basin.

2.9. Car washing

Where there is access to shallow river sections for cars, people drive their cars into the river to wash them. This activity takes mainly place in the summer period.

2.10. Forest cutting

Forests in Dashkesan and Goygol rayons are cut both legally and illegally. According the information of Zurnabad settlements the main part of forests had been cut in 1991-1995 when there was energy deficiency. Only 61 hectare forest was left in Goygol rayon (lower mountains) in 2008.

The total forest area was 178 sq. km or 24% by the information of 90^{th} now it is 20%, which means that about 20% of forest area is lost.

2.11. Hydromorphological changes of riverbed and valleys

On tributaries of Ganjachay there are almost no significant hydromorphological changes. There are some constructions on Ganjachay River. In 1927 the Zurnabad HPP was constructed on the river in Zurnabad village. A dam is constructed on the river to collect water by canal for HPP. The dam is very small and almost doesn't significantly differ from river bed. In Topalhesenli village river bed naturally is wide. In order to facilitate water abstraction for irrigation, the river bed is narrowed by establishment of concrete walls river banks. Concrete walls river banks along the Ganjachay River exist within Ganja city as well.

2.12. Trends in human activity

There are plans for mining activities in Dashkesan.

The State program on Social Economic Developments of Regions foresees support for farmers by providing them with agricultural techniques and fertiliser to intensify agriculture and increase yields. Some livestock types with high productivity are being imported to improve productivity of livestock.

There are also efforts to increase the industrial production in Ganja city.

The population is the basin is growing.

Accordingly it can be expected that the needs for water for irrigation, industry and drinking will increase.

3. Human pressures

This chapter discusses the impact of the pressures on water bodies of Ganjachay River basin. It is based on the description of human activities in the previous chapter. This chapter focuses on the assessment of the impact of each of the important pressures to make an expert judgment if it is significant or not.

The following pressures are selected for impact evaluation based on the description in chapter 2:
- Water abstraction for irrigation and household use
- Household wastewater
- Agriculture, crop production
- Industry, food and non-food production
- Car washing in rivers
- Solid waste disposal
- Deforestation
- Hydromorphological changes of river bed

For each pressure it is concluded whether it is significant or not. A pressure is considered significant, when it on its own, or in combination with other pressures, leads to a failure to achieve the objective specified in the WFD (good status for the water body).

In most cases identification of water significant pressures has to be based only on some (limited) knowledge of the size and impact of pressures and the vulnerability of receiving waters, as no monitoring data for the water bodies impacted by the pressure are available.

This chapter and the following chapters, evaluating the human impact on the rivers (water bodies) in the Ganjachay basin and proposing measures to improve the situation, needs to be more detailed and substantiated before it can be seen as a River Basin Management Plan that fulfils WFD/EU requirements.

The present draft plan is intended:
- as an input to discussions on the present situation in the basin, where water quality problems are and what needs to be done to improve the situation,
- as an input to the design/update of monitoring programmes
- to give some guidance on what kind of pressure data that is needed in order to establish a targeted and cost-effective programme of measures.

As the purpose of the report is to pilot the WFD approach for setting up River Basin Management Plans, we have used the advice given by EU water directors in relation to the characterisation of river basins in line with the WFD: “Lack of data is not an excuse, demonstrate that you tried”.

3.1. Water abstraction for irrigation and household use

The main use of water for irrigation is in the lower mountains (Goygol rayon) and on the plain north of Ganja (Samukh rayon).

Table 3.1 Water use for irrigation, Ganjachay basin (million cubic meter) – data from State Statistical Committee.

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Dashkesan rayon	0.3	-	0.4	-	-	-	-	-
Goygol rayon	20.0	28.0	27.0	30.6	30.5	43.6	36.0	45.0
Samukh rayon	61.0	45.0	88.0	97.6	92.0	100.0	100.5	128.0
Total	***81.3***	***73.0***	***115.4***	***128.2***	***122.2***	***143.6***	***136.5***	***173.0***
m^3/s*	3.9	3.5	5.6	6.2	5.9	6.9	6.6	8.3

*: Calculated as a mean over an estimated 8 month irrigation period

The data shows a clear tendency to increase in the use of water for irrigation. One of the reasons can be an increase in state subsidies to farmers in the beginning of the new century. The decrease in water use in 2006 can be explained by rising of prices on petrol, pesticides and chemical fertiliser.

Table 3.2 contains information about drinking water use per administrative rayons of the Ganjachay river basin annually.

Table 3.2 Information about drinking water supply to people living in rayons – data from State Statistical Committee. Water use per person is based on division of amount of water used by Azersu to the number of population served.

	2000		2005		2007	
	Total million. cubic m.	Per person, cubic m	*Total million. cubic m.*	Per person, cubic m	*Total million. cubic m.*	Per person, cubic m
Dashkesan rayon	*0.7*	23	*0.5*	16	*0.4*	12
Goygol rayon	*1.0*	19	*1.5*	27	*2.0*	35
Samukh rayon	*0.3*	6	*0.4*	8	*0.4*	8
Total/mean	*2.0*	16	*2.4*	17	*2.8*	18

In Goygol Rayon drinking water also is used for irrigation which can explain the increase during the last years.

No information is available that can explain the reduction of water use per person in Dashkesan rayon.

For provision of Ganja city surface and underground resources of water are used. The drinking water pipeline starting from the Gizilqaya area is located along the river below Topalhesenli village. Surface water for water supply to Ganja city is abstracted also from Goygol Lake.

Table 3.3 shows the amount of ground water used to supply Ganja city.

Table 3.3: Total amount of ground water used in Ganja city, long term average info up to 2006

Ground water	Ground water use, thousands m^3/day		
	Sweet	Weak salty	Total
Gizilqaya artesian aquifer	6.80	-	6.80
Exploited artesian wells*	67.5	15.5	83.0
Underground water pipe**	26.0	2.50	28.5
Total, thousands m3/day	*100.3*	*18.0*	*118.3*
Total, million m3/year	36.6	6.6	43.2

*: To distinguish for unexploited artesian wells which are old or not being used for some other reasons
**: Probably by use of old qanat[3] systems.

Total surface water use form surface sources approximately are 165 thousands m^3/day (60 million m^3/year) of which 16 thousands is taken from Goygol Lake and 149 with a pipe from Kura River.

The following conclusions can be drawn from table 3.1, 3.2 and 3.3:

1. The main use of water in the basin is for irrigation.
2. The use of water for supply of Ganja city also plays an important role.
3. The use of water for household supply for the people living in the three rayons is negligible compared to 1. and 2.

The main sewer, collecting the wastewater in Ganja City, transports the water to another river basin. This means the impact of water abstraction for irrigation and water supply for household and

[3] Qanats is tunnel systems for extracting groundwater in the dry mountain basins. The qanats technology dating dates back to the first millennium B.C.

enterprises is the same for the Ganjachay River: Lowering of the total flow in the river and changes in the flow regime. If water for irrigation is abstracted, distributed and used in an efficient way to cover the needs of agricultural crops, abstraction of surface water from the river for irrigation purposes will only impact river flow in the season where water is used for irrigation. Water abstracted from ground- and surface waters for supply of households and enterprises will impact the flow of the river throughout the year. For a closer evaluation of the impact of water abstraction for irrigation see section 3.3: Agriculture, crop production.

Conclusion
Water abstraction for irrigation and household use is considered a **significant pressure**.

3.2. Household wastewater

The main sewer from Goygol city leads to a treatment plant built near Mollacalilli village east of Goygol city in 2008. We have been informed that after treatment the wastewater is used for irrigation. Outside the growing season the treated wastewater are stored in reservoirs and evaporated.

Most of Ganja city is connected to the sewage system (except some new constructions) and the main sewer of Ganja city is leading to the location near Ziyadli village north of the city, see figure 3.1. Here is a WWTP was built in 1970 which is not working at present. The WWTP is situated close to the border of the Ganjachay basin (the basin is actually not very well defined in the flat alluvial plain).

The aerial photos on Google Earth indicate that the untreated wastewater is discharged to a big irrigation channel ca. 3 kilometres north of the old WWTP.

Information indicates that the wastewater from the right (eastern) Ganjachay bank part of Ganja City is transported to the river basin east of the Ganjachay basin, Kurakchay river basin.

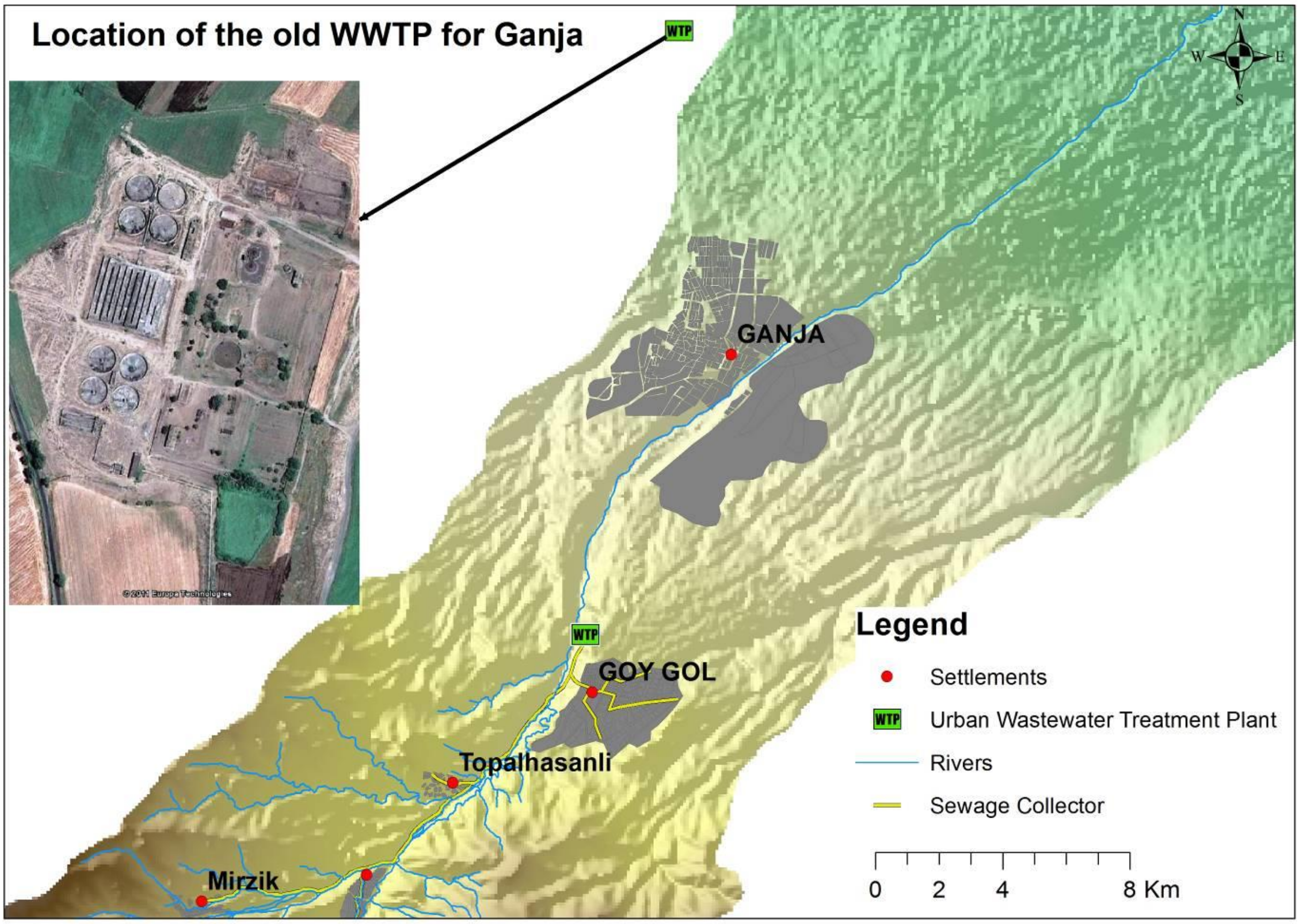


Figure 3.1: **Location of the old WWTP/WTP built in 1970 near Ziyadli village northwest of the city to treat the wastewater from Ganja. The WWTP is not working at present (from Google earth).**

Discharge of waste waters from is given in the table 3.4. People living in villages along the river have either outdoor toilets (open pit toilets) or water closets. They discharge their waste water to the ground or to the river without treatment. Wastewater from Samukh and Dashkesan rayons discharged to the ground can affect ground water.

The discharge of waste water for Ganjachay waste water system is described above.

In Goygol there is sewage system but as no proper treatment waste water affects quality of Ganjachay river waters.

Table 3.4. Discharge of waste water (million cubic meter/year) – data from State Statistical Committee.

Year	2000	2001	2002	2003	2004	2005	2006

Year	2000	2001	2002	2003	2004	2005	2006
Dashkesan	0.70	0.30	-	0.20	0.20	0.30	0.20
Goygol	0.10	0.04	0.03	0.20	0.20	0.05	1.00
Samukh	-	5.20	0.01	0.10	0.10	0.20	0.40
Ganja city	0.01	5.20	11.30	17.00	18.40	19.00	14.30
Total	***0.81***	***11.74***	***11.43***	***17.50***	***18.90***	***19.75***	***15.60***

As indicated in section 3.2, the water supply to Ganja city is approximately 100 million m^3/year. A reason for the difference between the amount of water supplied and the amount of water discharge can be that most if the water is used for irrigation of household gardens and that much of the wastewater is not discharged to the sewerage system.

As it is indicated in the table during 2001-2006 amount of produced waste waters have significantly increased in Ganja city and Goygol rayon. In Dashkesan it mostly was stable in last years indicated in the table.

Waste waters also in some places are discharged to ground and affects ground waters.

People living in villages along the river discharge their household waste water to pits or the river without treatment. None of the villages has sewerage systems

Conclusion
Discharge of household waste water from villages along the river is considered a **significant pressure**.

3.3. Agriculture, crop production

Irrigation
Figure 3.2: shows the irrigation network in Ganjachay river basin. The irrigation network starts is the river section from Topalhesenli to Goygol where the middle mountain meets the low mountain part of the basin.

The water from the irrigation channels is mainly used to irrigate the plain area of the basin. Some of the irrigation channels also transport water to arable lands outside the basin.

Water is taken for irrigation with 3 pipes from the Ganjachay River in Topalhesenli village. Between this village and Goygol city (near Arabli village) concrete water intake facility was built in the river. To irrigate arable lands east and west of Ganjachay two channels named Arabli argh and Khan argh were constructed.

6 irrigation channels can be identified on figure 3.2:
1. Ag korpu
2. Jandar arx
3. Khan arx
4. Arabli arx
5. Tolyak arx
6. Allahdad

For 4 channels from Ganja river which lead water to cultivated areas located in Samukh region the capacity is known:
3. Khan arkh (0.7 m^3/s)
6. Darin arkh (0.8 m^3/s) - The Allahdad channel starts divided into two channels - the left one is Darin Arkh.
Dinaraj (1.4 m^3/s)
6. Allahdad (1.5 m^3/s)

Capacity of pipes for irrigation is approximately $2m^3/s$.

This can be compared with an annual mean flow of 5.4 m^3/s in 2004 (high flow year), 4.4 m^3/s in 2003 (mean flow year) and 2.9 m^3/s in 2005 (low flow year). It seems that the capacity of the irrigation systems exceeds the flow in the river, at least in low flow periods, which is confirmed by the observation that the river runs dry in Ganja City during summer.

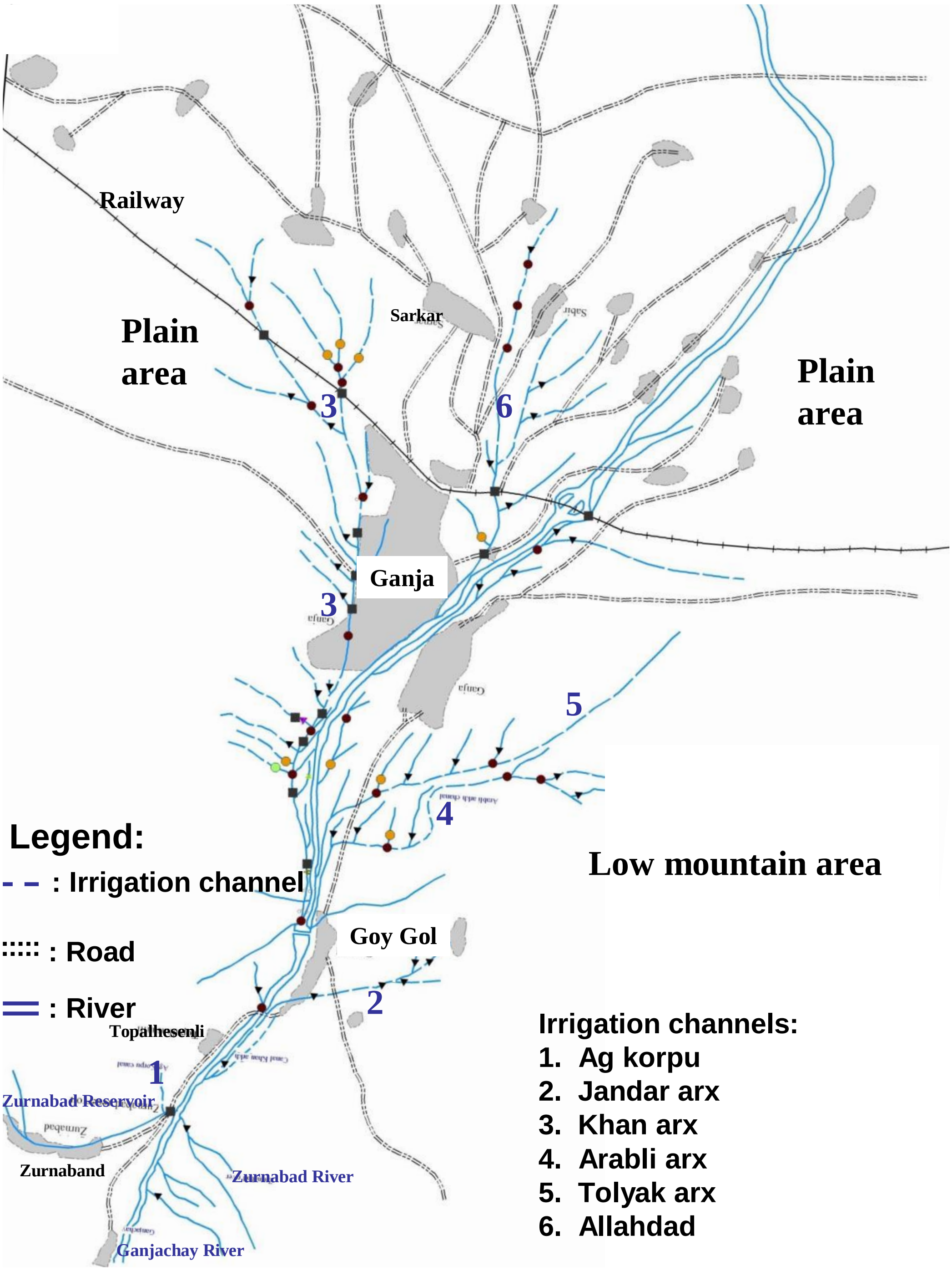


Figure 3.2: **Irrigation network in Ganjachay river basin (map from Soviet times?)**

Agrochemicals (pesticides and chemical fertilizer)
There is limited information available on the use of pesticides and chemical fertilizer. But there is a risk that the use of pesticides in agricultural areas leads to pollution of rivers.

Conclusion

As specified in section 3.1: Water abstraction for irrigation and household use, water abstraction for irrigation is considered as a **significant pressure**.

Use of fertiliser and pesticides in agriculture is **not** considered as a **significant pressure**.

3.4. Industry, food and non-food production

Most industrial enterprises is situated in Ganja city and connected to the sewerage system of the town. As the sewage system transports the waste water out of the Ganjachay basin to the neighbouring Kurakchay basin east of Ganjachay basin, the industrial waste water discharges will not affect the Ganjachay River. Environmental issues related to the discharge of waste water from Ganja have to be handled as a part of the elaboration of the Kurakchay basin management plan.

Conclusion
Discharge of waste water form industry is **not** considered as a **significant pressure**.

3.5. Car washing in rivers

During the summer many inhabitants in the villages and town along Ganjachay River drive their cars into shallow river sections to wash them. This leads to pollution of the river with oil products and petrol.

Conclusion
Car washing in rivers is considered as a **significant pressure**.

3.6. Solid waste disposal

The waste disposal site of Ganja is situated neighbouring Kurakchay basin east of Ganjachay basin and has no influence on the water quality of Ganjachay.

But population of the villages situating along the river throw main part of the litter to the river valley and the litter will enter the river water.

Conclusion
Solid waste disposal from people living in the villages situating along the river is considered as a **significant pressure**.

3.7. Deforestation

Forests in the upper and approximately middle part of the river basin had been intensively cut since 90th years of last century.

This causes changes on the flow regime of the river water: maximal water discharges increases, and minimal water discharges decreases.

The discharge of springs descended, even some of them dried.

Another result of the deforestation is that the erosion process has become stronger resulting in an increased content of suspended solids in the water.

Conclusion
Deforestation is considered as a **significant pressure**.

3.8. Hydromorphological changes of river bed

In Ganja city concrete walls are constructed along the at river banks of Ganjachay River. A dam in created for Zurnabad HPP in Topalhesenli village.

Conclusion
Hydromorphological changes of river bed (dams, concrete walls) are considered as a **significant pressure**.

3.9. Summary: list of significant pressures

We have identified the following 6 significant pressures:

- Water abstraction for irrigation and household use (both river water and subsoil water);
- Household wastewater - water pollution by household waste waters by people living along the river
- Car washing in rivers
- Solid waste disposal
- Deforestation
- Hydromorphological changes of river bed (dams, concrete walls)

4. EVALUATION OF DATA FROM ENVIRONMENTAL MONITORING

The important precondition for the development of the river basin management plan (RBMP) is the availability of sufficient and trustworthy data required (i) to support identification and quantification of the impacts on the water bodies in the river basin, (ii) to characterize the state of the water bodies and identify water bodies at risk, (iii) to define the environmental objectives, and (iv) to verify whether or not the environmental objectives are met.

There are limited water quality and water quantity monitoring data available for the Ganjachay River basin as well as for the other four selected pilot river basins (Alazani/Ganikh, Debed/Ganjachay, Aghstev and Aragvi). Both the quality and the amount of the data available are far from sufficient to be able to adequately characterize the water bodies and determine the water quality status class to fit the requirements of the EU Water Framework Directive (WFD).

The main objectives of this section (Section 4) are:

(i) to evaluate the existing monitoring data against the WFD requirements to identify the major gaps/deficiencies; and

(ii) to illustrate the way how the existing data can be used in the WFD methodology context to make a judgment about the water quality status class using the modified ICPDR approach

4.1 Biological monitoring of water quality

Biological monitoring of river water quality has never been undertaken the Ganjachay River basin as there has never been, and still there is no regulatory requirement for that. As the result neither institutional capacity nor technical expertise for biological monitoring has ever developed. Consequently, there is no baseline ecological data, no data to help to define ecological quality objectives, and no capability to generate such data in the short to medium term (3-5 years). Non-existence of the biological quality elements does not allow calculation of the Ecological Quality Ratios to define ecological quality status class of water bodies in the Ganjachay River basin. On the other hand, when sufficient physico-chemical quality elements are available and the data are trustworthy, it is possible to make a provisional assessment of the chemical quality status.

4.2 Chemical monitoring

For the assessment of the surface water quality the datasets from the national water quality monitoring database were used. The data were provided by the Ministry of Ecology and Natural Resources of Azerbaijan.

Nowadays, two surface water quality monitoring sites in the Ganjachay River basin are operational (see Map 4.3 below):

- Zurnabad sampling site (75 km upstream from the mouth);
- Ganja city sampling site (just downstream Ganja city).

However, only water quality data from Zurnabad sampling site were provided by the Ministry of Ecology and Natural Resources of Azerbaijan.

The water samples for chemical analysis are being taken monthly. About 40 physico-chemical elements are routinely measured to characterize the following conditions:

- Thermal condition
- Oxygenation conditions
- Acidification status
- Nutrient conditions
- Heavy metals

Specific organic substances like PAHs, pesticides, PCBs are not monitored at present in the framework of the national water quality monitoring programme. On the other hand, some grouped substances as Phenol Index, petroleum substances and surfactants, but those water quality elements were not used for the assessment of the chemical quality status *(note: in the EU WFD are defined* *only single chemical substances to be monitored and used for the assessment of the chemical quality status).*

The concentration of chemical substances in surface water is influenced by both natural conditions and human activities. As it was described in Chapter 1 and 2, there is a spectrum of both natural conditions (geological, hydrological, precipitation) conditions and human activities to drive changes in the concentration of chemical substances. Based on the knowledge about the human impacts in the catchment area, it seems that the surface water quality is mainly determined by the oxygenation conditions (mainly influenced by the degradable organic pollutants originating predominantly from untreated household waste waters), nutrient conditions and the levels of heavy metals. Selected physico-chemical quality elements to determine the chemical quality status are presented in Table 4.1.

Table 4.1:
Selected physico-chemical quality elements

Component	**Quality element**	***Unit***
Oxygenation Conditions	BOD_5	*mg/l*
	O_2	*mg/l*
	NH_4	*mg/l*
Nutrient conditions	NO_2	*mg/l*
	NO_3	*mg/l*
	PO_4	*mg/l*
Heavy metals	As	*μg/l*
	Cd	*μg/l*
	Cu	*μg/l*
	Pb	*μg/l*
	Ni	*μg/l*
	Zn	*μg/l*

A tentative assessment of the surface water quality status in the Ganjachay River is based on the datasets reported by the Ministry of Ecology and Natural Resources from the years 2006 to 2009. It is also necessary to be mentioned that these data are inconsistent, showing gaps and lacking details regarding analytical errors (e.g. detection limits, uncertainties). It was not possible to use the data reported prior to 2008 as these were more inconsistent, showing bigger gaps and lacking any details regarding analytical errors (e.g. detection limits, uncertainties)

4.2.1 Background concentration calculation

It is important to know the background (natural) concentrations of heavy metals in the river in order to assess the contribution of human activities into the total heavy metals load detected. Background concentrations were calculated using the statistical method based on theoretical log-normal distribution defined by two parameters (mean value μ and standard deviation σ). Due to fact that there are not sufficient data on the heavy metals concentrations available in the Ganjachay River basin, the heavy metals background concentrations calculated for the Alazani/Ganikh River basin were used in this case under the assumption that the Ganjachay River basin has similar conditions as the Alazani/Ganikh River basin.

The following steps were conducted to calculate the background concentrations:

1. The Alazani/Ganikh River, 1.7 km from the mouth (Sampling site Ayrichay) was selected as a location, where concentrations of heavy metals were available from the independent source the earlier NATO for Peace Project (*SfP Programme, Project: 977991 SfP"* www.kura-araks-natosfp.org/data) monitoring programme run from 2004 to 2007,
2. The whole data set was used to calculate statistical parameters,
3. One value, close to "0" was added to the original data sets (detection limit divided by 100),
4. All values in the data sets were re-calculated as log-values,
5. Both mean value μ and standard deviation σ are calculated from the log-values data sets to create the theoretical log-normal distribution functions,
6. Calculation of the given percentile in the range from 10 to 95-tile was done,
7. Estimation of the background concentration values was made from the log-normal probability curve, as percentile.

Following the above procedure the estimate of the background concentrations of heavy metals (Cr, Ni, Cu, Zn, As, Cd, Pb) in the Alazani/Ganikh River was made. The results are given in the Table 4.2 below.

Table 4.2:
Statistical characteristics of heavy metals concentrations for Ganjachay River River used to estimate background concentrations

Parameter/Characteristic	**Cd**	**Pb**	**As**	**Cu**	**Cr $_{total}$**	**Ni**	***Zn***
Detection limit (μg/l)	*0,05*	*0,7*	*0,5*	*0,7*	*0,05*	*0,7*	*0,7*
Number of measurements	74	74	74	74	74	74	*74*
Mean (μg/l)	0,06	0,78	0,84	1,31	1,44	1,62	*13,0*
Maximum (μg/l)	0,1	1,2	1,4	3,2	2,9	3,9	*37*
Standard deviation (μg/l)	0,01	0,15	0,26	0,56	0,55	1,00	*8,6*
C40 (μg/l)	0,044	0,63	0,65	0,94	0,97	1,01	*8,0*
C50 (μg/l)	0,051	0,72	0,75	**1,12***	**1,21***	**1,25***	***9,8****
C60 (μg/l)	0,059	**0,83***	**0,88***	1,34	1,51	1,54	*12,1*
C70 (μg/l)	**0,068***	0,96	1,03	1,62	1,91	1,94	*15,1*
C95 (μg/l)	*0,13*	*1,73*	*2,03*	*3,52*	*5,06*	*5,00*	*38*

** Background concentration*

However, only concentrations of Cu and Ni (Zurnabad sampling site) were reported by the Ministry of Ecology and Natural Resources in the years from 2006 to 2009, and they have appeared to be close to the calculated background concentrations.

4.2.2 Determination of the water quality status class for the purposes of RBMP

As it was mentioned earlier, the water quality status class in the context of the EU WFD should be used to help to identify the water bodies at risk in the river basin and it should be based on the biological quality elements data. In the case of the Ganjachay River basin, there are only limited physico-chemical quality elements available, which were used to make a provisional assessment of the chemical quality status to facilitate discussion and to illustrate the RBMP methodology.

4.2.3 Scheme for determination of the water quality status class

The determination of the water quality status class of the Ganjachay River at the monitoring sites was done using the approach proposed in the technical note "Water Quality Classification of the Surface Water Bodies in Pilot River Basin" (see Annex 1). The approach is based on the modified ICPDR Classification system for oxygen/nutrient (with some corrections for dissolved oxygen) as presented below.

Table 4.3

ICPDR system to determine the water quality status class for oxygen/nutrient conditions (Source: TNMN Yearbook and database in 2006 (ICPDR 2008))

Quality classes*/ Parameters		**High**	**Good**	**Moderate**	**Poor**	**Bad**
Oxygen/Nutrient regime						
Dissolved oxygen	mg/l	8	6	5	4	< 4
BOD_5 (mg/l)	mg/l	3	5	10	25	> 25
COD_{Cr}	mg/l	10	25	50	125	> 125
Ammonium-N	mg/l	0,2	0,3	0,6	1,5	> 1,5
Nitrite-N	mg/l	0,01	0,06	0,12	0,3	> 0,3
Nitrate-N	mg/l	1	3	6	15	> 15
Ortho-phosphate-P	mg/l	0,05	0,1	0,2	0,5	> 0,5

In case of heavy metals, they have been subdivided into two groups. The first group included only heavy metals relevant for the Pilot River basin. The second group included heavy metals defined as Priority Substances under EU WFD in accordance with EC Directive 2008/105/EC on environmental quality standards in the field of water policy (see Table 4.4).

Table 4.4

Pilot River basin scheme to determine the water quality status class for heavy metals (total concentrations)

Quality classes*/ Parameters		**High**	**Good**	**Moderate**	**Poor**	**Bad**
Relevant substances per Pilot RB[a]						
Zinc	µg/l	bg[I]	100	200	500	> 500
Copper	µg/l	bg	20	40	100	> 100
Chromium	µg/l	bg	50	100	250	> 250
Arsenic	µg/l	bg	5	10	25	> 25
EU WFD Priority substances[b]						
	Unit	**AA-EQS** **		**MAC-EQS*****		

Cadmium *(in dependence on the class of water hardness)*[II]	μg/l	≤ 0,08 (class 1) 0,08 (class 2) 0,09 (class 3) 0,15 (class 4) 0,25 (class 5)	≤ 0,45 (class 1) 0,45 (class 2) 0,6 (class 3) 0,9 (class 4) 1,5 (class 5)
Lead	μg/l	7,2	Not applicable
Mercury	μg/l	0,05	0,07
Nickel	μg/l	20	Not applicable

Source: [a]TNMN Yearbook and database in 2006 (ICPDR 2008) and[b] EC Directive 2008/105/EC for PS.

[I] *bg – background/reference concentration*

[II] *Water hardness: class 1: <40 mg $CaCO_3$/l, class 2: 40 to <50 mg $CaCO_3$/l, class 3: 50 to <100 mg $CaCO_3$/l, class 4: 100 to <200 mg $CaCO_3$/l and class 5: ≥200 mg $CaCO_3$/l.*

***AA-EQS – Average annual Environmental Quality Standard*

****MAC-EQS – Maximum annual Environmental Quality Standard*

The following steps should be followed to help decide about the water quality chemical status class:

1. Average annual concentration (AAC) should be calculated for each water quality parameter from the available data sets and for sampling site in the Ganjachay River basin.
2. Calculated AAC should be compared with the values in the scheme for oxygen/nutrient conditions and heavy metals (Zn and Cu) and put under water quality status classes.
3. If, the AAC is lower or equal to the 2^{nd} class (Good class), the sampling site for specific parameter is under good status. If it is not a case (AAC is higher to the 2^{nd} class), sampling site will be classified as failing to achieve good status.
4. For heavy metal that are identified as Priority Substances in EU WFD (Cd, Pb and Ni), AAC should be calculated for each heavy metal from the available data sets. *In case of concentration values of heavy metals below the detection limit, these should be used as 50% of the detection limit in calculating Average Annual Concentrations. If, there is more than 90% of measured concentration values below the detection limit the sampling site will be classified in class 1 for specific heavy metal.*
5. In case of Cd, it is advisable to consider water hardness as *mg $CaCO_3$/l*. Measured concentrations of Mg and Ca will be multiplied by 100,0872 that is M *$CaCO_3$* in g.mol^{-1} , and by coefficient 1,784 (that is ratio of M $CaCO_3$/ M CaO).
6. From the received classes of water hardness average annual water hardness should be calculated and used to decide about water quality status class for AAC for Cd. When applying MAC-EQS (Maximum annual Environmental Quality Standard), that water hardness class will be used, when maximum concentration of Cd was measured.
7. Calculated AAC for 4 heavy metals should be decreased by background concentrations (AAC – bg) and compared with AA-EQSs (Average annual Environmental Quality Standard), the same will be done in case of maximum concentrations, if applicable (compare with MAC-EQS).
8. If, the AAC is lower or equal to AA-EQS, the sampling site for specific heavy metal is in Good chemical status (achieving the Environmental Objectives as defined by EU WFD). If it is not a case, sampling site will be classified as failing to achieve good status.

4.2.4 Water quality status classes for the Ganjachay River

To illustrate the way how the existing data can be used in the WFD methodology context and to make a judgment about the water quality status class data from the Ministry of Ecology and Natural Resources for the years from 2006 to 2009 (only Zurnabad sampling site, results from the sampling site downstream Ganja city were not available) were used and the following colours were used to characterize the state of the surface water:

Status	High	Good	Moderate	Poor	Bad

Results from the water quality status class determination exercise have shown that the Ganjachay at Zurnabad sampling site corresponded to classes I (high status) and II (good status) for oxygenation conditions, nutrients conditions, Cu and Ni. Data on other four heavy metals were not available. The results are presented in Table 4.5.

Table 4.5
Results of the water quality status classes for the Ganjachay River at Zurnabad (2006 - 2009)

Ganjachay River basin water quality status class for oxygen/nutrient regime (mg/l)								
River-Sampling Site	Year	Dissolved Oxygen	BOD_5	COD	Amonium-N	Nitrite-N	Nitrate-N	Ortho-Phospate-P
Ganjachay-Zurnabad	2006-2009	7,7	2,2	No Data	0,15	0,02	1,25	0,019

Ganjachay River basin water quality status class for heavy metals (µg/l)									
River-Sampling Site	Year	Zinc	Copper	Chromium	Arsenic	Cadmium	Lead	Nickel	Mercury
Ganjachay-Zurnabad	2006-2009	No Data	1,7	No Data	No Data	No Data	No Data	1,5	No Data

4.3 Hydrological monitoring

Hydrological regime of the catchment area is affected by several characteristics as precipitation, temperature regime, shape and density of the river network, length of the river, slope, soil conditions, hydrogeological conditions, vegetation, water reservoirs, river courses modifications and others. However, among the basic factors belong the climatic conditions as precipitation and evaporation. Hydrological monitoring would give the information on the hydrological regime of the river basin to support the biological quality elements when assessing the ecological status of the surface water bodies.
At present time, there is a network of three hydrological stations in the Ganjachay River basin where hydrological monitoring is carried out (see Table 4.6 and Map 4.4). Water level is measured twice a day and river flow is calculated using the Q-H curve. Hydrometric measurements are

conducted to update the Q-H curve. There are also 3 hydrological stations where water quantity monitoring was done in the past (see Map 4.4).

Table 4.6
Existing operational hydrological stations and river flow characteristics (long term average annual values for the entire monitoring period) on the Ganjachay River

River/hydrological station	Area (km^2)	Q (m^3/s)	Flow volume, mln m^3/year	Specific runoff, l/s km^2
Ganjachay/Alakhanchally	94.4	1.51	47.6	16
Ganjachay/Zurnabad	314	4.61	145.4	14.7
Ganjachay/Goygol	439	4.66	147	10.6

Hydrological regime and river flow characteristics of the tributaries of the Ganjachay River might be characterized as the rainfall-snow type. Snow melting and rainfall can cause the flooding in the spring time and rainfall may cause also the significant flood waves in the late spring time of the year. Winter time and autumn are typical with minimum river flow discharges (see Fig. 4.1). At this time water intake should be regulated in order to secure environmental flow. In fact, below Ganja town the river flow discharges are very low and even river is dry due to large intake of the water.

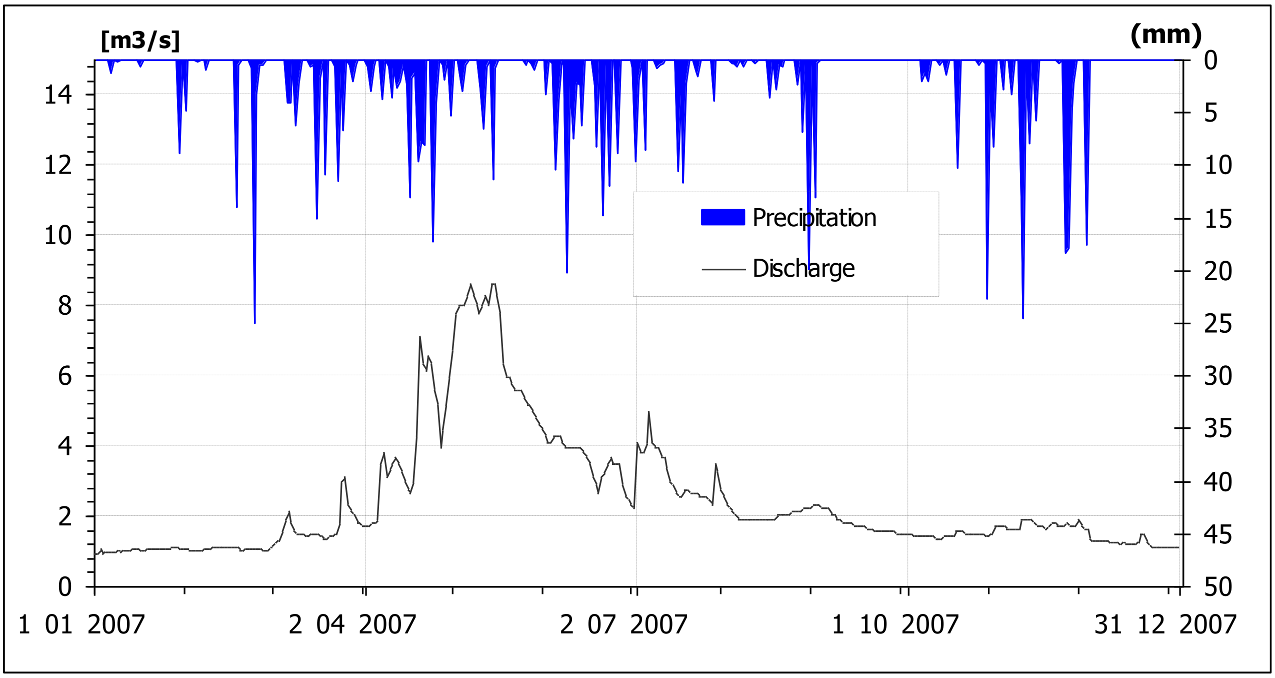


Figure 4.1 **Runoff and precipitation in Zurnabad hydrological station (2007)**

Critical period for the surface water ecosystems is the low flow period, when water quality may be easily deteriorated and when the river morphology can create the obstacles for aquatic fauna (migration, survival). Therefore, it is important to know the components of the runoff and to take such measures that keep the conditions for the most vulnerable aquatic flora and fauna. One of the method to separate the runoff can be used is BFI (Base-Flow Index, the ratio of base flow to total flow volume for a given year) a deterministic procedure proposed in 1980 by the British Institute of Hydrology. Although the method may not provide the exact base flow as a more sophisticated analysis may be needed, the index has been found to be consistent and indicative of a base flow (Local minimum method was used for runoff separation), which can be defined as a background river flow mainly maintained by seepage from the nearest body of groundwater.

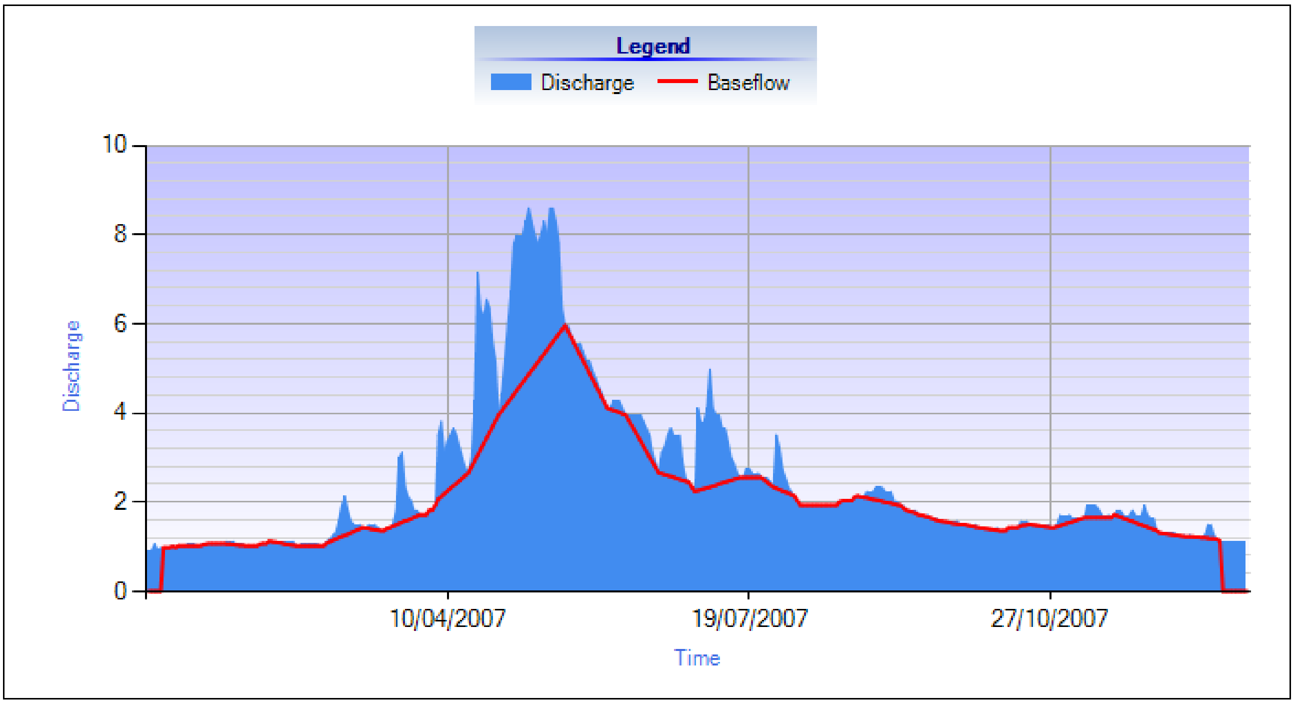


Figure 4.2 **Runoff components separation based on BFI methods (Ganjachay - Zurnabad, 2007)**

On the Fig. 4.2 is an example of base-flow calculation by using BFI method for Ganjachay – Zurnabad hydrological station. The base-flow was calculated as percentage of the total yearly flow. The higher the baseflow is compared to the total yearly flow, the less vulnerable the river is to water abstraction for the specific year. In this particular year 2009 the BFI is 0,90 that is high value and indicate low vulnerability to the water abstraction upstream Zurnabad hydrological station. However, it would be useful to know more on the relation between the baseflow and the total yearly flow changes for the longer time period (covering both wet and dry periods). The more stable this is from year to year the less vulnerable the river is to water abstraction on the long term.

The two maps below shows the monitoring sites for water quality and water quantity in the Ganjachay River basin

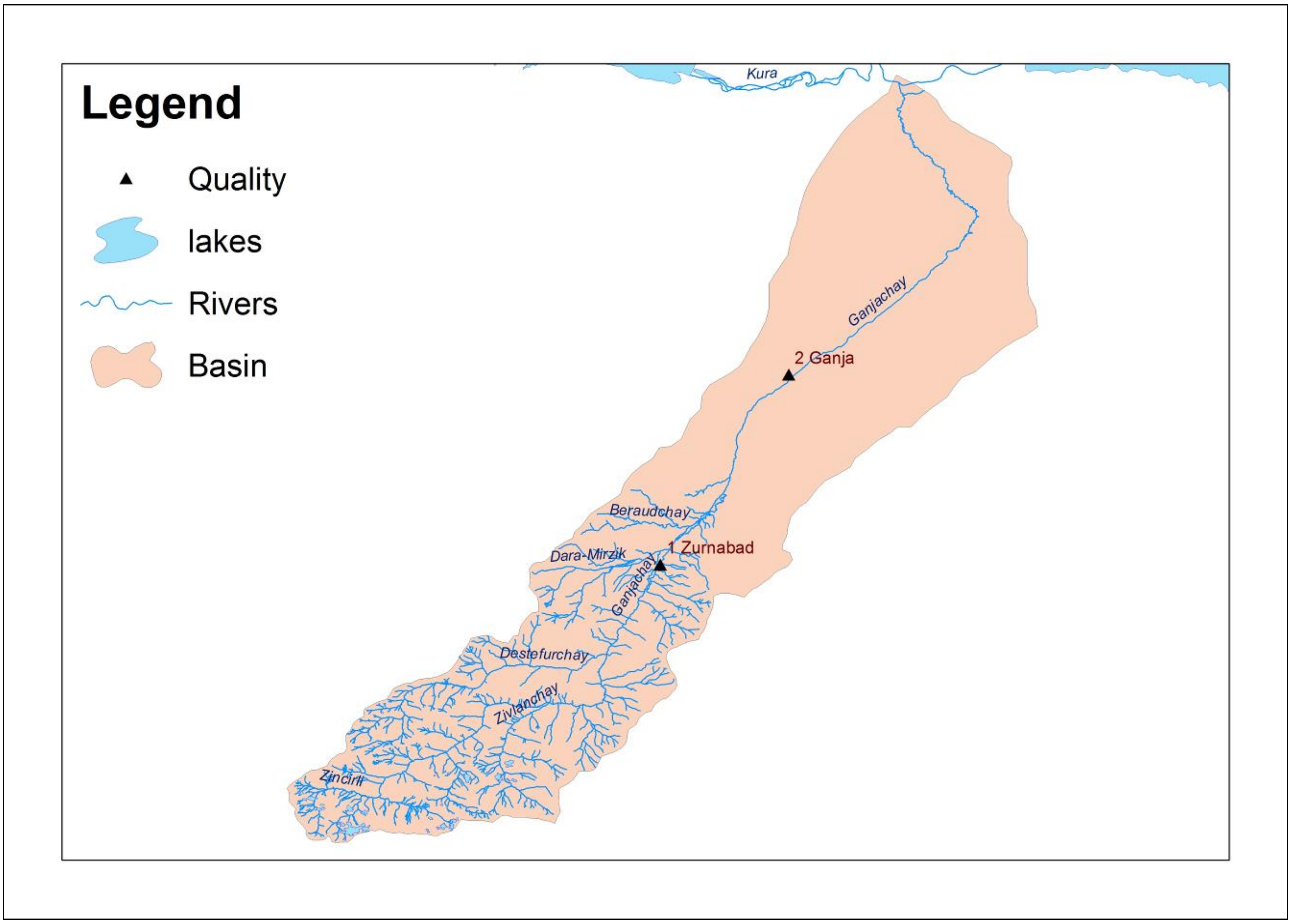


Figure 4.3 **Monitoring sites (marked by black triangles) for water quality in the Ganjachay River basin**

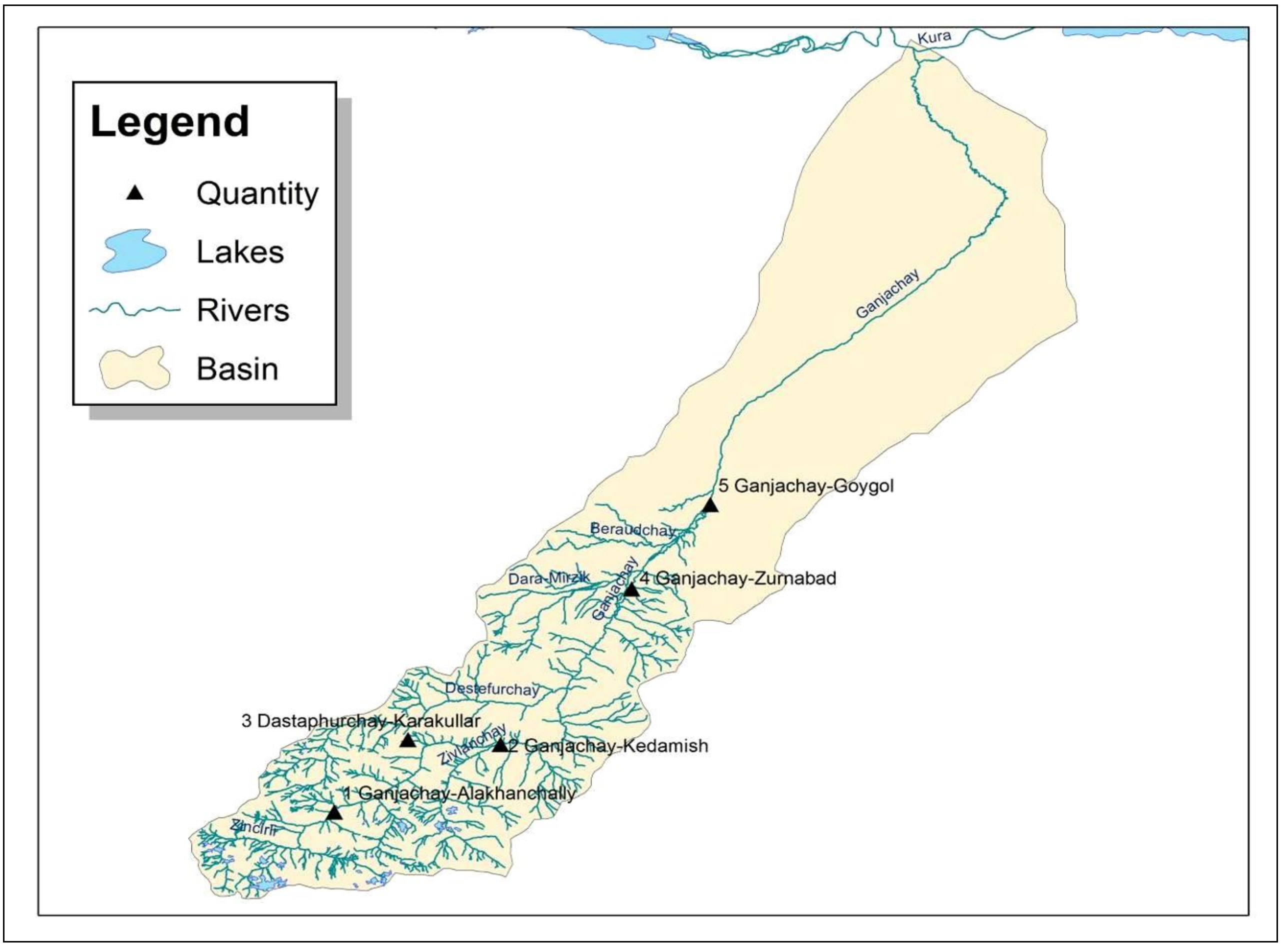


Figure 4.4 **Hydrological stations (marked by black triangles) for water quantity monitoring in the Ganjachay River basin in Azerbaijan (stations 2 and 3 are not operational)**

5. WATER BODY DELINEATION

5.1 Criteria and procedure

Here and afterwards the term "water body" is used in accordance to the provisions of EU WFD Article 2.3.1 and Chapter 3 of WFD CIS Guideline Document №2. The main purpose of the delineation of water bodies is:
1. As the administrative unit used to set up measures to improve the status (only for water bodies at risk).
2. As the basis for designing a WFD compliant monitoring programme.

The logic behind the delineation of water bodies are the following: A river or a lake can not possess the same natural conditions as a whole. As a consequence, they differ with regard to the sensitivity of the ecosystem to human pressures (in the WFD logic this difference in sensitivity is addressed in the surface water body typology). Further the anthropogenic impact is different for different sections of rivers. Therefore, it is not efficient applying the same planning and management objectives, requirements and tasks, e.g. for the entire river. It is necessary to delineate the surface waters first into categories (rivers, lakes, transitional and coastal waters) and further into discrete sections, so called "water bodies" for the purpose of water management.

According to EU WFD concept, one of the criteria for the delineation of surface water bodies is the water body type characterized by different vulnerability of their ecosystem. However due the very few data on river ecology and lack necessary ecological knowledge of river, in this work all rivers are assigned to one type. Similar all reservoirs and lakes are assigned to one type.

The first step of water bodies' delineation is the identification of the appropriate criteria. The EU WFD suggests the following groups of delineation criteria: physical (hydromorphological), biological and human impact on the ecosystem (significant pressures). The group of factors presented below cause quantitative and qualitative alterations of water resources and can be used as criteria for delineation.

1. Topography of the river basin (field, plain, valley, mountainous)
2. Main junctions of significant river flows (as hydrological factor)
3. Large settlements, industrial enterprises, zones of intensive agriculture
4. Hydro-morphologic factors, including level of modification of the natural flow of a river or lake

Re. 1 and 2: Geographic or hydromorphological characteristics can significantly impact on surface water ecosystems and their vulnerability due to anthropogenic activities. Such characteristics can also differentiate surface water bodies. For example, the confluence of part of the one river with another river can clearly mark a distinct geographical and morphological boundary of water body.

Re. 3: At the same time, the surface water body shall not belong to different quality classes of surface waters. It should belong only to one class. When there is an impact of human activity on water quality the boundary of water body will be the "meeting" point of two different quality classes.

Re. 4: Hydro-morphologic factors are reflected in the delineation of artificial and heavily modified water bodies.

5.2 Artificial water bodies (AWB)

"Artificial water body" means a body of surface water created by human activity (WFD Article 2.8) where no water has existed before.

In Ganjachay River basin there are 6 main canals used for irrigation purposes that can be considered artificial water bodies. The artificial water bodies of Ganjachay river basin can be identified on figure 3.2.

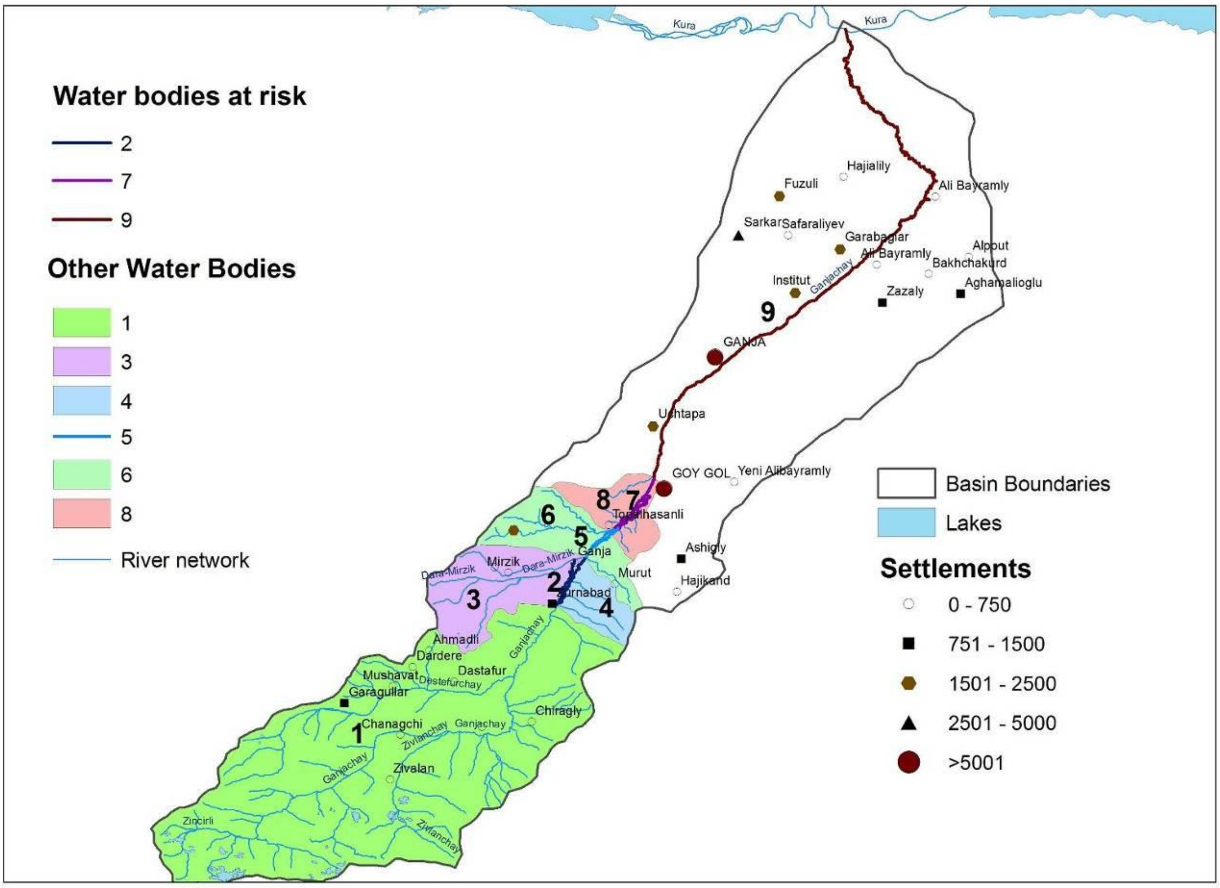


Figure 5.1: **Water bodies in Ganjachay river basin (AWB not included)**

5.3 Heavily modified water bodies (HMWB)

"Heavily modified water body" means a body of surface water which as a result of physical alterations by human activity is substantially changed in character (WFD, Article 2.9).

No heavily modified water bodies are identified in the Ganjachay River basin.

5.4 Water bodies at risk (WBR)

We have identified 3 water bodies at risk in Ganjachay basin, figure 5.1 and table 5.1.

Table 5.1:
Water bodies at risk in Ganjachay basin

No	**Name of water body at risk**	**Significant Pressure(s) causing the risk**
2	Ganjachay, from Zurnabad to Ganja village	1. Water abstraction for irrigation and household use (both river water and subsoil water); 2. Household wastewater - water pollution by household waste waters by people living along the river

No	Name of water body at risk	Significant Pressure(s) causing the risk
		3. Car washing in rivers 4. Solid waste disposal 5. Deforestation 6. Hydromorphological changes of river bed (dams, concrete walls)
7	Ganjachay, from Topalhesenli to Goy-Gol	1. Water abstraction for irrigation and household use (both river water and subsoil water); 2. Household wastewater - water pollution by household waste waters by people living along the river 3. Car washing in rivers 4. Solid waste disposal 5. Deforestation
9	Ganjachay, from Goy- Gol to mouth	1. Water abstraction for irrigation and household use (both river water and subsoil water); 2. Household wastewater - water pollution by household waste waters by people living along the river 4. Solid waste disposal

Water body 2, Ganjachay, from Zurnabad to Ganja village

The section of Ganjachay River from Zurnabad to Ganja village, water body No 2 (WBR), is situated in the middle mountains in the Goy-Gol region. In this section of basin precipitation is substantially lower than in the higher mountains, and the vegetation changes from oak and hornbeam forests to steppe. The dam for the Zurnabad hydropower plant (no longer functioning) is situated at the start of this section of the river/water body, and hydromorphological changes related to the dam is considered a significant pressure.

The flow regime of the river is impacted by both water abstraction (for irrigation and household use) and deforestation (decreased minimum flow, increased maximum flow). The impact of human activities on flow at this river section is significant but not substantial. The water body downstream (water body 5), where waters from the Dara-Mirzik has increased the flow in Ganjachay, is not considered to be at risk due to changes in the flow regime.

The water quality is impacted by deforestation (increased sediment load) and it is significantly impacted by household waste waters from the villages upstream of and along this section of the river, but again but again not substantially, and the water body downstream, where waters from the Dara-Mirzik has decreased the concentration of pollutants, is not considered to be at risk due to discharge of household wastewater (or other pressures).

In this section of the river people during the summer drive their cars out in the shallow water of the river to wash them and a broad spectrum of pollutants including oil enters the river. Car washing in rivers is also considered a significant pressure for this section of the river.

People in the villages along the river discharge their household waste into the river and solid waste disposal is also considered a significant pressure for water body No 2.

Water body 7, Ganjachay, from Topalhesenli to Goy- Gol

The section of Ganjachay from Topalhesenli to Goy- Gol is situated in the low mountains. In this section of basin precipitation is low, and the vegetation is steppe.

The flow regime of the river is impacted by both water abstraction (for irrigation and household use) and deforestation (decreased minimum flow, increased maximum flow).

The water quality is impacted by deforestation (increased sediment load) and it is significantly impacted by household waste waters from the villages upstream of and along this section of the river.

People in the villages along the river discharge their household waste into the river and solid waste disposal is also considered a significant pressure for water body No 7.

Water body 9, Ganjachay, from Goy- Gol to mouth
The section of Ganjachay from Goy- Gol to the Ganjachay river discharges into the Kura River is situated in the alluvial plain. In this section of basin summer precipitation is very low, and the vegetation is arid steppe.

The flow regime of the river is heavily impacted by water abstraction for irrigation, and the river runs dry in the summer. The water quality is impacted by household waste waters from Ganja (storm water and waste water not connected to the main sewer) and the villages along the river.

People in the villages along the river discharge their household waste into the river and solid waste disposal is also considered a significant pressure for water body No 9.

5.4 Other water bodies

"Other water bodies" of Ganjachay River basin, that are not identified as being at risk (in terms of quality or quantity), have been delineated according to criteria, mentioned in the EU WFD and EU WFD Common Implementation Strategy Guidance Document on "Identification of Water Bodies".

To minimize the administrative burden which is a result of having too many WBs in Ganjachay River basin these "other" water bodies are identified according to the following principles mentioned in the EU WFD Common Implementation Strategy Guidance Document No. 2 - "Identification of Water Bodies":

- Small rivers can be included as part of a larger river water body of the same type.
- Small rivers:
  (1) belonging to the same type,
  (2) influenced by the same pressure category and level and
  (3) having an influence on another well delimited water body,
  may be grouped.

We have identified 6 “other” water bodies at risk in Ganjachay basin, figure 5.1 and table 5.2.

Table 5.2:
Other water bodies in Ganjachay basin (water bodies not at risk)

	Water body
1	All the rivers in the southern mountainous part of the basin
3	The small tributaries to water body 2 (water body at risk) from west
4	The small tributaries to water body 2 (water body at risk) from east
5	The river section from Goy- Gol to Topalhesenli
6	The tributaries to water body 5 from west and east
8	The tributaries to water body 7 (water body at risk) from west and east

6. PROGRAM OF MEASURES

The purpose of the Programme of Measures (PoM) is to secure that WBRs are no longer at risk after the implementation of the measures. The PoM is both pressure specific and water body specific. It addresses the specific pressures causing each of the WBRs to be at risk.

The measures needed to improve the environmental status of the water bodies at risk is described below for each of the significant pressures:

1. Water abstraction for irrigation and household use (both river water and subsoil/ground water);
2. Household wastewater - water pollution by household waste waters by people living along the river;
3. Car washing in rivers;
4. Solid waste disposal;
5. Deforestation;
6. Hydromorphological changes of river bed (dams, concrete walls).

Some very rough estimates of investment costs (one-time setup cost of a plant or project) are presented in the last sections of this chapter for the proposed investments in sanitation and solid waste management.

These estimates can only be considered as indicative, as more precise estimates will require a detailed analysis (feasibility study) of each investment, which is outside the scope of this project.

6.1 Water abstraction for irrigation and household use

The process of designing measures to secure good status in the water bodies at risk due to water abstraction for irrigation and household use goes through five steps;

1) Setting separate requirements for minimum flow for all WBRs;
2) Detailed analysis of the present use of water and identification of possibilities to optimise the use;
3) Designing measures to meet the minimum flow requirement for al WBRs;
4) Socioeconomic evaluation of the measures;
5) Revision of objectives for WBRs if it is considered disproportionately costly or socially unacceptable to implement the measures (political evaluation).

There are too many gaps in the present data and information available on flow regime and water use to make it possible to make the analysis outlined above within the Kura project.

6.2 Household wastewater

For WBRs at risk due to significant pressure from household wastewater we have used the approach outlined in the Urban Wastewater Directive to design measures.

The first step is identifying agglomerations including the towns and villages where discharge of wastewater is a significant pressure to water bodies.

According to Urban Wastewater Directive, "Agglomeration" means an area, where the population and/or economic activities are sufficiently concentrated for urban wastewater to be collected and conducted to an urban wastewater treatment plant or to a final discharge point.

We have identified one agglomeration in the Ganjachay River basin: Goy-Gol (also called Khanlar or Xanlar). In this pilot River Basin Management Plan for Ganjachay River basin we will not analyse the situation for the Ganja agglomeration as it discharges wastewater to a neighbouring river basin.

Determination of settlements to be included in the Goy-Gol agglomeration was done in accordance with the "Guidance on How to Define Agglomerations Under the Urban Wastewater Treatment Directive 91/271"[4] and "Rural Wastewater Treatment in Hungary"[5]. Based on these two references the criteria for inclusion of a settlement into the given agglomeration are as follows:

- Population density - minimum 30 people/ha (indicative number),
- Time to reach the wastewater treatment facility - less than 6 hours (taking into consideration the changes of the daily flow),
- For 1 km of sewage collector the minimum number of customers - 120 people.

For the Goy-Gol agglomeration three settlements plus the town itself are included in the agglomeration.

Table 6.1: Goy-Gol agglomeration

Settlements and town	**Distance from the proposed UWWT plant**	**Area, ha**	**Number of inhabitants**	**Population density, inhabitants/ha**
Mirzik	13.5	2097	980	0.47
Ganja Village	9.2	781	500	0.64
Topalhesenli	5.9	199	1829	9.19
Goy-Gol	2	2502	23698	9.5
Total	-	5579	27007	4,8

4) http://www.mmediu.ro/proiecte_europene/01_integrare_europeana/02_POS_mediu/01_Axa_1/Regionalizare/Definirea%20aglomerarilor%20(Romania).doc

5) http://www.meif.org/uk/document/download/gazdag.pdf

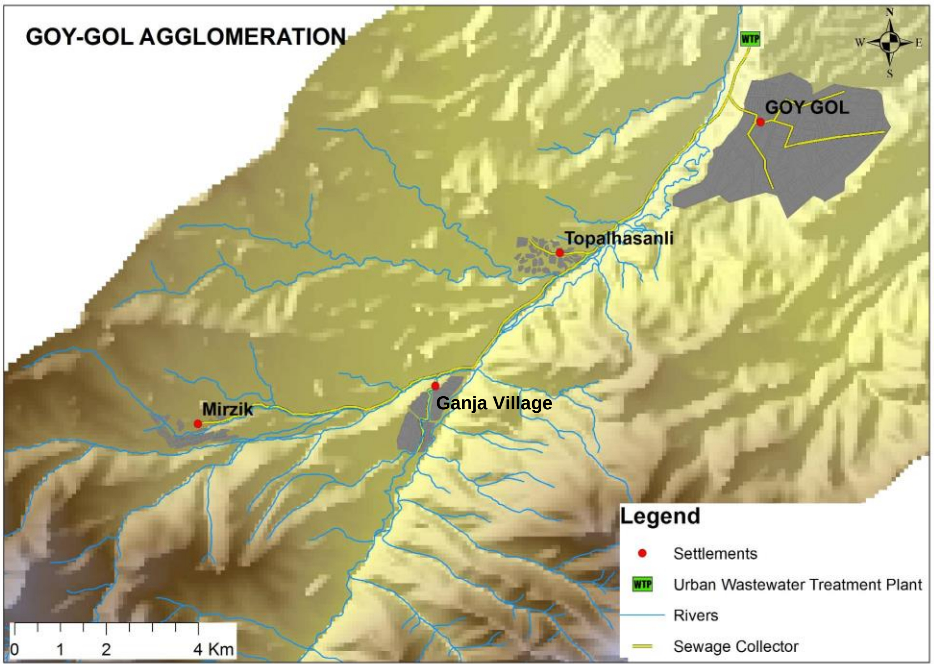


Figure 6.1: **Goy-Gol agglomeration**

For Goy-Gol agglomeration it is proposed to construct wastewater treatment plant on the bank of Ganjachay River, just downstream the city. This takes into consideration local the topography, to minimise the need for expensive pumping of wastewater.

Within the World Bank Urban Water Supply & Sanitation Project II in Azerbaijan a project on water supply systems and sewage collectors is planned for Goy-Gol. An EIA for the project has been drafted[6].

People living in villages along the river discharge their household waste water to pits or the river without treatment. None of the villages has sewerage systems. The Goy-Gol agglomeration will include sewerage systems and for Mirzik, Ganja and Topalhesenli villages and a main collector leading their wastewater to the Goy-Gol WWTP, thereby removing the discharge of wastewater to WB 7 (WBR): Ganjachay, from Topalhesenli to Goy- Gol. WB 2 (WBR): Ganjachay, from Zurnabad to Ganja village is mainly impacted of wastewater from Zurnaband (significant pressure). The possibilities for including Zurnaband in the Goy-Gol agglomeration should be considered during the pre-feasibility study for the sewerage system and WWTP for Goy-Gol.

The WWTP for Goy-Gol agglomeration will treat a major part of the wastewater presently impacting WB 9 (WBR): Ganjachay, from Goy-Gol to mouth, but an additional agglomeration with WWTP may be needed to reduce the pressure from wastewater from the villages downstream of Ganja. Wastewater from these villages may also be included in the Ganja city agglomeration.

[6] "AZERSU" JOINT STOCK COMPANY. National Water Supply and Sanitation Project. KHANLAR REGION WATER SUPPLY AND SANITATION SERVICES PROJECT. ENVIRONMENTAL IMPACT ASSESSMENT. Prepared by: Dr. RAUF MURADOV

6.3 Car washing in rivers

At present no legislation regulates car washing in rivers. Pollution from this activity would be avoided if a legal act prohibiting the activity was adopted and enforced.

6.4 Solid waste disposal

The pressures from solid wastes in Ganjachay river basin is related to the (lack of) waste management in the settlements and towns.

The amount of waste disposed should be reduced by implementing measures to reduce, reuse (e.g. reusable bottles) and recycle (e.g. metal, glass, plastic) as much of the solid waste as possible in line with the EU policy on solid waste.

But regardless on how effective the authorities, citizens and enterprises are in reducing, reusing and recycling, there will always be a rest fraction of the waste which has to be disposed.

It is proposed that a sanitary landfill for Goy-Gol region is established and the waste disposal site of Ganja City is reconstructed to fulfil the requirements of a sanitary landfill, alternative to construct one sanitary landfill where all solid waste from the basin is disposed.

Sanitary landfills[7] are sites where waste is isolated from the environment until it is safe, see figure 6.2.

[7] From: http://web.mit.edu/urbanupgrading/urbanenvironment/sectors/solid-waste-landfills.html

Figure 6.2: Sanitary landfill design[8]

Four basic conditions should be met by any site design and operation before it can be regarded as a sanitary landfill:

1. Full or partial hydrogeological isolation: if a site cannot be located on land which naturally contains leachate security, additional lining materials should be brought to the site to reduce leakage from the base of the site (leachate) and help reduce contamination of groundwater and surrounding soil. If a liner - soil or synthetic - is provided without a system of leachate collection, all leachate will eventually reach the surrounding environment. Leachate collection and treatment must be stressed as a basic requirement.
2. Formal engineering preparations: designs should be developed from local geological and hydrogeological investigations. A waste disposal plan and a final restoration plan should also be developed.
3. Permanent control: trained staff should be based at the landfill to supervise site preparation and construction, the depositing of waste and the regular operation and maintenance.
4. Planned waste emplacement and covering: waste should be spread in layers and compacted. A small working area which is covered daily helps make the waste less accessible to pests and vermin.

More detailed proposal for the number and locations for the sanitary landfills in the area should be made during the elaboration of waste management plans[9].

6.5 Deforestation

It is proposed that a plan for reforestation is made for the basin.

Reforestation should restore the natural vegetation cover in the areas, where human activates has resulted in deforestation, and

- which are vulnerable for soil erosion,
- where reforestation will support recharge of important aquifers,
- where reforestation will change the flow regime of rivers back to a natural situation (decreasing the number and severity of landslides, mudflows and flooding and increasing the minimum flow),
- where the reforested areas can provide important forest services for the local population and make the area more attractive for tourists.

The reforestation shall result in forests with the same biodiversity as the original forest.

Activities which can be included in a reforestation project:

A. Map the original vegetation cover in the basin.
B. List the benefits of reforestation that the project will focus on (criteria for reforestation).

[8] From PP-Presentation: Municipal Solid Waste Treatment Technologies and Carbon Finance, World Bank, Carbon Finance Unit, Thailand, Bangkok, January 24, 2008

[9] For EU member states waste management plan is a compulsory strategic document that describes how waste management objectives will be achieved. It should cover waste management and waste prevention and recovery, and aims to limit the environmental impact of waste on human health and the environment, and establish an integrated and adequate network of disposal facilities taking account of best available techniques.

C. Identify the areas where reforestation will be most beneficial based on identified criteria.
D. A prioritised reforestation plan.
E. Raise awareness in the local population on the benefits of forests.
F. Planting and protecting the new forested areas.

6.6 Hydromorphological changes

It is proposed that the existing structures of the former Zurnaband HPP in Topalhesenli village are removed.

6.7 Supplementary measures

The Water Framework Directive requires 2 types of measure, to be included in the PoM:

A. Basic measures which are mainly technical interventions as a minimum needed to reach good status in the water bodies at risk.
B. Supplementary measures which include institutional, awareness, legislation, research, economic instruments, education, demonstration projects etc.

The sections 1 to 6 of this chapter focus on basic measures.

Implementation of supplementary measures covering the topics mentioned above is also crucial for the improvement of the status of the water bodies at risk.

6.8 Cost estimate for Goy-Gol agglomeration

A cost estimate for construction cost for sewerage and waste water treatment plant for Goy-Gol agglomeration is made by Azersu. The estimate made by Azersu is compared with estimates based on data from Bosnia and Herzegovina and Slovakia in table 6.2.

Table 6.2: Cost estimate, Goy-Gol agglomeration

	PE	Cost, million EUR		
		WWTP	Sewage collection network	Total
NWSSP* estimate (Azersu)	11000	3,5	6,9	10,4
Experience from Bosnia-Herzegovina	9066	1,2	3,3	4,5
Experience from Slovakia¤	10 000	2,0	5,0	7,0

***Notes**: *: National Water Supply & Sanitation Project, Azerbaijan*
¤: Slovak prices are for mechanical, biological treatment including nitrogen removal

The costs of renovation and extension of the sewerage system and building the WWTP is dependent on the location and the situation in the country. The calculations based on experience from Bosnia-Herzegovina and Slovakia are based on unit costs and does not take into consideration the local situation. The three independent calculations give an indication of the size of the costs. They also show that the renovation and extension of the sewerage system counts for the major part of the investments.

The total running costs has not been estimated. The major part of the total running costs (operation, maintenance and running costs related to the investment costs (interest and depreciation)) will be the related to operation and maintenance (generally less than half the cost of water supply and sanitation is related to investments).

6.9 Cost estimate for solid waste

An indicative level of the costs for collection, transfer and disposal of solid waste is somewhere around 7 Euro pr. person pr. year for the Ganjachay basin[10]. As the amount of waste produced pr. person is heavily dependent on income and this number is based an estimated yearly income of 700 Euro pr. person pr. year as a mean in the basin. The figure of 7 Euro pr. person pr. year includes owning, operation, maintenance, and debt service, and assuming no equipment provision through grants.

7. GAPS IN KNOWLEDGE AND RECOMMENDATIONS HOW TO FILL THEM

The process of characterizing the basin, evaluation human activities in the basin, and the analysis of the pressures and impacts revealed several major data gaps. The gaps include expertise gaps and data/information gaps.

The most crucial is the gaps in knowledge infrastructure for WFD RBM in areas as:

- technical expertise in all the sectors that is needed to draft RBMPs including ecology,
- technical knowledge and knowledge in the EU approach to water management,
- very limited experience among experts in working interdisciplinary (working together with experts with other technical expertise in teams during the drafting of the WFD RBMP),
- scientific work in universities, research and scientific institutions is to a limited extent addressing the issues relevant for establishing River Basin Management Plans in line with the WFD methodology.

On top of that it there is very little information available on the status of the environment and the human activities which potentially can impact the environment.

7.1 Gaps in knowledge infrastructure

Expertise in relevant technical issues

There is limited technical expertise available in all the sectors needed to assess the environmental impact of economic activities and to draft RBMPs. The gaps in available expertise include lack of relevant expertise in ecology.

[10] Based on: http://www.unep.or.jp/ietc/Publications/spc/Solid_Waste_Management/Vol_I/31-AppendixD.pdf

Knowledge of WFD and other EU directives in the water sector

There is little use in Azerbaijan of the EU approach to water management, limited knowledge of the EU directives and of the approach of EU in relation to environmental issues (e.g.: polluter pays, precautionary principle, prevention, integrated approach, ecosystem approach etc.).

To facilitate the access to EU Water Framework Directive methodology the Kura Project has translated following key documents translated to Georgian, Armenian and Azeri, printed and delivered to the Beneficiaries and is available for the Kura project homepage:

1. EU Water Framework Directive;
2. EU Floods Directive;
3. WFD Technical Guidance: Identification of Water Bodies;
4. WFD Technical Guidance: Analysis of Pressures and Impacts;
5. Introduction to Biological Monitoring of Water Quality.

Further the project has elaborated the following documents:
- Analysis of the Baseline Situation in the Kura Aras Basin
- Monitoring Guidelines for Decision Makers
- Public Participation Guidelines for Decision Makers
- Good Laboratory Practice Guidelines for Sampling and Analysis

These documents are available in local languages from the Kura project homepage.

Experience in working interdisciplinary

To establish RBMPs in line with the EFD expect from different fields need to work together in teams during the drafting of the WFD RBMP. We have learned that limited experience is available in Azerbaijan in working interdisciplinary.

7.2 Gaps in data and information

In the course of development of this draft river basin management plan, some major data gaps were identified. If more data had been available they could significantly change the thinking, streamline the expert judgments made on the nature and impact of several pressures and largely help in development of cost-effective program of measures to achieve the objectives for the water bodies at risk.

The main data gaps, identified in the course of development of this draft report include the following categories:

- Ecology of the basin;
- Data on human activities, including land use data;
- Compliance assurance (data from self control, and inspection of enterprises);
- Physical-chemical and hydro-morphological monitoring (very few stations, limited coordination of the two types of monitoring);
- Quality assurance of data;
- Biological monitoring (not existing);
- Groundwater monitoring (not existing).

Gaps in knowledge of human activities

An important gap is the limited availability of general and reliable statistical information.

Land use data in the basin is scarce, uncoordinated and not systemized.

Permitting and compliance assurance (self control by the enterprises, control and inspection by authorities to check that the enterprises not violate their permit and enforcement by the authorities if the enterprise does not comply) is weak. We have not been able to get access to permits and to data from compliance assurance.

Water use (abstraction and discharge)

For water abstraction we need to know how much is abstracted, where, when and how. For point sources discharges we need to know how much is discharged, where, when plus the amount of or concentration of pollutants in the discharge. These site specific (not aggregated) data has not been available.

Agriculture, crop and livestock production

Agriculture impacts water quantity and quality in the basin mainly by:

1. Use of water for irrigation,
2. Loss of nutrients (from chemical fertilizer and animal manure) and
3. Loss of pesticides to surface and ground water.

No reliable monitoring exists in Azerbaijan for collecting and analyzing pesticide and fertiliser use information (type, quantity, technology used for spreading, when it is used and geographical areas) in crop production.

The quantity of water used for irrigation purposes is not measured. Information on the use of chemical fertilizer, number of livestock, handling of manure and water used for livestock production is not available.

Industry

There exists little information on industries by rayons and towns, and no specific data on the environmental impact is available. .

Solid waste

General and outdated information could be collected from different sources on solid waste disposal locations and conditions. No monitoring is conducted and no functional database storing relevant data exists.

Deforestation

No updated information on deforestation exists in Azerbaijan.

Transport

Negative impact from transport can be evaluated from pollutant spillages related to accidents, spillage of oil, use of salt as de-icer, use of herbicides and engine exhausts. No relevant data is available in Azerbaijan to assess the impact from transport.

Gaps in knowledge of impact of human activities

To evaluate the impact of human activities requires knowledge in four areas:

1. the extent or size of the activity (see above section: Gaps in knowledge of human activities);
2. the pressure from the activity (amount of pollutant in relation to the extent or size of the activity, see above section);
3. the nature of the impact (how does the pollutant released during the activity impact ecosystems);
4. the vulnerability of the ecosystems impacted by the activity.

Also for two last areas there is limited knowledge available in Azerbaijan.

Gaps in knowledge of environmental status

The information on the ecology of the Ganjachay basin, particularly water ecology is very scarce.

The gaps in the present monitoring programmes include:

- very few stations, both for chemical and hydromorphological monitoring;
- chemical and hydromorphological monitoring are not coordinated and corresponding chemical and flow measurements not available;
- no biological monitoring;
- limited quality assurance of data.

Water quantity and quality monitoring

To evaluate the impact of human activities we need knowledge of water quantity and quality throughout the basin.

Regular water quality monitoring activities are implemented at few stations in the Ganjachay basin, chemical and hydromorphological monitoring are not coordinated, biological monitoring does not exist, the quality control/quality assurance of the data are questionable and data are not easily accessible.

7.3 Recommendations, knowledge infrastructure

It is recommended that the strengthening of knowledge infrastructure for WFD in Azerbaijan includes:

- improving technical expertise (training existing experts and establishing curricula for the education/recruitment of new experts) in all the sectors that is needed to draft RBMPs (hydrologists, geologists, biologists, chemists, agronomists, economists, engineers with knowledge of wastewater treatment and main industrial sectors, etc.),
- the experts shall both have technical knowledge and knowledge in the EU approach to water management,
- further the experts needs to be trained in integrated planning: working together with experts with other technical expertise in teams during the drafting of the WFD RBMP,

- the building of knowledge infrastructure for WFD RBM should include scientific work in universities, research and scientific institutions and education of new experts for RBMP/IWRM.

7.4 Recommendations, data and information

Knowledge of human activities

Water use (abstraction and discharge)
Setting up monitoring for urban and household wastewater discharge – at least conducting general data collection survey and chemical sampling is a major recommendation for assessment of impact on water bodies.

Agriculture, crop and livestock production
Monitoring system must be set for collecting pesticide use information, measuring quantity of water used for irrigation purposes and livestock production and collecting information on number of livestock and handling of manure.

GIS based databases must be developed to store collected data to enable site specific analysis. Data must be shared easily among government agencies and be accessible.

Industry
Having access to site specific information on the production capacity and environmental impact for the industry in Ganjachay basin is important to make assessment of pressure and impact on water bodies from industries.

We recommend development of GIS of all industries in Azerbaijan (food and other industries) containing updated information on production volume and treatment of production leftovers.

Mining (including old tailing dams)
Data on mining industries and sand/gravel abstraction can be collected and stored in the GIS of industries proposed in the previous section. Areas of mining deposits should be digitized in polygon GIS layer for better illustration of ongoing mining activities; volume of production and environmental impact must be shown.

Solid waste
Our recommendation is to set up monitoring of waste disposal including (but not limited to) collecting the following information: geographical location of waste disposal site, legal status (official or unofficial site), area, responsible body, type of waste, current status.

Deforestation
Information on woodcutting industries can be including in the GIS database of industries discussed above.

Remote sensing is required to conduct the survey of deforestation areas. Data must be collected using aerial photography and digitized into GIS.

Monitoring programmes

Adding water quality and quantity monitoring stations in different locations (starting from locations in water bodies at risk) is most important recommendation for filling out data gaps. Collecting sufficient water quantity and quality data is also required for further monitoring of the effect of measures taken according to PoM for each water body at risk.

A new WFD compliant monitoring programme should be designed for the basin. The programmes should integrate chemical, hydromorphological and biological monitoring. The programme should be based on the basin characterization elaborated in line with the WFD, and address all water bodies.

Good Laboratory Practice should be fully implemented in the Laboratory of the National Environmental Monitoring Department in a structured way that in the end of the process fulfils the requirements for an accreditation in line with international standards.

As a part of the introduction of Good Laboratory Practice quality assurance/quality control elements should be introduced during the whole monitoring process at the of the Laboratory of the National Environmental Monitoring Department (sampling, analysis, data processing and reporting) to avoid any misinterpretations and confusions about the data

The Laboratory of the National Environmental Monitoring Department should start with improvement of the conditions and capacities to introduce the monitoring of the biological quality elements into the monitoring programmes

Training and international cooperation

We recommend using the programmes established by the EU for capacity building as this would be a very efficient way to build capacity for River Basin Management in line with the WFD. The relevant EU programmes include the following:

- TAIEX (Technical Assistance and Information Exchange)[11]
- Twinning (The Twinning programme aims to help beneficiary countries to develop modern and efficient administrations, with the structures, human resources and management skills needed to implement the EU acquis.)[12]
- Tempus (purpose: to modernise higher education in EU neighbours)[13]
- Erasmus Mundus (modernisation of education)[14]

[11] TAIEX is a quick and flexible tool, which assists partner administrations in their efforts to understand, harmonise or implement rules and regulations over a wide range of subjects. It also identifies possible issues for future joint working between the EU and its neighbours. http://ec.europa.eu/europeaid/where/neighbourhood/overview/taiex_en.htm

[12] Twinning is a European Commission initiative that was originally designed to help candidate countries acquire the necessary skills and experience to adopt, implement and enforce EU legislation; http://ec.europa.eu/europeaid/where/neighbourhood/overview/twinning_en.htm

[13] Tempus supports the modernisation of higher education and creates an area of co-operation in countries surrounding the EU. http://ec.europa.eu/education/external-relation-programmes/doc70_en.htm

[14] Support in the fields of in the fields of education and training, citizenship, youth, audiovisual and culture. http://eacea.ec.europa.eu/erasmus_mundus/programme/programme_guide_en.php

ANNEX I - Pilot Water Quality Classification of the Surface Water Bodies in Pilot River Basins

1. Introduction

Note
This document does not have the purpose to replace the surface water quality Classification schemes existing in the project countries, but it aims to help beneficiaries to assess the surface water quality status in Pilot River Basins, in a way that facilitates the link to the pressures and subsequent the establishment of the Programme of Measures (PoM) in line with the WFD methodology

For the assessment of water resources, monitoring data and other information allowing quantitative estimation of ecological conditions and trends and evaluation of effectiveness of the water management measures and policies are required. However, raw monitoring data should be transformed and presented in the understandable and meaningful way for the decision making process. Such information may be received using the classification scheme to define water quality classes based on the monitoring data.

According the WFD, the main European policy is to restore the ecological status of the surface waters. Only for priority substances general EU standards for water quality have to be established according the WFD. Member Countries shall establish classification schemes adapted to the natural characteristics of water body types. Classification system is focussed on the biological water quality elements. Chemical water quality elements are according the WFD used to support the ecological water quality assessment of surface water bodies. Classification systems based on the different water uses (Maximum Allowable Concentrations) no longer fit with this policy.

As it was found in the previous activities of the EU Kura River project, assessment and classification approaches of the river water quality in the project countries are different and results are not comparable. In all three EU Kura project countries, approach based on Maximum Allowable Concentrations is officially applied to assess the surface water quality in monitored rivers. There is a great need in the Kura River region for a WFD compliant assessment of surface water quality, which will be based on five quality classes, adequate to European policy.

It was agreed to prepare the Classification system, to assess the surface water quality status in Pilot River Basins, where River Basin Management Plans will be elaborated. The most important part of the proposed classification system is the principles for the classification based on chemical monitoring data. The parametric values for determining the borders between the quality classes can be adjusted according to experiences gathered during monitoring. Development of the background/reference concentrations for heavy metals will be as organic substances part of this Classification system, as well.

Based on the requirements of the EU water policy and current situation in the Kura River region, it is expected that, the proposed Classification system will contribute:

- to harmonization of the surface water quality targets (i.e. a common definition of the 'good' quality status) for all surface water bodies in Pilot River basins,
- to promoting assessment method for identification of water bodies at risk to achieve Environmental Objectives (later to establishment of Programme of Measures).

Furthermore, this pilot Classification system is intended to be readily understood by the users.

The pilot Classification system is based on the following:

- since no results of biological monitoring are available, only chemical water quality parameters were used,
- water quality parameters were selected based on the existing pressures in the Kura River basin and present data availability in the EU Kura River project countries (oxygen/nutrient regime parameters – organic pollution and eutrophication, heavy metals - pollution from mining activities, specific organic substances – diffuse pollution from using pesticides and other activities),
- water quality parameters representing heavy metals and specific organic substances were subdivided into two groups:
  - *Relevant for Pilot River Basin*
  - *EU WFD Priority Substances*
- water quality classes were used as defined in EU WFD, and threshold values for individual classes were used from Danube River Classification Scheme (*ICPDR, 2008) and Slovak Technical Standard (Phenols and Petroleum hydrocarbons),*
- EU WFD Priority Substances parameters will be assessed in accordance with approach defined in *EC Directive 2006/0129 (COD) for Priority Substances,*
- principle "One out, all out", will be used to classified water bodies (at risk to achieve "Good Status"),
- statistical method in combination with geological expert judgement is used to estimate the background/reference concentrations for heavy metals (assuming, given river basins geochemical environment is quasi-homogenous body),
- water quality parameters from National water quality databases will be used for assessment (known origin and quality of data sets).

2. Purpose

The main aim of this Working paper on Water Quality Classification of the surface water bodies is to support the process of preparation of draft sub-catchment River Basin Management Plans for 5 Pilot basins as identified by the EU Kura project and beneficiaries. More specifically, Classification system:

- should be used to assess the water quality status of the surface water bodies,
- to give more insight on the identification of the water bodies at risks (to fail Environmental Objectives defined by EU WFD),
- facilitate linking the water quality with the impact of the pressures and subsequent support the establishment of the PoM.

3. Selection of water quality parameters

Water quality parameters were selected to cover the main water related issues in the Kura River basin and on the data availability. These parameters were as follows:

Oxygen/Nutrient regime *- dissolved oxygen, BOD5, COD-Cr, ammonium, nitrite, nitrate and ortho-phosphate concentrations,*

Heavy metals (total)

Relevant substances per Pilot River Basin – Zn, Cu, Cr and As
EU WFD Priority substances – Cd, Pb, Hg and Ni

Specific organic substances

Relevant substances per Pilot River Basin – phenols, petroleum hydrocarbons, lindane, heptachlore
EU WFD Priority substances – DDT total , p,p-DDT, hexachlorocyclohexane

4. Classification system

"Environmental quality standard (EQS)" means the concentration of a particular pollutant or group of pollutants in water, sediment or biota which should not be exceeded in order to protect human health and the environment (EU WFD).

AA-EQS *is the EQS expressed as an annual average value, protective against long-term (chronic) pollution on aquatic organisms.*
MAC-EQS is the EQS expressed as a maximum allowable concentration, protective against short-term (acute) pollution peaks on aquatic organisms. (EC Directive 2008/105/EC) see
(http://www.kuraarasbasin.net/EU_KuraAras_webpage/Main_Events_files/EC%20Directive%202008_105_EC%20on%20environmental%20quality%20standards%20in%20the%20field%20of%20water%20policy.pdf)

As it was already mentioned earlier existing water quality standards on both EU and Member States levels were used in development of the Classification schemes (no standards were developed from scratch) for selected groups of water quality parameters. The standards used in ICPDR Classification system for oxygen/nutrient regime parameters were used (with small correction in dissolved oxygen) (see Table 1).

Table 1 Pilot River basin Classification scheme for oxygen/nutrient regime

Quality classes*/ Parameters	**Unit**	**High**	**Good**	**Moderate**	**Poor**	**Bad**
Oxygen/Nutrient regime						
Dissolved oxygen	mg/l	8	6	5	4	< 4
BOD_5 (mg/l)	mg/l	3	5	10	25	> 25

COD_{Cr}	mg/l	10	25	50	125	> 125
Ammonium-N	mg/l	0,2	0,3	0,6	1,5	> 1,5
Nitrite-N	mg/l	0,01	0,06	0,12	0,3	> 0,3
Nitrate-N	mg/l	1	3	6	15	> 15
Ortho-phosphate-P	mg/l	0,05	0,1	0,2	0,5	> 0,5

Source: TNMN Yearbook and database in 2006 (ICPDR 2008)

In case of heavy metals, they have been subdivided into two groups. The first group of heavy metals was created by those which are just relevant for the Pilot River basin. Here, similarly to the oxygen/nutrient regime ICPDR Classification system was used. In the second group heavy metals defined as Priority Substances under EU WFD were included and classified in accordance with *EC Directive 2008/105/EC* (see Table 2).

Table 2 Pilot River basin Classification scheme for heavy metals (total)

Quality classes*/ Parameters	**Unit**	**High**	**Good**	**Moderate**	**Poor**	**Bad**
Relevant substances per Pilot RB[a]						
Zinc	µg/l	bg[I]	100	200	500	> 500
Copper	µg/l	bg	20	40	100	> 100
Chromium	µg/l	bg	50	100	250	> 250
Arsenic	µg/l	bg	5	10	25	> 25
EU WFD Priority substances[b]						
	Unit	**AA-EQS** **		**MAC-EQS*****		
Cadmium *(in dependence on the class of water hardness)*[II]	µg/l	≤ 0,08 (class 1) 0,08 (class 2) 0,09 (class 3) 0,15 (class 4) 0,25 (class 5)		≤ 0,45 (class 1) 0,45 (class 2) 0,6 (class 3) 0,9 (class 4) 1,5 (class 5)		
Lead	µg/l	7,2		Not applicable		
Mercury	µg/l	0,05		0,07		
Nickel	µg/l	20		Not applicable		

Source: [a]TNMN Yearbook and database in 2006 (ICPDR 2008) and[b] EC Directive 2008/105/EC for PS.

[I] *bg – background/reference concentration*

[II] *Water hardness: class 1: <40 mg $CaCO_3$/l, class 2: 40 to <50 mg $CaCO_3$/l, class 3: 50 to <100 mg $CaCO_3$/l, class 4: 100 to <200 mg $CaCO_3$/l and class 5: ≥200 mg $CaCO_3$/l.*

Several specific organic substances are measured in the Kura River basin, both as sum parameters and as individual substances. Therefore, only those which were found listed in the protocols of analysis are included in the Classification scheme for specific organic substances (see Table 3).

Table 3 Pilot River basin Classification scheme for specific organic substances

Quality classes*/ Parameters	**Unit**	**High**	**Good**	**Moderate**	**Poor**	**Bad**

Relevant substances per Pilot RB						
Phenol index[c]	mg/l	0,01	0,02	0,1	0,5	> 0,5
Petroleum hydrocarbons[c]	mg/l	0,01	0,05	0,1	0,3	> 0,3
Heptachlore	μg/l	0,05	0,1	0,2	0,5	> 0,5
Lindane[a]	μg/l	0,05	0,1	0,2	0,5	> 0,5
EU WFD Priority substances[b]						
	Unit	**AA-EQS ****		**MAC-EQS*****		
DDT total	μg/l	0,025		Not applicable		
para-para-DDT	μg/l	0,01		Not applicable		
Hexachlorocyclohexane	μg/l	0,02		0,04		

Source: [a]TNMN Yearbook and database in 2006 (ICPDR 2008), [b]EC Directive 2008/105/EC) for PS and [c]Slovak Technical Standard STN 7221 Classification of surface water.

**Quality classes as defined in the WFD:*

***high status**: little or no sign of anthropogenic disturbance*

***good status:** slight changes compared to the natural condition*

***moderate status:** moderate changes compared to the natural condition*

***poor status:** biological communities deviate substantially from those normally associated with the surface water type under undisturbed conditions*

***bad status:** large portions of biological communities normally associated with the surface water type under undisturbed conditions are absent*

***AA-EQS – Average annual Environmental Quality Standard*

****MAC-EQS – Maximum annual Environmental Quality Standard*

5. Background concentrations of heavy metals

The assessment of heavy metals from human-made activities on surface waters is difficult due to the natural enrichment of metals in surface material and topsoil as a result of the influence of mineralized bedrock in the region. Therefore, it is required to make some examination of the study area (Pilot River basin) with respect the natural conditions of heavy metals contents in the surface waters, which also reflect the geological diversity of the region. This investigation/monitoring should be done presumably at the least anthropogenically influenced background sites in the Pilot River basins (reference sites).

5.1 Methods to develop background concentrations

The background values of heavy metals for the purpose of this document may be defined as both spatial and time characteristic concentrations of the heavy metals in surface waters without any anthropogenic influences. There are several methods and approaches to establish or to calculate such background values. Some of them are as follows:

- Estimation of the background concentration values of heavy metals in natural areas without, or at least minimal anthropogenic impacts,

- Estimation of the background values from the sediments of lakes, floodplain areas and soils,
- Geochemical methods,
- Statistical methods,
- Combined methods and others.

As the most convenient method to be used in this part of the project was selected statistical method in combination with correction made by geochemical expert judgement. The first three methods will need more expert knowledge, time and financial resources, which are beyond the scope of this project.

5.2 Statistical method and geological corrections

One of the statistical method, which can be used to estimate the background concentrations of heavy metals, is theoretical log-normal distribution defined by two parameters (mean value μ and standard deviation σ). This method is simple and stable, and do not need large time series of the water quality data. Current commercial statistical software can be used, or also program made in MS Excel, if more calculations are needed.

Following steps will be made to estimate the background concentrations of heavy metals in the Pilot River basin:

8. Selection of the sampling sites with natural, or minimal anthropogenic influence, where heavy metals concentrations are available,
9. Whole data sets are used to calculate statistical parameters,
10. One value, close to “0” is added to the original data sets (detection limit divided by 100). This value will approach distribution function close to “zero” concentration.
11. All values of data sets will be re-calculated as log-values,
12. Both mean value μ and standard deviation σ are calculated from the log-values data sets,
13. Calculation of the given percentile in the range from 50 to 90-tile for original data sets will be done,
14. Estimation of the background values from the log-normal probability curve, as percentile, where sudden concentrations arisen appeared (see Fig.) and corrections made by the expert judgement, compared to the geochemical conditions, if necessary.

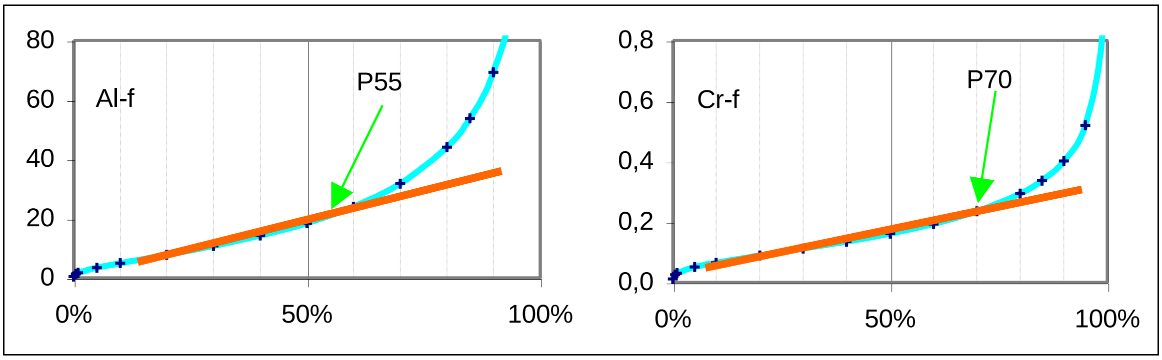


Figure 1 Estimation of the percentiles as background concentrations (Pekarova, 2008)

6. Assessment of the water quality status

6.1 Oxygen/Nutrient regime

Input data to assess the surface water status related to oxygen/nutrient regime will be used from the official databases of the EU Kura River project. The following steps will be done to classify the surface water (see Scheme 1).

9. Average annual concentration (AAC) will be calculated for each water quality parameter from the available data sets and for each sampling site in the Pilot RB.
10. Calculated Average annual concentrations will be compared with the values in the Classification scheme for oxygen/nutrient regime (Table 1) and put into classes.
11. If, the AAC is lower or equal to the 2^{nd} class (Good class), the sampling site for specific parameter is in Good status (achieving the Environmental Objectives as defined by EU WFD). If it is not a case (AAC is higher to the 2^{nd} class), sampling site will be classified as failing to achieve good status.
12. Based on the results from the previous point 3, water body represented by the sampling site will be presented on the GIS Map (see Table 4).

Table 4 Colour-coded classified surface water body to be presented on the GIS Map

Status Classification	Colour Code
High	Blue
Good	Green
Moderate	Yellow
Poor	Orange
Bad	Red

6.2 Heavy metals

Input data of heavy metals, Ca and Mg (to calculate the hardness), for classification of the water quality status with regards heavy metals contents, will be taken from the official databases of the EU Kura River project countries, where it is expected that certain quality of data is ensured. The assessment will be done separately for the part of heavy metals, which are just Relevant for the Pilot RB and those, which are on the WFD List of Priority substances (see Scheme 2).

Relevant substances per Pilot RB (Zn, Cu, Cr and As)

1. Average annual concentration (AAC) will be calculated for each heavy metals from the available data sets and for each sampling site in the Pilot RB. *In case of concentration values of heavy metals below the detection limit (or Limit of Quantification), these will be used as 50% of the detection limit in calculating Average annual concentrations. If, there is more than 90% of measured concentration values below the detection limit the sampling site will be classified in class 1 for specific heavy metal.*
2. Calculated Average annual concentrations will be corrected for background concentrations (AAC - bg) and subsequently compared with the values in the Classification scheme for heavy metals (Table 2) and put into classes.
3. If, the AAC is lower or equal to the 2^{nd} class (Good class), the sampling site for specific heavy metal is in Good status (achieving the Environmental Objectives as defined by EU WFD). If it is not a case, sampling site will be classified as failing to achieve good status.

4. Based on the results from the previous point 3, water body represented by the sampling site will be presented on the GIS Map (see Table 4).

EU WFD Priority substances (Cd, Pb, Hg and Ni)

1. Average annual concentration (AAC) will be calculated for each heavy metal from the available data sets and for each sampling site in the Pilot RB. *In case of concentration values of heavy metals below the detection limit, these will be used as 50% of the detection limit in calculating Average annual concentrations. If, there is more than 90% of measured concentration values below the detection limit the sampling site will be classified in class 1 for specific heavy metal.*
2. In case of Cd, it is necessary to classify the water in sampling site specifically for hardness as *mg* $CaCO_3$*/l*. Measured concentrations of Mg and Ca will be multiplied by 100,0872 that is M $CaCO_3$ in $g.mol^{-1}$, and by coefficient 1,784 (that is ratio of M $CaCO_3$/ M CaO).
3. From the received classes of water hardness Average annual water hardness will be calculated and this class will be used to classify AAC for Cd. When applying MAC-EQS, that water hardness class will be used, when maximum concentration of Cd was measured.
4. Calculated AAC of 4 heavy metals will be decreased by background concentrations (AAC – bg) and compared with AA-EQSs (Table 2), the same will be done in case of MAC, if applicable (compare with MAC-EQS).
5. If, the AAC is lower or equal to AA-EQS, the sampling site for specific heavy metal is in Good chemical status (achieving the Environmental Objectives as defined by EU WFD). If it is not a case, sampling site will be classified as failing to achieve good status.
6. Based on the results from the previous point 5, water body represented by the sampling site will be presented on the GIS Map as water body failing to achieve good status (red colour) or as delineated water body achieving “Good Status” (blue colour).

6.3 Specific organic substances

Similarly to heavy metals, specific organic substances are going to be classified in two ways. The first group which is just relevant for the Pilot River basin and the second one are those chemical substances which are on the WFD List of Priority substances (see Scheme 3).

Relevant substances per Pilot RB (phenols, petroleum hydrocarbons, lindane, heptachlore)

1. Average annual concentration (AAC) will be calculated for each water quality parameter of this group from the available data sets and for each sampling site in the Pilot RB. *In case of concentration values of the parameters are below the detection limit (or Limit of Quantification), these will be used as 50% of the detection limit in calculating Average annual concentrations. If, there is more than 90% of measured concentration values below the detection limit the sampling site will be classified in class 1 for specific water quality parameter of this group.*
2. Calculated Average annual concentrations will be compared with the values in the Classification scheme for heavy metals (Table 3) and put into classes.
3. If, the AAC is lower or equal to the 2^{nd} class (Good class), the sampling site for specific heavy metal is in Good status (achieving the Environmental Objectives as defined by EU WFD). If it is not a case, sampling site will be classified as failing to achieve good status.

4. Based on the results from the previous point 3, water body represented by the sampling site will be presented on the GIS Map (see Table 4).

EU WFD Priority substances (DDT total, p,p-DDT, hexachlorocyclohexane)

1. Average annual concentration (AAC) will be calculated for each parameter of this group from the available data sets and for each sampling site in the Pilot RB. *In case of concentration values of specific chemical substance are below the detection limit, these will be used as 50% of the detection limit in calculating Average annual concentrations. If, there is more than 90% of measured concentration values below the detection limit the sampling site will be classified in class 1 for specific chemical substance.*
2. Calculated AAC of the parameters will be compared with AA-EQSs (Table 3), the same will be done in case of MAC, if applicable.
3. If, the AAC is lower or equal to AA-EQS, the sampling site for specific heavy metal is in Good chemical status (achieving the Environmental Objectives as defined by EU WFD). If it is not a case, sampling site will be classified as failing to achieve good status.
4. Based on the results from the previous point 3, water body represented by the sampling site will be presented on the GIS Map as water body failing to achieve good status (red colour) or as delineated water body achieving "Good Status" (blue colour).

7. Conclusions

One of the basic steps to provide the information on water quality for decision making process is to prepare the appropriate assessment system. Classification of the surface water bodies should be one of the approaches. Due to fact, that in the Kura River basin countries there are no common classification systems used, it was decided to prepare the simple Classification system for surface water for selected number of water quality parameters. This Classification system is specifically targeted to be used in the 5 Pilot River Basins for pressure-impact analysis, the WBR identification and subsequently in the establishment of the PoM for the pilot basins of the EU Kura River project.

This Classification system was based on EU WFD to follow the EU water policy as much as possible, and the existing systems in EU Member States and ICPDR (Danube River).

Following surface water quality parameters were included into the classification schemes:

Oxygen/Nutrient regime *- dissolved oxygen, BOD5, COD-Cr, ammonium, nitrite, nitrate and ortho-phosphate concentrations,*

Heavy metals (total)
Relevant substances per Pilot River Basin – Zn, Cu, Cr and As
EU WFD Priority substances – Cd, Pb, Hg and Ni

Specific organic substances
Relevant substances per Pilot River Basin – phenols, petroleum hydrocarbons, lindane, heptachlore
EU WFD Priority substances – DDT total , p,p-DDT, hexachlorocyclohexane

Estimation of the background/reference concentrations of the heavy metals will be done by the Statistical method (Log-normal distribution) with expert corrections on geochemistry of the pilot areas.

This classification system will be used just for the purpose of the EU Kura Rive project, and do not have any implications with classification and assessment system used on national levels in the region.

References

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy, Brussels, 2000.

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Slovak Technical Standard STN 7221 “Water Quality - Classification of surface water”, Bratislava, 1999.

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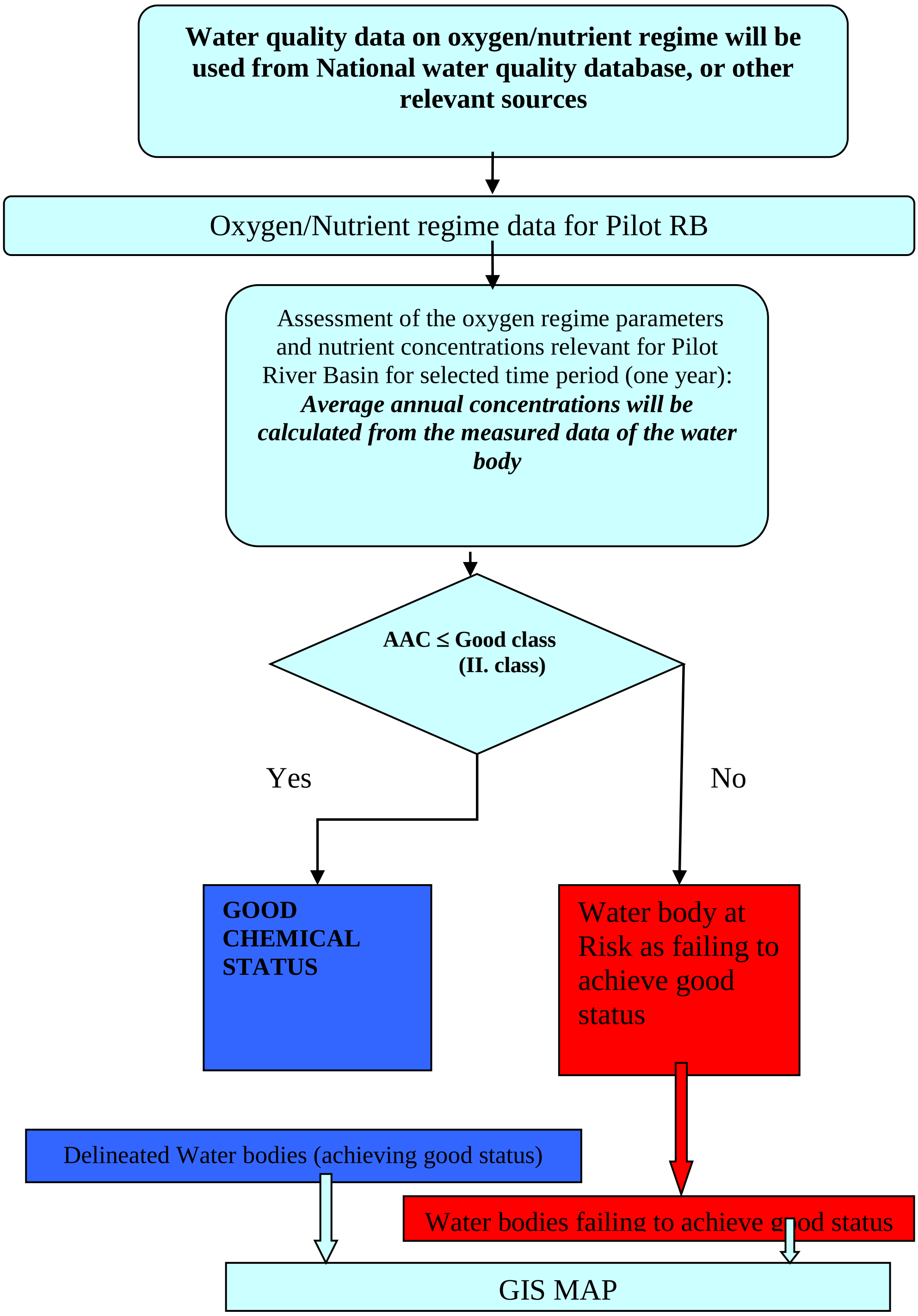
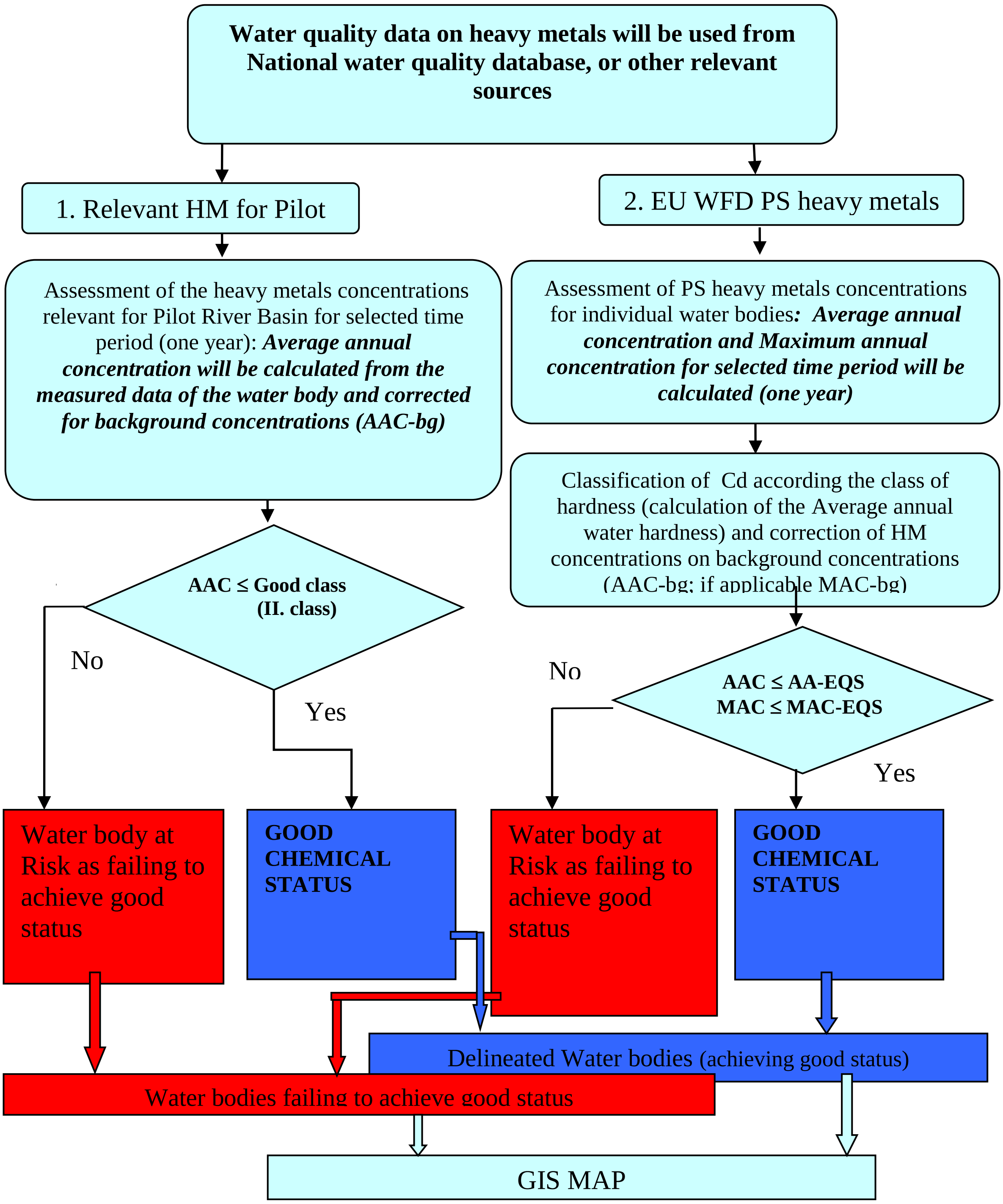
Scheme 1 Classification approach for oxygen/nutrient regime parameters of surface water bodies


Water quality data on oxygen/nutrient regime will be used from National water quality database, or other relevant sources
Oxygen/Nutrient regime data for Pilot RB
Assessment of the oxygen regime parameters and nutrient concentrations relevant for Pilot River Basin for selected time period (one year):
Average annual concentrations will be calculated from the measured data of the water body
AAC ≤ Good class (II. class)
Yes
No
GOOD CHEMICAL STATUS
Water body at Risk as failing to achieve good status
Delineated Water bodies (achieving good status)
Water bodies failing to achieve good status
GIS MAP

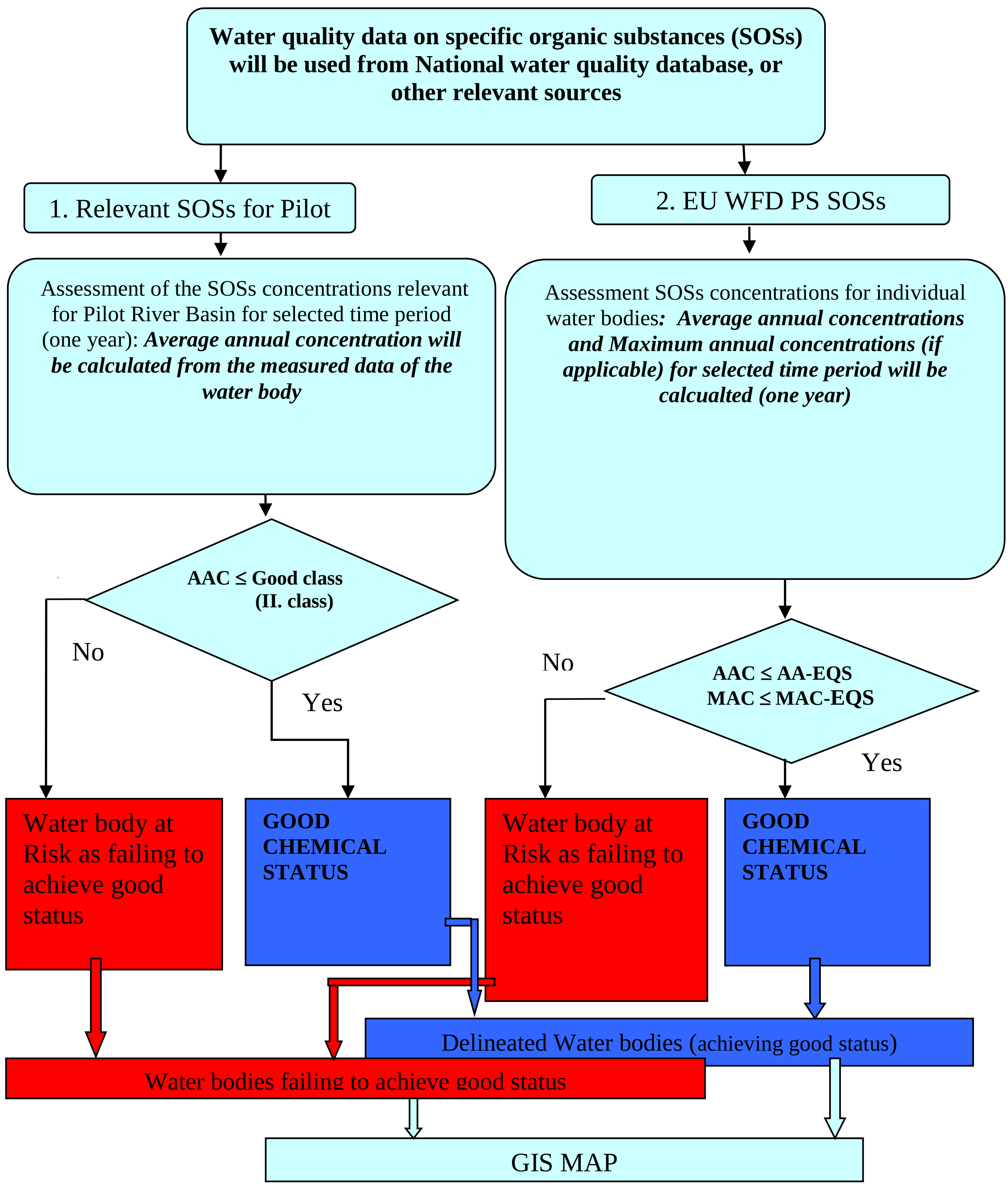
Note: blue and red colour is used just to differentiate between achieving and failing to achieve good status of surface water bodies.

Scheme 2 Classification approach for heavy metals of surface water bodies


Water quality data on heavy metals will be used from National water quality database, or other relevant sources
1. Relevant HM for Pilot
2. EU WFD PS heavy metals
Assessment of the heavy metals concentrations relevant for Pilot River Basin for selected time period (one year): Average annual concentration will be calculated from the measured data of the water body and corrected for background concentrations (AAC-bg)
Assessment of PS heavy metals concentrations for individual water bodies: Average annual concentration and Maximum annual concentration for selected time period will be calculated (one year)
Classification of Cd according the class of hardness (calculation of the Average annual water hardness) and correction of HM concentrations on background concentrations (AAC-bg; if applicable MAC-bg)
AAC ≤ Good class (II. class)
No
Yes
AAC ≤ AA-EQS
MAC ≤ MAC-EQS
No
Yes
Water body at Risk as failing to achieve good status
GOOD CHEMICAL STATUS
Water body at Risk as failing to achieve good status
GOOD CHEMICAL STATUS
Delineated Water bodies (achieving good status)
Water bodies failing to achieve good status
GIS MAP

Note: blue and red colour is used just to differentiate between achieving and failing to achieve good status of surface water bodies.

Scheme 3 Classification approach for specific organic substances of surface water bodies


Water quality data on specific organic substances (SOSs) will be used from National water quality database, or other relevant sources
1. Relevant SOSs for Pilot
2. EU WFD PS SOSs
Assessment of the SOSs concentrations relevant for Pilot River Basin for selected time period (one year): Average annual concentration will be calculated from the measured data of the water body
Assessment SOSs concentrations for individual water bodies: Average annual concentrations and Maximum annual concentrations (if applicable) for selected time period will be calcualted (one year)
AAC ≤ Good class (II. class)
No
Yes
AAC ≤ AA-EQS
MAC ≤ MAC-EQS
No
Yes
Water body at Risk as failing to achieve good status
GOOD CHEMICAL STATUS
Water body at Risk as failing to achieve good status
GOOD CHEMICAL STATUS
Delineated Water bodies (achieving good status)
Water bodies failing to achieve good status
GIS MAP

Note: blue and red colour is used just to differentiate between achieving and failing to achieve good status of surface water bodies.